An Electronic Ordering System for Table Service Restaurants

Thomas A. Roman

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AN ELECTRONIC ORDERING SYSTEM
FOR TABLE SERVICE
RESTAURANTS

BY

THOMAS A. ROMAN

A thesis submitted
in partial fulfillment of the requirements for the
degree Master of Science, Major in
Electrical Engineering, South
Dakota State University

May, 1972

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AN ELECTRONIC ORDERING SYSTEM
FOR TABLE SERVICE
RESTAURANTS

This thesis is approved as a creditable and independent investigation by a candidate for the degree, Master of Science, and is acceptable as meeting the thesis requirements for this degree. Acceptance of this thesis does not imply that the conclusions reached by the candidate are necessarily the conclusions of the major department.

Thesis Adviser / Date

Head, Electrical Engineering Department Date
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T.A.R.
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GLOSSARY OF TERMS

ADDRESS: A numerical or other expression that designates an electronic storage register, a location in a computer memory or other sources of information.

ASYNCHRONOUS: A system which is non-clocked. The state of the system does not have to be in a certain condition at a certain instant of time. Asynchronous systems proceed at their own speed regardless of any basic timing.

BAUD: The reciprocal of the time in seconds occupied by the shortest element in the array of data bits being sent over a communication channel. It is a measure of the signalling speed of the actual channel.

BCD: Binary Coded Decimal number.

BINARY SYSTEM: The system or method of counting which uses only two symbols, 1, 0.

BIT: An abbreviation of binary digit, the unit of information in the binary system.

BITS PER SECOND: The speed at which information (in the form of bits) is transmitted in a particular system. Sometimes used interchangeably with BAUD.

COS/MOS: Complementary Symmetry/Metal-Oxide Semiconductor. It is a special type of transistor.

CUSTOMER: One who enters a restaurant to purchase a meal. Also called PATRON.

EDP: Electronic Data Processing. Generally it refers to computer usage for accounting, personnel records, payroll, etc.; also known as Automatic Data Process (ADP), or Computer Processing.

FAST FOOD SERVICE RESTAURANT: A restaurant which provides food without the degree of service provided by the luxury service restaurant. The decor, space, time are not emphasized. This type of restaurant provides cheap, quick meals and is more of a convenience than a chance to enjoy the esthetic values of the eating experience.
FOOD SERVICE INDUSTRY: An organization whose function is the production of finished food items for consumption by the general public away from home.

FREQUENCY SHIFT KEYING: The type of frequency modulation in which two different frequencies are transmitted: one frequency to represent a "1"; the other frequency to represent a "0" in a digital communication system. (FSK)

GUEST CHECK: The form on which the waitress writes the meal order for the customer. It is used by the cook for preparing the meal and by the cashier in accepting the payment of the charges incurred. It provides the customer with a copy of items he has paid for. Also known as TICKET, CHECK.

INTEGRATED CIRCUIT: A combination of interconnected circuit elements inseparably associated on or within a continuous substrate. (IC)

INTERLOCK: When speaking of keyboards, this term refers to a protection system which prevents the activation of more than one key at a time.

LARGE SCALE INTEGRATION: An integrated circuit chip which contains more than 100 circuit elements. (LSI)

LIQUID CRYSTAL DISPLAYS: A type of display which utilizes a nematic liquid as a means of reflecting light. Segments of these are used to make up a number easily visible to the human eye. (LCD)

LUXURY SERVICE RESTAURANT: A restaurant which provides food, service, decor, space and time for the satisfaction of the customer's desire for food, entertainment and attention. This type of restaurant usually charges more for a meal to pay for these things that accompany the food.

MANIPULATIVE DEXTERITY: Skill and ease in using the hands to operate, manage or control mechanical devices.

MEDIUM SCALE INTEGRATION: An integrated circuit chip which contains less than 100 circuit elements.

MEMORY: The portion of computer that stores information in a form that can be understood by computer hardware. The terms, memory and storage, are interchangeable.
ORDER-TAKER: A waitress or cook who takes the orders of customers at the control console of a telephone or phone/speaker type of ordering system.

PAGING SYSTEM: A system used to call or alert a person remotely removed from the calling or paging point. This is usually done by means of a public address system. In large factories, hotels, farms and golf courses paging may be accomplished through the use of miniature radio receivers.

PARITY BIT: A binary digit appended to an array of bits to make the sum of all the bits always odd or always even. A parity check tests whether the number of 1's (or 0's) in an array of bits is odd or even.

SYNCHRONOUS: A system which is clocked or timed. It is timed by recurring pulses. In this system the state or condition of a particular circuit is important only at the times at which these timing pulses occur.

SYSTEM: A group of devices or artificial objects or an organization forming a network especially for distributing something or serving a common purpose.

TURNOVER RATE: The rate at which a number of persons are hired to replace those leaving or dropped from the working force.

WAITRESS: A female person who waits on the customer who desires to eat. She takes the meal orders, serves the meal and attends to the customer's desires. She is an employee of the customer who is the boss.

WORK SIMPLIFICATION TECHNIQUES: Techniques used in the systematic analysis of the factors that affect work in order to save time, effort or money.
CHAPTER I

OBJECTIVE OF THIS RESEARCH

1.1 INTRODUCTION

As the title of this paper suggests, we have designed an ordering system for table service restaurants. The "ordering system" is the process of communication from customer-to-waitress-to-cook.

In this first chapter, some of the problems which occur in table service restaurants will be briefly discussed and described to give the reader an idea of what this ordering system will attempt to solve. The specific problems and the proposed solution will be pointed out.

1.2 THE PROBLEMS IN TABLE SERVICE RESTAURANTS

1.2A WHAT IS A TABLE SERVICE RESTAURANT?

The reader is probably asking, "Just what is a table service restaurant?" A service restaurant is a restaurant where there is some type of service provided--by waitresses, busboys, maitre'd, etc. There are several ways to classify restaurants. Here we have described the characteristics of "table service" restaurants as classified by the Small Business Reporter.24

Included in this classification are the "service restaurants" which provide luxury service, and the "coffee shops" which have limited service and come under the category of fast food service. The luxury service restaurants are both those restaurants that provide
elaborate decor, specific atmosphere, well prepared and pleasantly served food, and those restaurants that cater more toward the family groups with less elegant menus, cheaper items, and less service and atmosphere. The exact border between "luxury service" and "fast food service" is not very clear. In many instances they overlap, or, the same establishment has both types. In Table 1.1 the characteristics of each type of restaurant have been listed. Not all characteristics need be met by a specific service operation.

The basic difference between the "luxury service" restaurant and the "fast food service" restaurant is based on the value-price relationship of eating out. The customer whose value-price relationship is centered on "food as entertainment" seeks more decor, more room, more service, more time to enjoy his meal. On the other hand, the customer whose value-price relationship is based on "food as a necessity or convenience" will settle for less decor, less service, less time, less space, and more convenience and pre-prepared foods.

The labor in these "service" restaurants makes this type of operation more expensive and, therefore, less attractive to those who are primarily interested in a "refueling stop". The utilization of seating capacity is lower in a service restaurant than in a fast food restaurant, because the customer may spend 25 to 50 percent of his time, while seated at the table, waiting for service. Therefore, the use of equipment, men and materials must be optimized in order to make the service restaurant a success.
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<td>2. Table service by waiter or waitress/assisted by bus boys.</td>
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<td>4. Assistance by skilled kitchen staff.</td>
<td>4. Some use of convenience foods.</td>
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<td>5. Extensive kitchen facilities. ALL or most food prepared on premises.</td>
<td>5. Open kitchen--&quot;exhibition cooking.&quot;</td>
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<td>7. Table linens used/&quot;coordinated&quot; silver, china, glassware.</td>
<td>7. Alcoholic beverages available.</td>
</tr>
<tr>
<td>8. Alcoholic beverages available; may have adjoining bar and cocktail lounge with separate staff.</td>
<td>8. Dining room appointments more functional than luxurious.</td>
</tr>
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<td>10. Full-course menu, wide selection of entrees.</td>
<td>10. Average check: $1.00 to $2.00</td>
</tr>
<tr>
<td>11. Average check: $3.00 to $4.00.</td>
<td>11. Average seat turnover: 2 to 3 times per meal.</td>
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1.2B THE HAND-WRITTEN GUEST CHECK SYSTEM

To put it simply, a good cash and food control system which optimizes the profits of a restaurant is what every food service manager likes. This system eliminates wasted and lost food and cash. There are many different and varied types of food and cash control systems used in restaurants.5, 26, 42 Here we have limited our discussion to the simple system of "hand-written guest checks (no checker)" since this is the system that our new electronic ordering system has been primarily intended to help.

The "hand-written guest check system" works in the following manner:

1. A hungry customer enters the restaurant and seats himself.
2. He waits for a while for the waitress to bring a menu and glass of water. (This usually takes only a few minutes.)
3. He examines the menu and decides what to eat.
4. He waits for the waitress to return in order to tell her what he wants. The waitress writes the menu items and their prices on a standard guest check.
5. He waits while the waitress takes the order back to the kitchen, and gives the order to the cook. The waitress serves coffee and other beverages or waits on other customers, while the meal is being prepared.
6. When the meal is prepared the waitress goes back to the kitchen, picks up the hot meal and delivers it to the waiting customer. The waitress may leave the check with the customer at this
time, or she may hold it in case the customer desires further items.

7. The customer takes the check and pays the cashier as he leaves; or, he pays the waitress who in turn pays the cashier and she returns the change to the customer.

1.2c PROBLEMS WITH THIS GUEST CHECK SYSTEM

Let us now discuss each step and show where problems arise.

1.2c1 CUSTOMER EXPECTATIONS MUST BE MET

When the customer enters a service restaurant he is saying that he has expectations of satisfying: (1) his physical appetite, (2) his psychological appetite (his ego needs a boost). He has little concern for other matters. Dr. John M. Welch likened the customer-waitress relationship to a boss-employee relationship.

A major factor in the commercial food service business is that it is a "people" business. It is a social event to eat out. The customer enters a food service establishment with the idea of being served. He has an "ego appetite" at least as important as his physical appetite. He expects service from everyone with whom he comes in contact in the establishment. He is, in effect, employing all personnel therein to serve him. Hence, he expects his relationship with all personnel to be that of employer (himself) to employee.

As the "boss", the customer wants: (1) quick courteous service, (2) good food, (3) atmosphere and decor to match the style. Quick, courteous service includes neatness, promptness, attentiveness, interestedness, friendliness, and competence. The customer expects at least good to excellent food. The price-value relationship must meet his expectations—that is, he does not expect to pay very little
for a large meal with all the trimmings, nor does he expect to pay a large amount for convenience or pre-prepared food that he can get for less in a "fast food" type of restaurant.

Likewise his expectations for the type of atmosphere must also agree with the style of service and degree of service provided. A customer usually picks a food service place depending on the service, style and atmosphere he has been given in the past. So he should get the same treatment whenever he goes there again.

In order to fulfill the customer's expectations the waitress must play the role of "employee"; her whole attitude, all her actions, speech and dress must tell the customer that he is the "boss". This is not always done. The Customer Attitude Survey (May, 1971) showed that some waitresses do not understand and act their role.¹⁵

Not surprisingly, the most frequently mentioned complaints had to do with slow service--to order, to be served, and, finally, to get the check and be able to leave.

Other annoyances were: (1) rudeness and impatience of waiters, (2) poorly prepared food, (3) inattentive waiters, (4) not getting what was ordered, (5) lack of cleanliness, and, (6) poor upkeep.¹⁵ These problems were caused by lack of training, incompetence, lack of communication, and poor management.

1.2C2 WAITRESS HAS "BOSSY" ATTITUDE: LACKS PERSONAL TOUCH In the second step of being waited on, the customer receives a glass of water and the menu. The waitress is there as his "employee". The immediate service she offers should match the customer's mood and tempo; she should be attentive to do anything to reduce anxiety and
frustration that the customer may have—this feeds his "ego" appetite. She must not treat the customer on the basis of how undemanding and civil the customer may be, nor on how large a tip the customer usually offers. Sometimes the waitress adopts a defensive attitude due to the status of her job, her low pay and the lack of good management. This does not serve to satisfy the customer's "ego" appetite but merely frustrates him.

In the third step, when the customer decides what to eat, the waitress may offer help especially to senior citizens, foreigners and the handicapped. The waitress may wait at the table to take the order immediately if she is not too busy, or she may take care of other customers while the customer makes his choice. The important thing for her to remember is to keep in mind her "employee" status.

1.2C3 POOR COMMUNICATIONS AND SLOW SERVICE In the fourth step, the customer usually accepts without complaint the waiting period during which the waitress is taking other orders, especially if there are many people to wait on. However, responsibility among waitresses is sometimes confused and several people are ignored; this is frustrating. The waitress must be attentive and competent.

The handwritten guest check is one of the most probable places for mistakes and errors. Poor handwriting, honest mistakes in writing items and prices, and forgetting to write things down cause many headaches for the manager, customer and the waitress. Carelessly written and illegible checks cause confusion in the kitchen too: the customer may end up with the wrong item. Also, if the amount is wrong,
the manager may lose money if it is too low; or, the manager will lose a customer if charged too much for the meal. Much time for walking to and from the kitchen delivering the handwritten order could be used to provide more personal service.

During the fifth step, while the customer waits for the meal to be prepared, the waitress takes care of other customers and serves beverages and salads. She has to be competent and attentive to keep up with all the orders during a rush period. This waiting time can become excessive and may displease the customer. Usually the customer expects to wait a certain amount of time when he comes to a service restaurant. When the meal is ready, there is usually some type of signalling system to notify the waitress that she can deliver a hot meal. In this case the waitress must be attentive.

1.204 Poor food and service turns the customer off

The sixth step, receiving the prepared meal, is the most important to the hungry customer. He has waited for this meal and he looks forward to being satisfied. If he dislikes the food, his physical appetite has not been satisfied and he is frustrated. He will go elsewhere for his next meal. When he is satisfied with his first meal, he may reorder or order other items. Reorders are not hard to obtain if the waitresses are attentive and competent. Rush periods put much pressure on waitresses; everyone wants attention at the same time. Those who are neglected are frustrated; their "ego" has been hurt. Next time they may go to a place with faster service. At this point, the manager begins to
Can I afford to lose these customers? Do I lose these customers because of incompetent waitresses? Can I afford to hire better waitresses? What are the alternatives? Will the addition of new equipment help the waitresses? Is there some way to reduce the number of waitresses, increase productivity and still maintain a profit?

When the waitress leaves the check with the customer immediately after bringing the order, the customer may leave anytime he wishes. This is usually done in fast food restaurants but not in luxury restaurants. Leaving the check immediately after bringing the order in a luxury restaurant may indicate to the customer that he is being hurried out of the place and not being allowed to take his time and enjoy the meal. This will frustrate him. The expectations of the customer must be satisfied.

1.205 CHECK SYSTEM LOSES MONEY Payment of the check is usually done at the cashier's station. Illegible and carelessly written checks slow the process down and delay the customer. Incorrect pricing causes losses. The cash register may have preset keys which relieves the cashier of some chance of error. Care must be exercised so that checks are not reused. Numbered checks are generally used so that a missing check is easily spotted. Some cash registers record all transactions on an audit tape, thus relieving the manager of some tedious auditing. Responsibility for checks must be clearly fixed with each waitress; without it, cash control will be a problem.
FOOD DISAPPEARS; POOR INVENTORY IS TO BLAME

Sometimes the only means of controlling the issuance of food is the use of guest checks and an audit procedure to keep track of food issued. Audit tapes from cash registers are helpful in this case. Individual registers for each food item provide a better, quicker means of control. Larger service restaurants sometimes use the precheck system which is very good, but not every service restaurant uses this system. A good inventory system not only allows a manager to keep track of the issuance of food but helps him foresee the need of supplies. This enables him to keep up with the demand of any particular food item.

Losses in the form of "walkouts" also occur. This means that someone eats at your restaurant and quietly slips out the door without paying for his meal. Those who do this usually look for unsuspecting waitresses who they feel will not catch them.

LABOR IS ONE OF THE BIGGEST PROBLEMS

The reader has more than likely become aware that a severe labor problem exists in service restaurants. It is one of their biggest problems. Even with the present high unemployment rate the service restaurant can expect labor to be a problem.

THE SHORTAGE OF SKILLED AND UNSKILLED LABOR

This shortage of skilled and unskilled labor is a problem for the growing food service industry. There is a need for an additional 250,000 employees per year to fill the growing number of positions. With employment, in general, shifting toward service type jobs, more people
will go into food service work, but only if they are offered competitive wages and fringe benefits comparable to other service jobs. This labor shortage implies that the labor you now have is not as productive as it can be. The sales volume per worker in the food service industry is about the same as it was three decades ago.\(^9\)

1.2D2 **THE HIGH TURNOVER RATE OF LABOR** The labor turnover rate in the food service industry is about three times higher than in all other manufacturing.\(^9\)

What is the cause of the labor shortage and high turnover rate? There are several reasons: (1) wages are below the retail average, (waitresses do not count tips as part of their wages), (2) there are poor working conditions and poor job image, (3) there are low entry requirements, (4) there is a lack of adequate training, (5) there are seasonal and part time workers, who will accept lower wages and hardship for a while.

1.2D3 **THE MINIMUM WAGE MAY GO UP** The U.S. Congress has considered raising the minimum wage for all workers and eliminating the exemption for low volume business places. This will require even the smallest restaurants to pay the minimum wage.\(^{44, 98}\) This blanket minimum wage would put small operators out of business. The status of this federal minimum wage law is at present still in doubt.\(^{74}\) The National Restaurant Association supports higher wages in order to attract more capable employees.\(^{105}\)
WAYS TO PROFITABLE OPERATION

Losses incurred through poor cash and food control usually are made up by charging higher prices. Labor problems point toward higher prices if other costs are not reduced or if productivity is not increased. Many food service managers have turned to reducing labor costs by a variety of ways. Here we have listed five ways:

1. Use machinery, automatic equipment to replace or assist manual labor.
2. Rearrangement of kitchen and service area equipment to save steps.
3. Application of work simplification techniques to all tasks.
4. Reschedule employees to fit the fluctuations in the labor demand.
5. Develop participation of employees and improve team work.

The trend toward the use of automatic equipment has been great. The use of such equipment has been suggested in Article II, Section 1 of the Code of Ethics of the National Restaurant Association: The employer shall provide labor saving devices to lessen the drudgery in the restaurant business.

The use of microwave ovens, infra red ovens, automatic controls, conveyor systems, special communications systems, sophisticated cash registers and computers by restaurants has steadily increased. In Chapter II, THE REVIEW OF THE LITERATURE, we have discussed several techniques that have
been tried in order to automate the ordering process.

1.4 FIVE OBJECTIVES OF THE PROPOSED ELECTRONIC ORDERING SYSTEM

Now that we have briefly examined some of the problems that exist in a table service restaurant which uses handwritten guest checks, let us state the objectives of the proposed electronic ordering system.

1.4A REDUCE SLOW SERVICE

Reduction of slow service will be accomplished through the elimination of the time used by the waitress in walking back to the kitchen to deliver the handwritten guest check. Other systems similar to the proposed system have done this and have effectively cut the walking distance of the waitress in half. 72

1.4B IMPROVE COMMUNICATIONS

The proposed system includes a two-way communications system which:

1. tells the cook the items desired by the customer, how to prepare them and the amount of the item desired
2. tells the waitress when an item is out of stock immediately so that she can tell the customer to reorder
3. tells the waitress when a numbered order is ready to be delivered to a customer
4. tells the waitress she is wanted by the manager, in case of emergency, telephone call or other matters
The ticket that is printed by this proposed system will be clear and very legible for easy reading by the cook. The prices and items will be easy for the customer to check also.

1.4C  IMPROVE FOOD AND CASH CONTROL

Food will not be issued from the kitchen without a ticket printed by the proposed system. The printed check will be clear and accurate—this eliminates mistakes in addition, the opportunity for changing the amounts or items by the waitresses, and reuse of checks already used. Instant inventory will be available to the manager. Any menu item can be entered and stored along with its price. The menu item and its price can be easily changed at any time. Totals of all items will be kept, as well as totals of each waitress. The manager will be able to manipulate the stored information (addition, subtraction, division, and multiplication of menu items and prices). Responsibility for orders will be clearly fixed through the printing of the booth number, waitress number, number of people at the booth, and the time of the order on each guest check.

1.4D  HELP THE WAITRESS PROVIDE MORE PERSONAL SERVICE

Personal service hopefully will be improved if the above three objectives are met. Meeting these objectives is only one step toward more personal service. The waitress still must be trained. The proposed system makes personal service more probable by lessening the walking time, by improving communications, and by improving food and cash control.
1.4E REDUCE THE NUMBER OF WAITRESSES NEEDED

This objective is not one of the primary objectives of the proposed system. The restaurant manager must work any possible savings out for himself. Adaptation of the proposed system may indicate that less waitresses are needed. Then the manager must decide whether or not personal service to his customers will remain after reducing the number of waitresses.

1.5 LIMITATIONS OF THIS RESEARCH

Our limitations in this research were centered about our lack of knowledge of the food service industry and the work that may be or is being done by manufacturing firms. Correspondence and inquiries yielded some valuable information; some companies did not bother to reply. Those that did reply gave generously of their advice and information. Perusal of many food service trade magazines helped familiarize us with the problems and state-of-the-art of the food service industry. We were aided immensely by food service operators who very generously advised and critized our ideas in the initial design.

1.6 OBJECTIVE OF THIS RESEARCH

The objective of this research was to design an electronic ordering system that meets the objectives outlined above. This system provides an alternative to food service operators in their efforts to
reduce the rising costs of operating their restaurants. Figure 1.1 shows a sketch of the proposed system.

A review of the literature and the advice of many food service operators seemed to indicate a design of an electronic ordering system which consisted of four parts:

1. A **Waitress Ordering Station (WOS)** which transmits and receives messages from the central processor. The waitress carries this station with her. It has no dangling wires.

2. A **Central Processor (CP)** which receives the orders from the waitress ordering station and transmits messages back to the waitress ordering station. It has a memory to store the menu item information and prices, as well as the sales totals for each waitress. It includes a small calculating machine so the manager can manipulate the information as he wishes.

3. A **Kitchen Console (KC)** which prints the order for the cook, and has a signalling device so that the cook can signal the waitress when the meal is ready to be delivered.

4. It also has a **Beverage Station Console (BSC)**. This visually records (temporarily) the beverage order at the beverage station.

A more detailed description of the system is given in Chapter III, DESIGN OF THE ELECTRONIC ORDERING SYSTEM.
(a) WAITRESS ORDERING STATION
(b) CENTRAL PROCESSOR
(c) BEVERAGE STATION CONSOLE
(d) KITCHEN CONSOLE

FIGURE 1.1: ELECTRONIC ORDERING SYSTEM FOR TABLE SERVICE RESTAURANTS
CHAPTER II

REVIEW OF THE LITERATURE

2.1 INTRODUCTION

In Chapter I (Section 1.3), we mentioned several ways to reduce costs for the restaurant manager. One of them was "use machinery, automatic equipment to replace or assist manual labor." Since our proposed electronic ordering system is included in this category, we reviewed the past and present systems that have been used to aid the communication between waitress and cook.

In this survey we reviewed the systems used for the immediate service to the patron. We included communication systems used by all types of restaurants—fast food as well as luxury restaurants. Paging systems were not included since they are usually not used by waitresses and cooks but by managers and their immediate staff in a restaurant operation.

2.2 RESTAURANT COMMUNICATION SYSTEMS FOR WAITRESS AND COOK

2.2A FOUR STEPS TO EATING OUT

In Chapter I (Section 1.2B), we outlined seven steps in the handwritten guest check system. Let us again consider the last four of these seven: (1) The patron tells the waitress his order which she records on paper, (2) The waitress communicates the order to the kitchen,
The waitress brings the prepared meal to the patron, (4) The patron pays for his meal.

2.2A1 ORDERING In this first step, ordering, the patron tells the waitress his order in two ways: (1) person-to-person, or (2) by means of telephone or phone/speaker system. The essential part of this step is that the patron tells the waitress his desired menu choices and she writes these choices down on paper. People choose the type of communication they want to use by patronizing a drive-in, which may use a phone/speaker system, or by patronizing a table service restaurant, where the waitress communicates with the patron in person. There are advantages to both systems. Some people dislike the "depersonalization or dehumanization" of automatic or electrical/mechanical devices. We have discussed this in detail in Section 2.4 of this chapter.

2.2A2 DELIVERING THE ORDER TO THE KITCHEN The waitress performs this second step, communicating the order to the kitchen, in several ways: (1) phone/speaker system, (2) electronic writing or signalling system, (3) personal delivery of the guest check to the kitchen, and (4) conveyor system. The phone/speaker system as used by drive-in and some fast food indoor restaurants, is a hybrid step: that is, at the same time of performing the order-taking, part of the second step, delivery of the order, is also performed. But the order only gets part way to the kitchen. Then the waitress personally carries it to the kitchen or the cook hears the patron himself over a loudspeaker. The use of electronic writing allows the waitress to send the order
via wires to the kitchen. A light signalling system with pushbutton control can be used to send the order from the waitress station to the kitchen. A conveyor belt may be used to send the order to the kitchen and back to the waitress station; or, it may only be used to deliver the order from the kitchen to the waitress station. Coded trays and electronic eyes control the path of the trays. Personal delivery of the guest check to the kitchen is the most widely used system, especially in small places. One can immediately recognize that this "personal delivery" takes more steps. In performing this personal delivery some food service restaurants employ a "pre-check" system, which is a very effective means to control food and cash. There are many variations of the pre-check system in use today. We have discussed an example of it in Section 2.2B4.

2.2A3 DELIVERING THE MEAL TO THE PATRON The third step, bringing the prepared meal to the patron, is performed (1) by a waitress in person, (2) by means of a conveyor of some kind, or, (3) by a combination of waitress and conveyor. The first of these, personal delivery, is the most pleasing to those dining in a luxury restaurant. Often the waitress is assisted by means of a "waitress call system" or a "waitress signal system." This consists of a board of lights full of numbers. When a light is on, the waitress assigned that number is signalled to come and deliver the prepared meal; or, a "specific order" is assigned a number which lights up on the board when it is ready--then the waitress delivers it. Even without the signalling system, the waitress has to be alert to notice when the cook finishes preparing a meal.
(Sometimes bus boys bring the meal to the waitress station.) A conveyor system may be used in a large restaurant. This only brings the meals to a waitress station, from which the waitress delivers the meal. A drive-in may employ a conveyor belt to take the meal all the way to the patron waiting in his car.

2.2A4 PAYING FOR THE MEAL

The fourth step, paying for the meal is done in a variety of ways. Modern day cash registers with preset keys are used to improve accuracy in recording the items and prices. Cash registers may also be tied to computers to aid in accounting, inventory and sales analysis. Settlement of charges in a hotel-related restaurant may take the form of sending all bills via computer punch card to card reader, then via wires to a cashier's station in the main lobby where the hotel guest may pay for his bills all at once by using his credit card, check or city ledger account. In many restaurants the bill for the meal is not given to the patron when the meal comes. In other restaurants, the bill arrives with the meal. The degree of service provided determines the time at which the patron receives his bill.

Thus far, we have not discussed any one particular system in much detail. We have tried to give the reader an idea of the steps performed in a restaurant system where a patron is waited upon, served, and fed a meal in his favorite eating place. In the following sections, we have discussed, in detail, the systems that have been tried in the past and those systems that remain today.
2.2B EIGHT CATEGORIES OF RESTAURANT COMMUNICATION SYSTEMS

There are eight categories of restaurant communication systems:

1. Phone/Speaker and Telephone Systems
2. Electronic Remote Writing Systems
3. Signalling Systems
4. Cash and Food Control Systems
5. "Completely Automatic" Systems
6. Systems for Drive-In, and Walk-Up Fast Food Restaurants
7. Conveyor Systems
8. Hospital Food Service Communication Systems

2.2B1 PHONE SPEAKER AND TELEPHONE SYSTEMS These phone systems are used in drive-through, drive-in, and fast food indoor types of restaurants. Most of us are familiar with the operation of these restaurants. The patron enters, sits down, selects his meal and orders it on the phone. This ordering involves picking up a phone-headset or pushing a button to get the attention of the "order-taker" back in the kitchen. If there are others giving their orders, the patron usually waits no more than a few seconds before hearing a welcoming voice at the other end. When the order is taken, the cook can hear the patron giving the order, and the cook begins preparation immediately. The prepared meal comes to the patron through the personal service of a carhop or waitress.
There are two parts to this system: (1) a menu ordering panel (usually more than one) which has a phone/speaker or a telephone headset nearby, and, (2) a switchboard. The phone speaker panel has a push button which the patron pushes when he is ready to order. This button is released when the "order-taker" is ready to take the patron's order. The system works like an intercom. In the indoor systems, a light lights up on the switchboard in the kitchen area to get the attention of the "order-taker", who writes down the order as the patron gives his order. The switchboards made today are either manually or automatically operated. They employ a three-way switch for: (1) "off" position, (2) communication with a particular booth or station, and, (3) selective paging. The automatic switchboards employ a monitoring system which shows the number of the station calling in "dim" light and the number of the station communicating in "bright" light. The automatic switchboard sequences the calls properly, has an automatic volume control, has dual amplifiers for increased reliability and has plug-in component for easy replacement.

The advantages of phone/speaker and telephone systems are:

1. Faster superior service--The patron orders at his convenience; less waitresses are needed to take the order. Orders come in more orderly.

2. Increased patron capacity--The increase in the speed of order-taking helps to increase the turnover rate of patrons.
3. Increased sales--Sales volume can be increased without increasing the physical outlay of the food service operation; the "order-taker" can increase sales by being friendly, courteous and suggesting additional items.

4. Reduced labor and training costs--Less walking time leads to a reduction in the number of carhops, carhops do not need to write items on a guest check and add the prices; the system is easy to operate.

5. Increased profits--The system encourages the sale of higher profit items while reducing the overall operating costs; order-taking by a key person reduces the chances of loss through inaccurately written guest checks; installation of this system can pay for itself in one year.\textsuperscript{19, 31, 71}

Intercom systems have also been used.\textsuperscript{72}

2.2B2 \textbf{ELECTRONIC REMOTE WRITING SYSTEMS} Electronic remote writing includes those systems which use electronic circuitry to convey the order from the waitress station via wires to the kitchen. There are several different forms: (1) Electrostatic writers, (2) Closed circuit T.V., and, (3) Card reader and printer combination.

Several restaurants have used the electrostatic remote writers with success and satisfaction. Van de Kamp's coffee shops in Los Angeles have used an "auto-writer." It operates as follows:\textsuperscript{2}

1. Five transcriber machines in the dining room are connected to the appropriate point in the kitchen: the fountain, the sandwich table, the salad area, the frying area and the fish area.
2. After taking the customer's order, the waitress goes to the appropriate machine and writes the order, including her station number.

3. The machine duplicates whatever she writes on the receiving end where the order is torn off the machine and hung up on a hook to be filled.

4. After preparing the order the cook turns on a signal light corresponding to the waitress' number on a board in the dining room; a red light means a hot order and a white light means a sandwich order.

5. The waitress then leaves to pick up the order, brings the order to the customer and turns the signal light off.

The advantage of the system is apparent: the waitress has to make only one trip to the kitchen. Therefore, she has more time to spend in the dining area and can give more attention to the customers, while the orders are being prepared.

Another similar system is the "Telautograph." Mr. Merrill Cohen, President of Industrial Catering Co., Inc., Indianapolis, Indiana stated:55

We own and operate a restaurant in Indianapolis that utilized electronic ordering 18 years ago. It still operates successfully. The waitress never leaves her station. She writes a coded order on Telautograph. It writes simultaneously in the kitchen. The food comes to her on conveyor belt, and soiled dishes return to the kitchen.
As one can see this "Telautograph plus conveyor" system is less work for the waitress than the Teleautograph or Auto-writer alone.

Mr. H. H. Pope, President of Pope's Catering Company, St. Louis, Missouri, has used the Telautograph system for his food service cafeterias. The kitchen is remote from the cafeteria service line. The Telautograph system was used by the employee who worked on the service line. However, Mr. Pope has turned to the less expensive closed circuit T.V. system:

What we finally worked out was a system of sending messages by closed circuit television. A camera with a close up lens is mounted vertically, focused on a felt pad. The written messages are duplicated on television screens located in production departments. A bell is used to attract the attention of the production department. Communication by voice is also included in the arrangement.

Mr. Pope stated that the cost of the system averages $500.00 including the installation. The main variables are the length of the wire between monitor and receiver, and the type of lens required for the monitor.

The use of remote card reading terminals in restaurants usually has been done where the restaurant is connected with a hotel. An IBM RAMAC 1401 computer together with an IBM 357 Data Collection System has been used to collect the charges made by a guest in the restaurant, in order to transfer them to the front office of the hotel. There was another system which consisted of a card-punch, card reader and keyboard located at the cashier's station in the dining room. Totals were accumulated in the kitchen. This system
was used with a pre-check system. The advantage of this system was in the saving of steps for the waitress.

2.2B3 SIGNALLING SYSTEMS There are several variations of these systems but, in general, they can be classified into three groups: (1) Systems with a panel on which lighted numbers appear, (2) Call systems for self-service, fast food restaurants, (3) Seating control for large restaurants with many rooms, (4) Push button systems.

The first of these systems is for the waitress. It operates in the following manner:19

...waitress is given her individual number that appears on every food check that she turns in to the kitchen. When her order has been completed, chef presses her signal number and rings chime. Upon hearing the chime, looks at the annunciator to see if her number is lighted. If her number is lighted, she automatically picks up her order and cancels her signal call by pressing her number on the switch panel, clearing the way for her next order.

This is how one of the systems works. There are innumerable variations.19, 43

Another waitress call system was used by Sip N' Dip Drive-In in Sycamore, Illinois.10 It operated like that described above except that colored lights were used instead of lighted numbers. In addition, the carhops wore colored scarfs, used colored trays and baskets, and wrote on colored guest checks in order to distinguish between each carhop and to define responsibility. Supervision of carhops was made easier and it eliminated the confusion in a system where the manager had to call out the orders to waitresses, especially in the case where names sounded similar.
A call system used for self-service, fast food restaurants is quite similar to the number call system for waitresses. It operates the same except that the customer orders for himself, waits in his car or waiting area, and serves himself when the order is ready.19

Another type of customer call system is that used by Barnaby's.3 The customer makes out his own check card which also serves as the menu card. He pays for his order and sits down to wait at a table. When his order is ready, one or both of the two small flashing lights at each table signal him to come and pick up his order. One advantage of this system is its silence. Formerly the order number was called out over a public address system. Another advantage is that the customer sees the light immediately. In the old public address system, the order number had to be called out several times before the customer recognized that his order was ready.

The signal system used by Blackie's House of Beef in Washington, D.C. is called an electronic table status service.20 A floor plan of the rooms of the restaurant was outlined on plastic-faced panel and each table was represented by a light. When one or more lights were lit up, the maitre'd at the entrance to the restaurant knew exactly which tables were ready for service, and which tables were being used or had not yet been cleaned off and prepared for the next customer. Information about menu items being sold out or being on special for the day was also communicated. A control panel with toggle switches which were also connected to the master control panel for the maitre'd. Van de Kamp's in Los Angeles also had a seating control panel that
operates in a similar fashion. The advantage of the system was that the manager knew exactly which tables in his restaurant were being used at any time.

Several pushbutton systems have been tried. One was the press button system displayed at Hotelympia in 1960 (London). 30

Press buttons at the calling point light up when pressed and coincident buttons on the master control at the receiving or servery end are instantly illuminated. When the order is ready in the servery and the buttons at that end are pressed the lights at each end go out, thus completing the signalling cycle.

It was claimed that the system would be able to reduce delay, errors and duplication. However the system has never been put into successful production. 106

Another pushbutton system has been tried in Sweden. 88

Automatic ordering systems are rather common in Sweden, especially in self-service restaurants where the customer pushes a button along side of the selected item listed on a menu board. Pushing the button releases a colored ball which drops into a dish at the cook's station. The color of the ball corresponds with the item ordered. A difficulty with this system is some confusion in matching up the item with the customer. A newer system involves a check being automatically issued to the customer when the button is pushed. The check is used to identify the customer when the customer reaches the point where the hot food item is to be picked up.

With these pushbutton systems trouble arose when the customer needed special information which he could not obtain from the mechanical pushbuttons.
2.2B4 CASH AND FOOD CONTROL SYSTEMS In the past as well as in the present, the cash register is the primary instrument for the control of cash in a restaurant. Today cash control usually takes one of two forms: (1) pre-check systems, and, (2) post-check systems. The pre-check system includes a control system for the issuance of food from the kitchen. There are many different types of cash registers used to implement these two different types of cash and food control.

2.2B4a THE PRE-CHECK SYSTEM In this system the customer's order is registered in the cash register before the order is sent to the kitchen for preparation. The cash register prints the items and amounts clearly and accurately on the guest check for easy reading by the cook and for eliminating mistakes by waitresses and reuse of guest checks. The kitchen personnel will not prepare an order without the receipt or duplicate made by the cash register. In other words, a permanent record of the order is made before the order is given to the cook. This system provides one of the best means of cash and food control.

Other benefits of the pre-check system include:

1. an audit tape for comparison against ticket sales for inventory purposes

2. a waitress identification key identifies all orders each waitress has served and the manager can see how productive each waitress is

3. control of guest checks against reuse, changes and alterations, discarding, and inaccuracies
4. **customer confidence** in machine printed checks and in machine figures

5. **control by management** of locked in records

6. **identification of responsibility** for specific guest checks

Preset keys on some cash registers relieve the waitress or cashier of the responsibility of pricing correctly and accurately. For more complex operations, especially in larger restaurants and chain restaurants, the cash register may be connected to a central computer for sales analysis, daily reports, inventory control, and automatic purchasing. 66, 86, 110

For more accounts and more detailed description of the pre-check system, the reader is referred to the literature. 5, 6, 7, 11, 16, 29, 35, 39, 56, 72, 95

Dr. Charles I. Sayles, Professor, Cornell School of Hotel Administration summarized one pre-check system operation as follows. 58

The waiter cannot get major food items without giving the kitchen a stub, which provides one side of the food-cost control described later. Once the amount is on the check there is documented responsibility throughout. Missing checks are the responsibility of the waiter, who must either have the check or the receipt. The receipt can only come from the computer and then only if the amount is charged to a cashier or to an identified account. If the check is missing, full details of items on that check are available from the system. Tips are printed on a waiter's receipts so that he has an accurate record of what is coming to him. Tip amounts are also detailed in the computer by waiter and at the end of the watch the machine can produce the total when the waiter's badge identification is used. When the cashier pays out the tips, he gets automatic machine produced receipt. The waiter's badge identification is the only means of getting this amount during the meal period.
The above summary pertains to an elaborate pre-check system using a computer. Such a system would not be needed in a restaurant unless it was very large. However, it gives the reader an insight into what can be done today. The above system is a very good pre-check system for controlling food and cash.

2.2B4b  **POST CHECK SYSTEMS** Post-check systems are those in which the guest check is added by machine along with the tax, but food control is not performed. This is the normal system used by many restaurants. Usually it is implemented by the *simple cash register* at which the customer pays his bill as he leaves the restaurant. Also in use is the *automatic adder*, otherwise known by their trade names. These adders are for restaurants with fixed menus. The waitress inserts the specially marked guest check into this adder either at her station or at an easily-accessible-location-point on her trip back from the kitchen. The adder reads the guest check, prints the proper prices clearly and accurately, adds tax and totals the prices. The guest check comes out of the machine in a matter of seconds. Accumulating registers within these adders keep track of the amount of each menu item that has been added on the guest check. These adders print a pleasing, clear, and accurate total of the menu items and prices for easy examination by the customer. The customer gets the check and takes it to the cashier to pay it in the usual manner. The cashier's register must balance against the adding machine total—otherwise the cashier is responsible.
Another plan to insure proper addition at the cashier's register is the RED STAR PLAN. A Red Star is factory printed on the receipt tape and occurs periodically along the tape. When the cashier rings up a sale, the appearance of a Red Star on the customer's receipt gives the customer the opportunity to collect a cash reward if he notices it. This encourages the customer to look at his receipt and makes the cashier more attentive and accurate in her job.

The cash registers used in post-check systems can be very simple or very complex. Some cafeterias use a register with a button for every item on the cafeteria service line, with an automatic adder including tax addition. Many restaurants use a cash register which, besides totalling the amount of the menu items, records the transaction on an audit tape, and also computes the exact change which is given automatically. In the future the reader will see more cash registers which are electronically controlled: that is, instead of being electro-mechanical, the cash register will be almost completely electronic. This is being accomplished through the use of Large Scale Integration. At the present, only four of these LSI "chips" are being used in the "Sharp" and "Victor" calculators made by the Comptometer Corporation. It doesn't require many changes to convert to a cash register. The cost of the new electronic machine will be 1/10 of the present day electromechanical machines.

2.2B5 "COMPLETELY AUTOMATIC" SYSTEMS The "Completely Automatic" Systems we shall briefly describe here are: (1) The ORBIS/AMFARE automatic kitchen with phone/speaker ordering system, (2) Vending machine
operations. These are included only to give the reader an idea of the systems that have been tried and the mistakes that were made.

2.2B5a ORBIS/AMFARE SYSTEM The ORBIS/AMFARE system was built by the American Machine & Foundry Company. It was a completely automatic kitchen which saved about 40% of the labor in a restaurant. A girl operated the control console which had buttons for each item ordered. Another assistant assembled the orders as they came from the several automatic preparation machines. The system worked as follows.

1. Orders were phoned in from the dining room or drive-in stations
2. The girl operator received the order, put it into the automatic check printer and activated the automatic preparation machines.
3. The order was prepared automatically by six different machines; then it was assembled and delivered by carhop or waitress.

The ORBIS/AMFARE system provided successful operation through strict control of food and cash. It reduced labor and food costs by using fixed portions and automatic cooking/preparation. The ORBIS was the computer part of the system and kept a record of all cash and items ordered. It also provided a printed check to the order assembly area.

Although there were several advantages to this system, it could not cook a hamburger "rare"; it could not adjust for personal, individual preferences because portions and sizes are fixed.

Because of the excessive cost and the complexity of the system,
reliability was extremely important. Since 1964, when this system was first tried, AMF Electrosystems has developed and tried similar systems, until reliable systems called MANEX and MINEX were built. They are management information systems built into the cash register. Reliability was one of the most important criteria and without it MANEX and MINEX systems would not have been profitable.

Since the ORBIS/AMFARE system there have been no other attempts to automate, on such a large scale, the food service restaurant, except in the area of management information systems.

2.2Vb VENDING MACHINE OPERATIONS There are and always will be the need, in particular situations, for vending machines. However they are not the complete answer.

Because of the compromises which must accompany food service through vending machines, it would seem logical to predict that within the foreseeable future the growth of food service vending will be in only those areas where unusual conditions make it impossible to provide self-supporting manual food service. Enough attempts to open public vending restaurants have been made to indicate that machines cannot compete with personalized service. Vending machines are expensive and have a high cost of depreciation and maintainence.

Contrary to this opinion, the survey, Food Service Industry, 1971, published by Alex, Brown & Sons stated that the vending industry will practically double in the next ten years and that recent trends were consolidation into large groups, diversification into related areas (inflight feeding, etc), and greater use of sophisticated management systems.
Actually the two seemingly contradictory opinions given above are really not contradictory. Together they mean that vending seeks a special market for people "on the go" and that vending cannot and will not satisfy those who wish to dine in a restaurant with table service. There are several interesting vending restaurants which the reader may wish to investigate. 57, 102, 103

2.2B6 SYSTEMS FOR DRIVE INS AND WALK UP FAST FOOD RESTAURANTS

We have discussed two systems here: (1) the AMFare Crest 72C System, and (2) the SOS Robicon System.

AMFare Crest 72 C combined: (1) Sales and Cash Control, (2) Data Processing System, (3) Production Control System. It consisted of a keyboard module, a display module and a computer module. The keyboard module provided the item keys (prices were preset), multiplier keys, and function keys (error correction, change computation, manual entry, and total prevue). A remote data control switch was used by management for control of pricing and readout of operating data. The display module presented visual readings and data totals on the screen. This display module was also used for production control in the kitchen. 1

The several disadvantages of this system were: 110

1. High cost (about $15,000)
2. Large volume of electronic components
3. Reliability problems due to the large number of interconnections
A major fast food chain restaurant tested these and later ordered a large number of them. However the order was cancelled because the AMFare 72 C did not satisfy the needs of the industry. The SOS Robicon system is used in drive-ins. The essential components of this system are; (1) a phone/speaker ordering system, (2) a "preset key" cash register with automatic guest check printing, (3) validation by cash register. Advantages of this system are described here:

Accuracy is increased, because all errors due to wrong pricing, handwritten figures and mental arithmetic are eliminated.
Customer service is faster, because automatic order writing is quicker than handwriting.
Manpower requirements are less, because one girl now is able to take orders and prepare bills, even during the busiest periods. This also allows greater flexibility in staffing.
Training of new personnel to take orders is easier.
The descriptive item-priced keyboard is simple to operate and thus it's easier to train a new girl.

2.2B7 CONVEYOR SYSTEMS There are many kinds of conveyor systems used in hospital food service operations, but we shall not discuss them here, since their operation is similar to the conveyors in commercial restaurants. We shall describe four different attempts at using conveyor systems.

About 20 years ago, the Fountron Restaurant (St. Louis, Missouri), attempted to improve service through the use of a conveyor belt to deliver the food from the kitchen to the waitress.
It used Telautograph to communicate with the kitchen and the food came out on a moving belt, stopping automatically at the waitress station through a system of special covers which activated electric eyes.

The Fountron has been out of business for some time.

Another system used the conveyor for both delivering the order to the kitchen and returning the meals. It was called the "Waitress Always In Room" system (WAIR). It consisted of low cabinets which extended from the kitchen wall out into the dining room. These cabinets divided the dining room into sections. On each side of each cabinet were small waitress stations. Each waitresses' tables were adjacent to her station. The waitress would write out her order and put it on one of her own trays. Each waitress had a tray with a coated metal base. The coating would direct the tray back to the waitresses' stations, with the food which was placed on the tray by order fillers in the kitchen. In other words, the waitress would put the tray with the check on the moving belt which ran inside the cabinet. Someone in the kitchen would put the necessary food on the tray and put it back on the belt. The waitress would handle, from her station, such items as coffee or tea, bread and butter.

Although this system increased the productivity of the waitress, things became complicated when the customer wanted to change his mind, or if the order-taker in the kitchen made a mistake. Lyon's, the manufacturer, finally decided that automation has no place in the service end of the restaurant and that it should be kept behind the scenes in the back of the restaurant.

Another attempt at automating the service end of the restaurant brought the experimenters to the same conclusion. Their goal was to automate the delivery of food from the kitchen to the customer. Mr.
Gerald T. Rabideau and his associates of Lynn's Restaurant in Toledo, Ohio, presented a demonstration of their invention at Michigan State University, during a conference on "Restaurants of the Future." The device was a kitchenless restaurant which had eight, 20 foot by 6 foot, automated service stations. It appeared to be a rather ungainly device which would destroy the whole atmosphere of any restaurant. It consisted of heating ovens and preparation areas for pre-prepared foods and a large mechanical system of conveyors. Mr. Rabideau's conclusion was:

You can change the back of the restaurant but not the front.

Finally, there was an attempt to use conveyors at Hotelympia (London, 1960) in conjunction with the pushbutton system described in Section 2.2B3. This conveyor system consisted of: (1) the conveyor belt or feed-up belt (located above the low level eating counter), and (2) a pushbutton control system for stopping the conveyor belt at any point. This conveyor system, like the accompanying "press button" system, has never been put into successful production.

2.2B8 HOSPITAL FOOD SERVICE COMMUNICATION SYSTEMS. In modern hospitals the use of automatic equipment has helped cooks, dietitians, and nurses provide better food service to the patients. Equipment has been developed to aid in diet ordering, tallying of orders, charge reporting, medication-drug-services ordering, and information handling. There are many examples of the use of equipment for these purposes. The reader is referred to related magazines and journals to satisfy his curiosity about this equipment.
We mentioned hospital food service communication systems here since research into this area of food service has provided us with a broader view of what is and can be done in this food service industry.

2.2c SUMMARY OF RESTAURANT COMMUNICATION SYSTEMS

We have reviewed many uses and attempts to use automatic equipment in the food service industry. We have discussed some of the advantages and disadvantages of this automatic equipment. This knowledge of past errors and past successes will serve as a guidepost in the design of the electronic ordering system.

In the future, many more and different applications of an ever-evolving electronics technology will, hopefully, bring to the food service industry new and better machines with which to make table service more personal.50

2.3 WHAT WILL THE FUTURE BRING?

2.3a INTRODUCTION

The food service industry will not survive without meeting the demands of its customers. Satisfying the customer is good business.33, 46, 77, 109

With this in mind we shall direct our attention to three ideas: (1) Social Changes, (2) Trend toward automation and the use of computers, and, (3) Two future types of restaurants.
2.3B SOCIAL CHANGES

2.3B1 POPULATION TRENDS The population of this country is changing. This decade of the 70's will be the decade of the young marrieds as the post World War II population explosion moves into it's 20's. More young people will be setting up new homes; they will be economy minded (especially with the poor economy now) and will eat out at economy type food service restaurants.

The present day mobility of our people, the decline in the birth rate, the change in the age distribution, and the changes in the inner parts of our cities point toward a change in the food service industry. The food service industry will have to deal with these changes to stay up to date. 18, 62

2.3B2 CHANGES IN MORES AND MANNERS Changes in the working and living habits of U.S. citizens have been taking place. The four-day week has been adopted with success by several companies. In cities, people work at all hours. There are more working wives—about 60% of working women are married. Restaurants operate around the clock to satisfy all people. Today there is more emphasis on travel and on the fulfillment of personal rights and aspirations. People are mobile and go where they can satisfy these rights and aspirations, as well as their needs. Today there is a growing desire by people to fix their own meals in restaurants. "Do-it-yourself" is the motto of many fast food restaurants where you serve yourself and do everything else except provide the food and the means to heat or cook it. (Note that this same motto was the motto of food service in early American times.) 79 The
young people of our country have caused a social revolution that will continue in this decade--this will include eating and drinking habits among other customs and traditions. Many people put the emphasis on having "meaningful experiences"--they want to make the eating experience not just a refueling stop but a time and place to share food and drink with friends and acquaintances.¹⁷, ³², ⁴⁶, ⁷⁷

With the population bulge moving into its 20's there will be more family style restaurants. Growth in this area has already taken place and continued growth is expected.⁶³ Many drive-to restaurants are replacing drive-ins.³⁷ Some family and luxury restaurants are moving from the inner city to the suburbs and are beginning to employ labor saving devices.⁶¹ A recent survey described the general direction of the service restaurant.²³ (See Appendix I for Figure B)

Like fast food, the service restaurant market is changing constantly. High labor costs, low availability of labor, and shifts in the life style are all combining to force significant alterations in the way in which Americans dine out. The general directions of this change are outlined in Figure B. Most of the change involves the combination of certain aspects of conventional restaurant formats (drive-ins, coffee shops, etc.) into hybrid types designed to attract specific parts of the consumer public. A particularly interesting development is the "mini-menu dinnerhouse." By combining informality, a relatively limited menu, high average check size, and a degree of customer involvement in serving himself ("do-it-yourself"), this format has wide appeal and permits efficient operation with comparatively low labor costs. As chains gain a greater foothold in the service restaurant market, such innovation may well become commonplace.

2.3B3 ECONOMIC FACTORS AND LABOR PROBLEMS A very pressing problem in the food service industry is the rising cost of service. This is due to the higher wages that are being demanded or established
by minimum wage laws. We discussed this problem in Chapter I (Section 1.2D). Many Americans are being plagued today by the problem of buying any kind of service without paying an exorbitant price for it. Food service is one type of service. World travelers may enjoy plentiful personal service as they travel around the world and stop in Hong Kong, Montevideo, or Paris. There, labor is cheap and plentiful. However plentiful service is usually the opposite side of poverty in those cities.62

The outlook for the solution to this labor problem is dismal: in the future there will be higher wages, more fringe benefits, shortages of skilled and unskilled labor.33, 34, 109 Several people have stated that the only solution lies in automation and the use of computers.33, 34, 49

2.3c TREND TOWARD AUTOMATION AND COMPUTERS

There has been much done toward the application of automation and computers to the food service industry and more work is being done now.28, 50, 53, 81, 94, 110 Table 2.1 lists some trends in food service facilities.83 Notice the emphasis on ways to reduce labor. Automatic equipment in the future will be an important part of every food service operation. There will be problems in the development of this automatic equipment but they will eventually be offset by the rising cost of labor.50 One of the biggest problems with automated equipment has been its reliability, and what to do when it fails to operate properly.49, 110, 139
Trends in Food Service Facilities

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>More emphasis on convenience, efficiency, ready foods.</td>
</tr>
<tr>
<td>2</td>
<td>More sanitary restrictions.</td>
</tr>
<tr>
<td>3</td>
<td>Greater consciousness of bacteriological problems.</td>
</tr>
<tr>
<td>4</td>
<td>Greater degree of self-service to save labor and to encourage impulse sales.</td>
</tr>
<tr>
<td>5</td>
<td>More amenable surroundings especially in restaurants.</td>
</tr>
<tr>
<td>6</td>
<td>Use of limited menu to reduce labor and increase turnover.</td>
</tr>
<tr>
<td>7</td>
<td>Increased use of single service products.</td>
</tr>
<tr>
<td>8</td>
<td>Increased use of sophisticated automatic equipment for improving speed and quality while reducing labor.</td>
</tr>
<tr>
<td>9</td>
<td>Increasing awareness of waste problems,...</td>
</tr>
<tr>
<td>10</td>
<td>Awareness of the value of communications with all allied fields.</td>
</tr>
</tbody>
</table>
Computers are used widely. In the future the reader will see greater use of mini-computers for food and beverage control. Problems arise when computers are applied to a particular situation. Often people in the computer industry do not communicate well with people in the food service industry. Sometimes people view the use of a computer as the cure-all, however it is only as good as the system that uses it. Some people are biased against computers: they feel that computers are inhuman, tyrannical giants who come to make life more inhuman, more impersonal. The situation to which the computer is being applied is sometimes already inhuman. The computer relieves a human being from an inhuman job. We have discussed this first problem in more detail in Section 2.4, of this chapter. It must be remembered that the computer can make an operation more efficient but today's educated and discriminating customer will come back only to a friendly smile and an inviting atmosphere.

As far back as 1960, people were wondering what the future would bring; here's one man's question:

People, it must be remembered, view dining as a traditional rite as well as a necessity. Customs change slowly. Food has been sold through automatic coin dispensers for more than one generation. Will the time soon come when the patron first views a diorama of the day's menu on a colored, closed circuit TV, then punches buttons to select his meal automatically and simultaneously records the proper charge against his credit card?

Some colored, closed circuit TV applications have been tried in self-service restaurants with little success. No one has ever tried it in a service restaurant nor has anyone attempted to convert
service restaurants to such an operation.

Another similar view was expressed in 1966, by Mr. Robert Huyot, President of Intercontinental Hotel Corporation.41

I can see, perhaps, the time when you might have a computer on your restaurant table; you will push buttons to order your meat, decide what kind of dressing you want on your salad, what kind of garnishment you want, or entree. The computer will put it on the fire, and when it is ready you will get a red light on the computer—but I don't believe we are quite yet there.

2.3D TWO FUTURE TYPES OF RESTAURANTS

To end our discussion of what the future will bring, we have looked at two restaurants predicted for the future: (1) the Palace of Culinary Expertise, and, (2) Tomorrow's Specialty Restaurant.

2.3D1 PALACE OF CULINARY EXPERTISE This restaurant will be a highly computerized food service operation including reservations, credit check and suggestions for what to eat, depending on the occasion. Cooking will be controlled by a computer as well as the normal back-of-the-house restaurant record keeping, accounting and inventory.109

The computer enables the restaurant captain to provide personalized service, service tailored to the preference of individual guests.

The computer will remember when and why you came the last time, and what you had to eat on that occasion. It will suggest a menu to suit your tastes and the type of occasion. It will determine a nutritious and the least costly meal for your discriminating judgement. It will
2.3D2 TOMORROW'S SPECIALTY RESTAURANT

This restaurant will cater to people between the ages of 20 and 30 who want to decide for themselves and to express themselves by making their own meal. The director-host will provide the food, utensils, equipment and technical assistance—the "do-it-yourself" patron will provide the labor, expertise and expenses to feed himself, without any (or with the least) regimentation.109

2.4 THE "DEHUMANIZATION MYTH" OR HOW TO GET ALONG WITH A COMPUTER

There are two fears about the increased use of automation and computers: (1) labor will be displaced, and, (2) the individual will be dehumanized. People are afraid of being replaced by a cold, inhuman machine that can't relate to them very easily. These fears are understandable, especially in the food service industry.68

...let us remember that our business is people-oriented and any systems approach that dehumanizes, regiment, or otherwise seeks to deny fulfillment to the individual—be he fry cook, customer, patient or dishwasher—is in immediate and unequivocal contradiction to the name we give ourselves. In the food service industry—service is the key word!

One argument used in the food service industry, in order to justify the use of computers, is that it relieves the human being from repetitive, routine work and makes it possible for him to give his attention to serving the customer in a more individual, personal way.68

Mr. John P. Casbergue, President of the Society for the Advancement of Food Service Research, said:12
Contrary to some fears, it does not threaten to depersonalize a personal service industry. Rather, it might well work to improve the degree of personal service, by freeing management from tedious back-of-the-house tasks, and allowing them to spend a greater portion of the day at the front of the house. And EDP may well increase the morale and efficiency (as well as wages) of employees. EDP promises to be the harbinger of a completely new employer-employee relationship. The food service/lodging industry needs it.

The idea is to use any technological innovations to free service personnel so that they can give more personal service, not merely replace them.41 The more time and attention that can be given to the presentation and merchandising of the meal, the more satisfied the customer will be.

However, the use of machines must be compatible with considerations of human, individualistic values: self-esteem, relationship, communication and growth. Efficiency and immediate growth of profits of a company might take place when a machine is installed but unless the people who use the device are given consideration, the effect is to dehumanize the operation. These service people who use machines to serve the customer must be given understanding, encouragement, recognition and a chance to participate in the on-going process of improving the service. Lack of the human element or dehumanization by strict standardization of food service operations has caused young people to look elsewhere for self-fulfilling careers and opportunities.69

The service state toward which our society gravitates demands more personal attention. In a people business, and that essentially is what food service is, the demands for recognition, understanding participation are all part of a new look at where the industry is going.
With the use of the computer and other automatic equipment, the customer can expect the gratification of more than just his nutritional needs. With food service personnel relieved of much of the tedious work, it would seem that more of the social and human needs of the patron could be attended to. This is important since people eat away from home to...76.

...seek values that are being depersonalized at work, and blunted in other social relationships.

The basis of any hospitality is the sharing of food and drink with friends. If food service personnel have more time to make such occasions more pleasant, then everyone will be happy—the customer, the waitress and the manager.

People will not accept complete mechanization since it does not fulfill the human need for interaction, fantasy and festivity.69 While the computer does the tedious work, the waitress can provide the service with a friendly smile, or she can provide special service to the senior citizens, foreigners, and the handicapped.45

Those who have feared that systems would dehumanize work forces will find increasingly that they stimulate human expressions, multiply involvement and motivation, and pay off in self-fulfillment.

The use of computers in food service systems will not dehumanize service in restaurants if human potential is released, if human dignity is enhanced and if the human spirit is liberated.
2.5 OPINIONS OF SOME LEADERS IN THE FOOD SERVICE INDUSTRY

Through correspondence and personal interviews we have attempted to find out what has been done in the past and what the food service industry leaders foresee for the future.

2.5A MR. H. H. POPE, PRESIDENT OF POPE'S CATERING CO.,
ST. LOUIS, MISSOURI

Mr. Pope has given us the most significant information concerning systems that have been tried in the past. He is very keen in his observations and judgements and has recommended that...

"...better check forms, which facilitate taking and transmitting the order, would be just as effective as automatic or electronic ordering systems."

2.5B MR. M. COHEN, PRESIDENT OF INDUSTRIAL CATERING CO.,
INC., INDIANAPOLIS, INDIANA

Mr. Cohen uses the Telautograph system and has for the past 18 years without much problem. In another 5 years he will be looking for a new system. He foresees a completely automatic ordering between retailer and wholesaler similar to what is presently called "One Stop Shopping."
The most helpful in his advice and recommendations was Dr. Welch. With fifty years of experience in the food service industry, he is now Professor and Acting Director, Course in Food Service and Lodging Management, Department of Food Science and Nutrition, College of Agriculture, University of Missouri at Columbia. He has suggested a restaurant ordering system that he believes needs only to be tried to see if it will work. (See Appendix E). We have used some of his ideas in the design of our electronic ordering system which will be described in the next chapter.

2.6 SUMMARY OF THE STATE-OF-THE-ART

We have tried to give the reader an idea of the many different types of communication systems used by waitresses and cooks in serving customers. We have also discussed what the future will bring. Our discussion of the "dehumanization myth" has hopefully persuaded the reader that computers and automatic equipment are good if used as a tool for better and more personal service. Finally we have presented some opinions of leaders in the food service industry.

After having studied past and present systems, we believe that our proposed electronic ordering system is a step forward in the right direction. It appears that no such system exists today. However today's technology is far enough advanced such that the proposed
electronic ordering system can be easily implemented. It is only through the use of modern electronic technology that such system is possible.
CHAPTER III
DESIGN OF THE ELECTRONIC ORDERING SYSTEM

3.1 INTRODUCTION

Now that we have reviewed the problems (labor, service, food and cash control) and have examined past systems, we shall present the design of the new electronic ordering system. The new system will:

1. Improve the speed of service
2. Improve communications between cook and waitress
3. Improve food and cash control
4. Improve personal service
5. Improve productivity of waitresses/reduce number of waitresses

We shall discuss (1) the overall concept and operation of the system, (2) the menu coding system, (3) the Waitress Ordering Station (WOS), (4) the Central Processor (CP), (5) The Kitchen Console (KC) and (6) the Beverage Station Console (BSC).

3.2 OVERALL SYSTEM CONCEPT AND CHARACTERISTICS

3.2A SYSTEM DEVELOPMENT

We originally considered an ordering console for each booth in fast food restaurants. Several reasons which caused us to modify our original objectives and design a system for service
restaurants and not particularly for fast food restaurants were:

1. The emphasis will be on the family type service restaurant for the next ten years. This is because the population bulge is moving into its 20's. (See Section 2.3E1)

2. The human-to-machine interface presented a problem: How do you design a panel for the least intelligent, the illiterate, foreigners, and the handicapped? Our solution was to use the waitress and thus provide the human-to-human interface to the restaurant system. The human-to-machine interface will be between the waitress and the ordering system. This limits the type of people to consider in the design of the system.

3. "Service" is the word in a table service restaurant. A waitress waits on the customer. You don't provide service by presenting a pushbutton panel to the customer.

4. A system with mounted menu panels (including all the wiring and labor involved) would not be as economically practical nor as flexible and reliable as a waitress operated ordering station which was portable.

5. The advice and ideas offered by Dr. John M. Welch steered us toward our final design. He suggested several system concepts, some of which we borrowed for our design. We feel that his 50 years of food service experience, his knowledge and advice have added much to improve our design. (See Appendix E)
3.2B BASIC SYSTEM CONCEPT

As we have briefly outlined in Chapter I (Section 1.6 and Figure 1.1, p. 17), the electronic ordering system is a digital communication system to be used by waitresses and cooks. The waitress enters the order into her Waitress Ordering Station (WOS) and the cook receives the order in the kitchen, from the Kitchen Console (KC). The cook prepares the meal, signals the waitress that the meal is ready to be delivered, and the waitress comes to pick it up and deliver it. The arrangement and/or placement of the Kitchen Console (KC) will depend upon the particular restaurant to which the system is adapted. The Beverage Station Console (BSC) is needed to remind the waitress of the specific beverages ordered by each table. This is located at the beverage station. See Figure 3.1. This BSC indicates visually the table number and the desired beverages so that the waitress can serve the beverages while the cook prepares the meals, (since the cook has the guest check in the kitchen).

The waitress, when delivering the meal, may give the guest check (which has been printed out by the KC) to the customer immediately or may hold it until later. Nevertheless, a new guest check will be printed if the customer orders additional items. The customer pays for the meal in the usual manner for that particular restaurant. The cash control system in that restaurant need not be changed with the adaptation of this electronic ordering system.
FIGURE 3.1: BLOCK DIAGRAM OF ELECTRONIC ORDERING SYSTEM FOR TABLE SERVICE RESTAURANTS
When the waitress begins to take an order using this electronic ordering system, the first entries are:

1. A two-digit number to indicate the booth or table
2. A two-digit number to indicate her waitress number
3. A one-digit number to indicate the number of people at the booth or table

These numbers are displayed on the Waitress Ordering Station for the waitress so that she may verify that she entered the proper numbers. See Figure 3.2.

The waitress then continues to take the orders from the customers at the booth. While she is doing this, the system is continually interrogating her ordering station, asking it for any orders. This system is formally called a scanning telemetry system. Essentially what it does is to ask each station, once every second, if there is any information (i.e., orders) to be taken. If there are, then, the Waitress Ordering Station transmits the data for the order to the Central Processor. Next, the Waitress Ordering Station receives any messages sent from the Central Processor. Every second the data is transferred to the Central Processor and stored temporarily until the complete order has been given, and the waitress presses the PRINT button (The "P" button in Figure 3.2).

Within the electronic ordering system the following is actually happening:
FIGURE 3.2: SKETCH OF WAITRESS ORDERING STATION
1. The data for the order is converted to binary numbers and arranged as shown in Figure 3.3.

2. The four bit binary name-code at the beginning of each set of data is automatically generated by the Waitress Ordering Station without the help of the waitress.

3. Although the menu item code, the preparation instruction code and the amount code are entered as decimal numbers, they appear in the data as a BCD number, which is made up of bits.

4. The final 8 bits in the data carry the commands. Only one is given at a time. The ORDER command is always implied as far as the waitress is concerned unless she presses the PRINT or CANCEL buttons.

5. This data is sent over the radio channel in groups of 8 bits each. Since the radio channel uses asynchronous transmission and reception, start and stop bits are added to each group of 8 data bits. Also, parity check bits are added.

6. When the Waitress Ordering Station is interrogated, the data for the order is sent as shown in Figure 3.4. After the transmitter has been turned on, the four groups of 8 data bits are sent along with start/stop and parity bits for each group. After the data has been sent, the Waitress Ordering Station receives any one of six messages from the Central Processor. The messages are:

   a. Menu item out of stock--This message is accompanied by information indicating how many of that item are left in stock.

   b. Order is ready
FIGURE 3.3: DATA FOR TRANSMISSION OF ORDER
(a) TRANSMITTER TURNS "ON" AFTER W.O.S. DECODES INTERROGATE SIGNAL.
(b) FOUR BLOCKS OF DATA, 8 BITS EACH (SEE FIGURE 3-3), ARE SENT TO CENTRAL PROCESSOR.
(c) TRANSMITTER TURNS "OFF".
(d) WAITRESS ORDERING STATION RECEIVES MESSAGES.

FIGURE 3.4: TIME BLOCK FOR TRANSMISSION OF ORDERS AND RECEPTION OF MESSAGES
c. Transmit data for order

d. Invalid Code, Reorder--This tells the waitress that she has pressed the wrong buttons and must reorder. The five digit display shows all zeros for this message.

e. Waitress Call-- Tells the waitress she is wanted by the manager for some reason.

f. Reset all registers in Waitress Ordering Station--This causes all circuitry to be reset so that a new order may be entered. This message is sent after the waitress has pressed the PRINT command and all data has been transferred to the Central Processor.

7. All of the above takes place in 125 milliseconds. This time interval was selected to allow eight Waitress Ordering Stations to operate simultaneously and, to utilize the radio channel efficiently. Each of the eight stations can be interrogated and reply concerning the order every second.

8. At the end of each order, the waitress presses the PRINT button in order to print out the order on the kitchen console for the cooks. The beverage order is displayed on the display panel at the beverage station at this time.

9. After completing the order, the waitress delivers the beverages and takes orders from other customers, until the cook signals to her that her order is ready. The receiver of the Waitress Ordering Station is always "on" so that it will receive any messages at any time.

10. A small holster or pocket is provided to carry the Waitress Ordering Station when not in use.
3.3 CODING SYSTEM FOR MENU ITEMS, PREPARATION INSTRUCTIONS AND AMOUNTS OF EACH ITEM TO BE ORDERED

The waitress will enter a code for a menu item, a code for the preparation instructions and a code for the amount of the menu item to be ordered. She will do this for each item ordered. The codes for each menu (breakfast, dinner, and lunch) will be on a small card mounted on the face of the Waitress Ordering Station. See Figure 3.2, p. 58. There is a separate code card for each meal; it has been made so that it can be easily inserted and removed from the Waitress Ordering Station.

3.3A MENU ITEM CODES

Menus from a table service restaurant are shown in Figure 3.5. A menu item code was assigned to each item or class of items. For the breakfast menu, in order to conserve the number of codes, each item within a "numbered" breakfast combination has its own individual menu code. This was also done for dinners and lunches which were made up of several individual items listed separately on the menu. Numbers used for menu items for breakfast may be used for other menu items on the dinner menu, or lunch menu. Only the numbers 00 to 99 were used for menu item code numbers so as to keep the size of the device small. Larger numbers would require more circuits and hardware. The menu item codes were listed next to the abbreviated name of the menu item on the code cards. The menu item codes were printed on the left side of the code cards. See Figure 3.6. The menu item code always appears in the first two digit places from the left on the Waitress Ordering Station.
FIGURE 3.5a: BREAKFAST MENU

SANDWICHES

LUNCH'S CLUB WURTZ 1.15

POOR BOY $0.90

STEAK SANDWICH 1.15

CHICKEN SALSA 1.15

BANANA Split 1.25

TOMATO SALAD 1.15

POTATO SALAD 1.15

MEXICAN SALAD 1.35

NUT SALAD 1.25

SALADS

FRUITS AND JUICES

SATURDAY SPECIAL

SANDWICHES

BREAD AND BUTTER

PASTE

FRUIT

BAKED POTATOES

VEGETABLES

SALADS

BREAKFAST SPECIAL

FIGURE 3.5b: LUNCH MENU

FIGURE 3.5a: BREAKFAST MENU

FIGURE 3.5b: LUNCH MENU
FIGURE 3.5c: DINNER MENU

(Note: These menus were furnished through the courtesy of Mrs. Florence Holton, Lemonds' Finer Foods, Sioux Falls, South Dakota. Menus shown here have been reduced ten times.)
FIGURE 3.6: CODE CARDS FOR BREAKFAST (a), LUNCH (b), AND DINNER (c)
The preparation instruction code is assigned to each and every different way any item on the menu can be prepared. There are preparation instruction codes for:

1. Ways to prepare eggs
2. Ways to prepare breakfast cereals
3. Ways to prepare hamburgers and toast
4. Different types of rolls and toast
5. Different types of beverages
6. Ways to prepare potatoes
7. Different types of desserts
8. Different types of pies
9. Ways to prepare tossed salad
10. Different types of juices

In essence the use of the preparation code was intended to lessen the number of menu item codes. For instance, there is one menu-item code for beverages, "15". The preparation instruction code tells the cook whether the customer wants sanka, coke or lemonade, etc. The same is true for the rest of the preparation instruction codes (See Appendix F for a complete listing). Like the menu item code, the preparation instruction code is a two digit, decimal number (00-99). These codes remain the same for all three meals. The preparation instruction code always appears in the third and fourth digit places from the left on the Waitress Ordering Station. See Figure 3.2, p. 58. The preparation
instruction codes were printed on the right side of the cards. See Figure 3.6.

3.3c AMOUNT CODES

The amount code is a one digit, decimal number which tells the cook how many of the corresponding menu item that the customer wants. The highest number of any one item which a waitress can order for a customer is nine. If the customer wishes more of that item the waitress merely enters it again. The amount code always appears in the far right-hand digit place on the Waitress Ordering Station. See Figure 3.2, p. 58.

3.4 THE WAITRESS ORDERING STATION, (WOS)

The Waitress Ordering Station is shown in Figure 3.2. It is a small portable FM transceiver which sends orders to the kitchen and receives messages from the cook. It consists of (1) a code-card holder, (2) five digital, numeric displays, (3) two lights for signalling the waitress, (4) a numeric keyboard for entry of codes, and (5) the necessary electronic circuits, and battery for power. The design of this Waitress Ordering Station took into account the fact that the waitress will be carrying it all day and may become fatigued. It was designed to be as light or lighter than a small two-way portable radio-transceiver. It is easy to handle and operate so that anyone who comes in off the street can operate it within a few hours.
3.4A FUNCTIONS AND CHARACTERISTICS OF WOS

3.4A1 FUNCTIONS AND CHARACTERISTICS RELATED TO WAITRESS OPERATION OF WAITRESS ORDERING STATION

As already noted in Figure 3.2, the codes will be entered through a keyboard. The "P" and "C" keys represent "PRINT" and "CANCEL" commands. The waitress presses the PRINT button after all orders have been entered. This causes the Kitchen Console to print the desired menu items, the preparation instructions, the amount desired, prices, and totals on the guest check. The CANCEL button is pressed when an item must be cancelled from the order. This allows the customer to change his mind before the waitress presses the PRINT button. The menu item code, the preparation code, and the amount code are displayed on the numeric digital readouts on the Waitress Ordering Station when the waitress enters them by means of the keyboard. The code numbers will remain there until the next item is ordered or until the PRINT or CANCEL buttons are pressed.

When the waitress is ordering something and that item is out of stock, the number in the "amount" digit-place will change to the number of that item which is remaining. This will indicate to the waitress that she should tell the customer to order something else.

The two indicator lights, CALL and ORDER READY, tell the waitress to go back to the kitchen to pick up a prepared meal and deliver it, and/or tell her to see the manager who has a message, or a telephone call for her.

3.4A2 INTERNAL FUNCTIONS AND CHARACTERISTICS OF WOS

Figure 3.7 shows the block diagram of the Waitress Ordering Station.
FIGURE 3.7: BLOCK DIAGRAM OF WAITRESS ORDERING STATION
It consists of seven parts:

1. Keyboard and Interlock System
2. Error Control and Synchronization System
4. System Clock
5. Display System
6. Multiplexing System
7. FN Transceiver

3.4A2a KEYBOARD AND INTERLOCK SYSTEM The numbers entered on the keyboard are converted to a 4 bit BCD code. The interlock system prevents the waitress from activating more than one key at a time. If she presses more than one key, none will register. Upon releasing one of the keys, the other will register.

3.4A2b ERROR CONTROL AND SYNCHRONIZATION SYSTEM These systems are included in the UNIVERSAL ASYNCHRONOUS RECEIVER/TRANSMITTER (UART). This is an LSI device for converting 8-bit parallel data into serial data for transmission after adding the parity check bits and the start and stop bits. The start and stop bits are used since this system uses asynchronous transmission and reception. For each group of 8 bits, parity bits are added, along with a start and stop bit. The receiver portion of the UART does the reverse: it accepts serial data, samples the data, checks the parity, and converts it to parallel data for decoding by the Security and Message Code/Decode System.
3.4A2c SECURITY AND MESSAGE CODE/DECODE SYSTEM This system provides for security against other signals entering the Waitress Ordering Station. Only the right code sent from the Central Processor will activate the Waitress Ordering Station. Likewise, the Waitress Ordering Station sends a name-code in order to access the Central Processor. The message code/decode system provides for converting to BCD coded messages into a form suitable for presentation to the waitress.

3.4A2d SYSTEM CLOCK The system clock is used to control the timing of the multiplexer, the display system and the Universal Asynchronous Receiver/Transmitter. The clock frequency is 16 kilohertz in order to transmit the data at a rate of 1000 baud. The clock is crystal controlled and must have a crystal with a calibration tolerance less than .0025%. This is necessary in order to maintain accurate transmission of data in this asynchronous system.

3.4A2e DISPLAY SYSTEM The display system uses liquid crystal displays (LCD) for displaying the menu item code, the preparation instruction code and the amount code. A multiplexing system is used to control the digit displayed at any one time in order to prolong the life of the LCD. Liquid crystals of the reflective type are used to maintain low power drain from the battery. The reflective LCD's use ambient light as the light source and reflect this light when they are turned on.

3.4A2f MULTIPLEXING SYSTEM The multiplexing system controls the data signals and directs them to their proper place at the proper time. It receives data from the keyboard and sends it to the display
system and to the UART for transmission to the Central Processor. This system also contains the necessary control circuitry for the UART and the circuitry for the PRINT AND CANCEL commands.

3.4A2g  **FM TRANSCIEVER**  A small portable transceiver is used to transmit and receive the data in this asynchronous system. The data will be sent by means of the Frequency Shift Keying (FSK) method which is the most popular method and is relatively free of noise. With FSK and the name-coded for stations, adequate security against the noisy restaurant environment and other radio signals will be provided. The restaurant is a noisy environment. There are fans, motors, switches, static electricity—all these generate noise on the air waves.

3.4B  **IMPLEMENTATION OF THESE SYSTEMS IN TERMS OF HARDWARE**

Complementary MOS (COS/MOS) circuitry will be used in the Waitress Ordering Station. The goal was to provide a low power drain on the battery power supply and to maintain high noise immunity. These circuits have high noise immunity, have low quiescent current drain and have an input network to prevent accidental destruction by static electricity. This static electricity can be a problem especially in a restaurant where there is a rug with many people walking across it and generating static charges. Although these circuits are more expensive than other types of transistors, they have the least power drain. The prices on these circuits will more than likely be reduced in the next few years.
The antenna for this Waitress Ordering Station will be within the case so that there are no dangling wires to get caught or break off. Concerning the physical environment of the Waitress Ordering Station, it is very rugged. A keyboard with sealed keys was used so that the whole WOS could be sealed. This prevents dirt, grease, water, food, etc., from contaminating the system components.

Frequencies available for use in this system are known as business frequencies. There are many frequencies to choose from. It may be wise though to obtain FCC authorization to use a certain frequency exclusively so that unnecessary interference from a radio station using the same frequency would be eliminated.20

The design of the Waitress Ordering Station is given in the Appendix A.

3.5 CENTRAL PROCESSOR

3.5A EXTERNAL FUNCTIONS AND CHARACTERISTICS OF THE CENTRAL PROCESSOR

The Central Processor is the heart of the electronic ordering system. It is under the lock and key of the manager. The Central Processor is shown in Figure 3.8. Like the Waitress Ordering Station, it has a display for menu item codes, preparation instruction codes, amount codes, but it also displays the price code. This last, price code, enables the manager to change the price of any item at any time. The keyboard for the Central Processor is more complex in that it has arithmetic functions in addition to the numeric keyboard. The Central Processor has eight sales registers for recording the sales of each of
NUMERIC DISPLAY OF MENU
ITEM CODE, PREPARATION
INSTRUCTION CODE
AMOUNT OF ITEM
INVENTORY AND PRICE
CODE

SWITCHES FOR
SELECTION
OF MENU

KEYBOARD
FOR ENTRY
OF DATA
INTO THE
SYSTEM

10"

12"

6"

FIGURE 3.8: SKETCH OF CENTRAL
PROCESSOR
eight waitresses—for a day, month or year. A switch on the Central Processor also allows the manager to switch the menu being used by the Central Processor. In other words, only a certain menu will be used at any one time. The switch controls the part of the memory being used.

The Central Processor will be located near the back part of the restaurant, possibly even in the managers office. Wires going from the Central Processor will connect to the Kitchen Console and to the Beverage Station Console.

3.5B INTERNAL CHARACTERISTICS AND FUNCTIONS OF THE CENTRAL PROCESSOR

The systems which make up the Central Processor are shown in Figure 3.9. There are eleven systems:

1. Keyboard and Interlock System
2. Error Control and Synchronization System (UART)
3. Security Decoder and Message Code Generator System
4. System Clock and Time Clock
5. Display System
6. Multiplex System
7. FM Transceiver
8. Main Memory System
9. Temporary Memory System
10. Decode, Tax and Totallizer System
11. Waitress Sales Register
FIGURE 3.9: BLOCK DIAGRAM OF CENTRAL PROCESSOR
3.5B1 KEYBOARD AND INTERLOCK SYSTEM  The keyboard on the Central Processor has the following keys in addition to those found on the Waitress Ordering Station: (1) Store, (2) Display, (3) Print out, (4) Calculator Electronic Ordering System Control, (5) Divide, (6) Add, (7) Subtract, (8) Multiply. These controls enable the manager to put into the system any menu item at any price. It also enables him to check any item's sales at any one time. The calculator is provided so that he can perform any necessary arithmetic on the machine itself. The keyboard interlock system is the same as that in the Waitress Ordering Station. The manager may also enter an order from this Central Processor.

3.5B2 ERROR CONTROL AND SYNCHRONIZATION SYSTEM This is the same as that in the Waitress Ordering Station. Another UNIVERSAL ASYNCHRONOUS RECEIVER/TRANSMITTER is used to provide the necessary parity check bits and the start/stop bits for the asynchronous transmission/reception system.

3.5B3 SECURITY DECODER AND MESSAGE CODE GENERATOR SYSTEM Like the Waitress Ordering Station, the Central Processor will only be accessed by means of the name-code sent from the Waitress Ordering Station. The message code generator sends messages to the Waitress Ordering Station to control it or to tell the waitress something.

3.5B4 SYSTEM CLOCK This is a 16 kilohertz clock to run the Central Processor. It is crystal controlled and must be of the same calibration as the crystal in the Waitress Ordering Station. The time clock is used so that the time of day may be printed on the guest check. This enables the manager to check for meals prepared late or delivered late.
3.5E5  DISPLAY SYSTEM  The display system in the Central Processor has additional digit-places as compared to the Waitress Ordering Station. For the Amount Code, it has three digit places instead of just one. This allows the manager to tell the system that up to 999 of any one menu item are on stock. The price code has two digit places. Since there are only a limited number of different prices used on the menu, each price was given a name-code (numeric, 00-99). This eliminated listing the BCD (4 bits per decimal digit) equivalent of three- or four-digit decimal prices (on the menu) in the system. When the manager uses the calculator, the display will be like any other calculator and the numbers will enter the display from the right and be shifted to the left.

3.5B6  MULTIPLEX SYSTEM  This system controls the timing of the systems described here, and steers the data to the proper places at the proper time (Clock, UART, Display, Memory).

3.5B7  FM TRANSCEIVER  This is the radio part of the system and is similar to the FM Transceiver in the Waitress Ordering Station. FSK is used and data is transmitted at a rate of 1000 baud. The control of transmit/receive function is controlled by an internal clock.

3.5B8  MAIN MEMORY SYSTEM  This system contains the address system, core driver, and magnetic core memory. It stores the menu item prices in certain locations. The address system contains different addresses for the different menu items. The menu item codes and some of the preparation instruction codes serve as the addresses. At each of these
tax code, the menu item codes, the preparation instruction codes, and
the price codes are decoded into a form which the printer (in the
Kitchen Console) will accept. This decoded information is sent to the
Kitchen Console for printing. This system also sends the beverage
order information (table number, type of beverage and amount) to the
Beverage Station Console.

3.5B11 WAITRESS SALES REGISTERS After each sale, the amount
of the sale is registered in the appropriate register in order to give
the waitress credit for the sale. This enables the manager to monitor
the activity of each waitress.

3.5C IMPLEMENTATION OF THE ABOVE SYSTEMS IN TERMS OF HARDWARE

Since the Central Processor will be powered by normal 115VAC,
there is no need to employ low power circuitry. Instead, less expensive
logic circuits will be used together with a magnetic core memory and its
associated drive circuitry. Higher powered display systems will also
be used. Sales register for the waitresses will be mechanical counters
which can be advanced electronically. Semiconductor memories will be
used for temporary storage. A magnetic core memory is used to store
the menu item amounts and prices. This storage medium is permanent in
case of power outage (See Appendix B).

3.6 KITCHEN CONSOLE

Figure 3.10 illustrates the Kitchen Console. Its purpose is to
receive the data from the Central Processor and print it on a numbered
KEYBOARD FOR NOTIFYING WAITRESS THAT HER ORDER IS READY

TICKET COMES OUT FROM THIS SLOT.

FIGURE 3.10: SKETCH OF KITCHEN CONSOLE
guest check accurately and clearly. It prints the abbreviated (alphanumeric) name for the menu item, an abbreviated form of the preparation instruction, the amount desired and the price. The tax and total are printed at the bottom of the guest check. The Kitchen Console will be located within easy reach of the cook or food checker (who calls out the order to the cook).

Figure 3.11 is the block diagram of the Kitchen Console. Besides the printer, there is a small numeric keyboard similar to the keyboard on the Waitress Ordering Station. This is used by the cook to send a signal to the waitress telling her that her order is ready. This signal is sent only to the Waitress Ordering Station from which it originated. (See Appendix C)

3.7 **BEVERAGE STATION CONSOLE**

The Beverage Station Console is illustrated in Figure 3.12. It is composed of a Self-Scan™ Panel Display and a control switch. The Panel Display indicates what beverages are desired by the customers at a certain booth or table. The information concerning these beverage orders is sent from the Central Processor through wires and displayed on this panel. There will be a separate Beverage Station console for each waitress ordering station. The control switch enables the waitress to turn off the displayed beverage order after she has fixed that order. The information displayed is also recorded on the ticket which has been already printed by the Kitchen Console. The block diagram of the Beverage Station Console is shown in Figure 3.13 (See Appendix D).
FIGURE 3.11: BLOCK DIAGRAM OF KITCHEN CONSOLE
ALPHANUMERIC DISPLAY OF BEVERAGE APPEARS HERE

CLEAR SWITCH CLEARS DISPLAY PANEL AFTER ORDER HAS BEEN FILLED

FIGURE 3.12: SKETCH OF BEVERAGE STATION CONSOLE
FIGURE 3.13: BLOCK DIAGRAM OF BEVERAGE STATION CONSOLE
3.8 SUMMARY OF DESIGN

We have briefly described the design and operation of the Electronic Ordering System for Table Service Restaurants. The Appendices contain further information that you may be interested in, concerning more details of the design. We are aware that this design is only the beginning and many improvements and changes will be necessary before it can be fully operational, and feasible in a restaurant operation.
CHAPTER IV

APPLICATION OF THE ELECTRONIC ORDERING SYSTEM

TO LEMONDS' FINER FOODS

4.1 INTRODUCTION

In order to illustrate the advantages of using the electronic ordering system, we have presented here its theoretical application to Lemonds' Finer Foods, Sioux Falls, South Dakota. We have also discussed the amount of time necessary for training new waitresses to use this system.

4.2 LEMONDS' FINER FOODS USES NEW ORDERING SYSTEM

4.2A OPERATIONAL CHARACTERISTICS

Lemonds' Finer Foods is a medium sized, table service restaurant. It has a very extensive menu for all three meals: breakfast, lunch and dinner. (See Figure 3.5, pp. 64-65). Its wooden booths offer privacy and very good atmosphere in which to enjoy a meal any time of the day. It seats about 160 customers with additional seating for about 25 more during the rush hours. There are several waitresses. Each waitress serves about five booths. Figure 4.1 shows the floor plan of Lemonds'. It was not drawn exactly to scale since it is only for illustrative purposes. The parts of the electronic ordering system are shown by triangular shaped symbols.
Figure 4.1: Floor Plan, Lemonds' Finer Foods, Sioux Falls, South Dakota

(Note Drawn to Scale)
4.2B ADVANTAGES OF USING THE ELECTRONIC ORDERING SYSTEM

4.2B1 THE WAITRESS SAVES TIME, STEPS AND COMMUNICATES WITH THE COOKS FASTER, MORE CLEARLY  The waitress takes the orders in the usual way, except that she enters the order into the Waitress Ordering Station. When she does this, she gets the order to the cooks quicker and more accurately than with the handwritten guest check system. Use of the electronic ordering system eliminates errors in handwriting and forgetting to write down an item. While waiting for the order to be prepared, the waitress gets the beverages. These were displayed on the Beverage Station Console when the waitress entered the order into the Waitress Ordering Station. Now she reads the beverage order from the Beverage Station Console, prepares the order, clears the display and delivers the beverage. When she is called, she goes back to the kitchen, picks up the order and delivers it.

4.2B2 SLOW SERVICE SPEEDED SWIFTLY  It appears that this ordering system will be most advantageous during the rush period. The time saved in delivering the checks enables the waitress to give more time to serving the customer. There will be less pressure on her to hurry. She will be able to enter any number of orders and get the necessary beverages for several booths--without having to run back to the kitchen to deliver each order.

For items out of stock, the electronic ordering system will save the waitress twice as many steps. Often an item runs out of
stock and the waitress does not know about it, until a customer tries to order that item. With this new system, she does not have to run back to the kitchen to become aware that it is out of stock. The electronic ordering system tells her immediately whether or not an item is available. This reduces the time needed to serve the customer; it increases the turnover rate. Profits are increased.

4.2E3 RESPONSIBILITY IS FIXED With this system, the responsibility for each order is fixed. The time of day is printed on each guest check so any delay will be evident and documented. Records of each waitress' sales are kept. The cook is not allowed to issue any food without a guest check issued by the system—food control is improved. The manager has control over the items and prices at all times; he can change them at any time. Cash control is aided by clearly and accurately printed checks.

4.2B4 USE OF THE ELECTRONIC ORDERING SYSTEM INVOLVES LITTLE CHANGE IN THE PHYSICAL ARRANGEMENT Installation of this system involves very little labor and only a few wires. The manager needs only to turn on the switch, enter the data for the menu items, train his waitresses for a few minutes and he is ready for improved business. The system is very flexible. No special wiring needs to be installed to each booth. No operator, or "order-taker", is needed to answer the telephone when a customer calls from the dining area. The Kitchen Console and the Beverage Station Console can be placed anywhere the restaurant manager desires. Reliable operation is expected since precautions were taken in selecting reliable electronic circuits.
4.2C2 **METHOD OF WORKING WHEN A SALAD IS ORDERED** Due to the physical arrangements of Lemonds' facilities, the waitress has to go back to the kitchen to obtain the salads. Therefore, when a salad is ordered, the new electronic ordering system will not save her from having to make this trip. Nevertheless, it will allow the cook to begin preparing the hot menu items while the waitress serves the beverages. Also, if only a salad is ordered, the waitress can pick up the guest check as she picks up the salad orders.

4.2C3 **WAITRESS MUST VERIFY PROPER CODE ENTRY** We have tried to reduce errors and illegible, handwritten guest checks, but the waitress still has to be attentive when using the electronic ordering system. The menu codes are displayed as she enters them for visual verification. If she makes a mistake, she can cancel that misordered item. If the mistake was entry of an invalid code, the system will tell her to reenter the order. If she does not verify proper code entry, the wrong item will be prepared by the cook. Her mistake will be documented so she will be encouraged to make few mistakes.

4.3 **TRAINING EXPERIMENT**

Since several food service managers pointed out that training would be a problem with the adoption of the electronic ordering system, we performed a small experiment.91

With the advice and suggestions of Mr. Marco Montoya (Ph.D. candidate, Rural Sociology Department, South Dakota State University)
and security was built into the system. For volume production of this system cost will be low; the restaurant operator can expect to recover his investment in the form of saved time/steps and increased productivity within two years.

4.2C REMAINING PROBLEMS

After applying the electronic system to Lemonds' Finer Foods, several problems presented themselves: (1) Poor method for waitress to obtain the guest check when only a beverage is ordered, (2) Poor method for the waitress to proceed when orders include a salad, and (3) Incorrect code entered. The first two problems are due to the physical arrangement of the facilities at Lemonds' Finer Foods. Another restaurant may not have these problems if the facilities layout is more suitable.

4.2C1 OBTAINING THE GUEST CHECK WHEN ONLY A BEVERAGE IS ORDERED

When the waitress orders a beverage with this system, the guest check is printed in the kitchen and a visual display is given at the beverage station. With the Kitchen Console located close to the food checker and cooks, the waitress must make a trip back to the kitchen to get the guest check. If she has to be back there for other reasons, she does not waste the trip. Otherwise, the system makes more steps for her to walk. If the Kitchen Console could be located adjacent to both the food checker and the beverage station, this problem would not exist.
we designed a simulated meal ordering experiment. This experiment was only intended to be a "rough" estimate of the amount of time needed to train totally unfamiliar people to be waitresses using the new electronic ordering system. Because of the limited time and finances, all of the variables were not strictly controlled. Nevertheless, the results of the experiment generally indicated that unfamiliar people could be trained to use the new system quite accurately within half-an-hour. After discussing the results with Mr. Montoya, we concluded that a more closely controlled experiment would indicate the same results. (See Appendix H)

This experiment brought our attention to the design of the code cards (See Figure 3.6, p. 66). The abbreviations for the menu items and the codes can be arranged more advantageously. Also, the training problem is more a problem of managers not taking the time to train their employees than a problem of slow-learning, unintelligent people working as waitresses. Any use of this electronic ordering system must be preceded by a training session.

4.4 SUMMARY

We have briefly discussed the theoretical use of the electronic ordering system by Lemond's Finer Foods. Use of this system offers better food and cash control, better communication between waitress and cook, more accurately and clearly written guest checks and the saving of some steps made by a waitress. Some problems still exist due to the physical arrangement of the food service
equipment and personnel.
CHAPTER V

SUMMARY AND CONCLUSIONS

5.1 SUMMARY

Several problems exist in table service restaurants:

1. **Labor problems**: there is a high turnover rate, demand for higher wages and the lack of skilled and unskilled labor;

2. **Lack of personal service**: the waitress is slow, incompetent and inattentive; she does not serve the customer;

3. **Poor communications**: the cook has problems reading the waitress' illegible handwriting; the waitress has to physically carry the handwritten guest check to the kitchen;

4. **Lack of good food and cash control**: food is issued without a written guest check; wrong prices are written down; prices on the handwritten guest check are manipulated to the advantage of the cashier or customer who is a friend of the cashier.

After reviewing past and present "communication systems used for ordering" in all types of food service operations, we became aware of ordering system concepts and some mistakes to avoid. We designed an electronic ordering system for table service restaurants with these concepts in mind. The system specifications are given in Appendices A through D.

After theoretically installing our electronic ordering
system in a table service restaurant (Lemonds' Finer Foods), we found that it offers an alternative among several other solutions to the problems above. Due to the physical arrangement of facilities at Lemonds' several minor problems remained.

A crude training experiment indicated that the amount of time needed to train prospective waitresses to use the electronic ordering system would be an half-hour.

5.2 CONCLUSIONS

The use of electronic devices to solve the problems of table service restaurants is only one alternative. However, it appears to be a popular alternative to avoid the rising labor costs (See Chapter I, Section 1.3). This is not altogether unreasonable since the prices of LSI and MSI electronic circuits are decreasing. This means that more complex functions can be done with smaller equipment at less expense.

The design of an electronic ordering system for a particular restaurant must take into account the existing physical layout. As mentioned in Chapter IV (Section 4.2C) several minor problems remained after we theoretically installed our system in Lemonds' Finer Foods. Each restaurant will be arranged differently. Therefore, the design must be modified to fit the restaurant system.

The design we have presented here is not completely fool-proof as we discovered in Chapter IV (Section 4.3). Besides, since we did not actually build the system, there will certainly be
problems which we have not forseen. Many improvements, which we are not now aware of, can and must be made to insure proper operation of the system in the restaurant operation. Future innovators will hopefully benefit from our research and use some of our ideas presented here--just as we have benefited from ideas and concepts tried by others in the past.
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## APPENDIX A

### WAITRESS ORDERING STATION

### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Power requirements</th>
<th>Battery, rechargeable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+ 15 Vdc, 400 ma.</td>
</tr>
<tr>
<td></td>
<td>+ 5 Vdc, 40 ma.</td>
</tr>
<tr>
<td></td>
<td>- 5 Vdc, 10 ma.</td>
</tr>
<tr>
<td></td>
<td>- 12 Vdc, 10 ma.</td>
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<table>
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<th>Integrated circuits</th>
<th>Linear, LSI/MOS, COS/MOS</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Series 4000</td>
</tr>
</tbody>
</table>

| Cooling                  | Convection               |

| Temperature Range        | 40° F to 130° F          |

| Humidity Range           | 5% to 95%                |

| Communication system     | Asynchronous, digital, scanning telemetry system using FSK; RF output: 100 milliwatts on business frequency band |

| System clock frequency   | 16 Kilohertz, crystal controlled, crystal calibration tolerance: less than .0025% |

| Information transmission rate | 1000 Baud |

| Data entry               | Keyboard, numeric and sealed: 10 key plus two function keys |

| Data output              | Liquid crystal display, numeric, five digit, multiplexed, f=50 Hz.; two indicator lights |

| External characteristics | Antenna enclosed inside case made of molded plastic, card holder |

| Security                 | Parity check, station name code, circuits immune to noise |
APPENDIX A

WAITRESS ORDERING STATION

SYSTEM OPERATION

The keyboard and interlock system of the Waitress Ordering Station is shown in Figure A.1. The keyboard activates the decimal-to-BCD converter (R1-R5, A1, I1-I4, FF1-FF4). The interlock network (E1-E11, I5-I7, A2, R6) prevents more than one key from being activated at the same time. This interlock system also sends a clock pulse to the Flip-Flops (FF1-FF4). This interlock signal from E11 controls the Print/Cancel Commands of Figure A.4.

The Multiplex System, Part I, Figure A.2, controls the signals from the transmission gates (TG1, TG2). Transmission gates (TG3-TG7 and TG8-TG-12) and flip-flops (FF5-FF23) are controlled by a "divide-by-five" counter (C1) in such a way as to direct the successive digits to their proper places and then to the display system.

The Multiplex System, Part II, Figure A.3, controls the input to the transmitter data holding register of the Universal Asynchronous Receiver/Transmitter (UART). The station name-code is added here (TG20). "Transmit enable" (from Figure A.6), "Load enable" (from the UART), and the "five-digits-present" signal control the loading of data into the UART.

Figure A.4 shows the logic which generates the Print/Cancel and Order Commands. These commands accompany each item ordered.
The Display System, Figure A.5, displays the decimal digits of the menu codes to the waitress. Signals enter this system from the Multiplex System, Part I, (TG8-TG-12). D1, D2, D3 are counters which control the digits displayed. A7-A19, J14, and R7 controls the "Display enable" Command. The liquid crystal displays are pulsed at 50 Hz. to extend their life.

The Multiplex System, Part 3, Figure A.6, contains the switching and decoding necessary to gain entrance to the station. Data that follows the name codes is converted to 4-bit parallel for entry into the Multiplex System, Part 1, Figure A.2 through TG2. Controls for the Message Code Decoder are also shown.

Figure A.7 shows a possible configuration for the station name-code and the message code decoder.

Figure A.8 shows how the messages are implemented.

Figure A.9 shows the logic within the UART.

Figure A.10 illustrates the control and interface logic for the UART. Logic level shifters are not shown.

Figure A.11 is a block diagram of the FM Transceiver.
APPENDIX A

LOGIC DIAGRAMS
FIGURE A.1: KEYBOARD AND INTERLOCK SYSTEM
FIGURE A.2: MULTIPLEX SYSTEM, PART I
FIGURE A.3: MULTIPLEX SYSTEM, PART II
FIGURE A.4: PRINT/CANCEL COMMANDS
FIGURE A.6: MULTIPLEX SYSTEM, PART III
**FIGURE A.7: STATION NAME-CODE (a) AND MESSAGE CODE (b) DECODERS**
MESSAGE 1
FROM 2 (5),
FIG. A.7
FROM FF42,
FIG. A.6
FROM 3,
FIG. A.7
MESSAGE 3
FROM 4,
FIG. A.7
MESSAGE 4
FROM 6,
FIG. A.7
MESSAGE 6
FROM 1,
FIG. A.7
FROM Ao,
FIG. A.1
MESSAGE
FROM 3,
FIG. A.7
MESSAGE 4
FROM 6,
FIG. A.7
MESSAGE 6
TO 0\text{DA},
FIG. A.2;
TG31, FIG. A.6
TG7, FF21–24,
FIG. A.2
TO A,
FIG. A.10
TO RESET,
FIG. A.2
TO RESET,
FIG. A.8: 2, 5
FIG. A.2
FIG. A.4
FIG. A.6

FIGURE A.8: MESSAGE LOGIC
**FUNCTIONAL DIAGRAM**

**SYMBOLS AND DEFINITIONS**

Ose — received data at input of LSB of data word enters on Ose register due to data in length.

Oel — received data, enables. Oel enables the received data buffer to output data.

O5y — received parity error. Goes to O5y if received data word has a parity error.

Oeg — received framing error. Goes to Oeg if received data word is not complete.

O6a — received-length error. Goes to O6a if received data word is not complete and characteristic is ready to be transferred to buffer holding register.

Y4L — receiver status word enables. Y4L enables the status word report file. O6a, O5y, Oel, Ose.

Dc — receiver clock line. Frequency = 16 a baud rate.

O2a — receive data available. Y5a enters O2a register.

O5a — received parity error. Y5a indicates a parity error has been received.

Y5a — transmitter valid state. Asserts transmitter circuit. When data is being transmitted, this line is held high.

O7a — external reset. Y5a opens all inputs and sets transmitter status to reset. Should be used after power turn-on.

O8a — transmitter reset holding register enables. Goes to O8a when external reset is held open into the register.

O9a — transmitter data word input clock. Y5a enters data into the input holding register. Transitions to O5a when start bit of next received data transmission.

O10a — transmitter end of character flag. A Y5a, to O10a, transition represents completion of a character word. The 8-bit data transmitted. Y5a is maintained until the mark to space conversion of the start bit of a new character transmission.

O11a — end of character detected. Character to be transmitted is shifted out serially on this output. Returns to Y5a during data time.

Y4c — transmitter data clock. The output must be the transmitted Y4c, a LSB equivalent length between word.

Yga — transmitter data enable. Y5a enters Yga data into the current bit transmission register. Can be enabled or held high to Y5a.

Yg — transmitter data enable. Y5a is alternates between start of received data and disables the receiver parity check. Y5a also checks whether the data and Z5a enter O8a or O9a.

Y5 — transmitter clock line. Frequency = 16 a baud rate.

O12a — receiver data available. Y5a enters O12a register.

O13a — received parity error. Y5a indicates a parity error has been received.

O14a — received framing error. Y5a indicates a framing error has been received.

Y13a — transmitter valid state. Asserts transmitter circuit. When data is being transmitted, this line is held high.

O15a — external reset. Y5a opens all inputs and sets transmitter status to reset. Should be used after power turn-on.

O16a — transmitter reset holding register enables. Goes to O16a when external reset is held open into the register.

O17a — transmitter data word input clock. Y5a enters data into the input holding register. Transitions to O15a when start bit of next received data transmission.

O18a — transmitter end of character flag. A Y5a, to O18a, transition represents completion of a character word. The 8-bit data transmitted. Y5a is maintained until the mark to space conversion of the start bit of a new character transmission.

O19a — end of character detected. Character to be transmitted is shifted out serially on this output. Returns to Y5a during data time.

**FUNCTIONAL DIAGRAM**

**FIGURE A.9: FUNCTIONAL DIAGRAM OF UNIVERSAL ASYNCHRONOUS RECEIVER/TRANSMITTER**
\[ I_{CS} = V_{IH}, \text{MODE CONTROL FIXED} \]
\[ I_{NP} = V_{IL}, \text{PARITY CONTROL} \]
\[ I_{NB2} = V_{IH}, \text{8 BITS/CHARACTER} \]

(a) UART CONTROL REGISTER

\[ I_{2SB} = V_{IH}, \text{2 PARITY STOP BITS} \]
\[ I_{PS} = V_{IH}, \text{ODD PARITY} \]
\[ I_{NBI} = V_{IH}, \text{8 BITS/CHARACTER} \]

\( V_m = +5 \text{Vdc}, V_l = 0 \text{Vdc} \)

(b) DATA CONTROL INPUT TO UART TRANSMITTER HOLDING REGISTER

\[ +V_{DD} \]

| \[ \text{FIGURE A.10: UART INTERFACE LOGIC} \] |
(c) END OF FOUR CHARACTERS / RECEIVE ENABLE

(d) RECEIVED DATA AVAILABLE

FIGURE A.10: UART INTERFACE LOGIC
(e) ERROR STATUS CONTROL—RETRANSMISSION FOR FRAMING ERROR AND PARITY ERROR

FIGURE A.10: UART INTERFACE LOGIC
FIGURE A.11: FM TRANSCEIVER
## APPENDIX B

### CENTRAL PROCESSOR

#### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power requirements</strong></td>
<td>115 Vac, 60 Hz., Single Phase, 500 watts</td>
</tr>
<tr>
<td><strong>Integrated circuits</strong></td>
<td>Standard 54/74 Series TTL, MOS and LSI/MOS</td>
</tr>
<tr>
<td><strong>Cooling</strong></td>
<td>Convection and forced air</td>
</tr>
<tr>
<td><strong>Temperature Range</strong></td>
<td>40°F to 130°F</td>
</tr>
<tr>
<td><strong>Humidity Range</strong></td>
<td>5% to 95%</td>
</tr>
<tr>
<td><strong>Communication system</strong></td>
<td>Asynchronous, digital, scanning telemetry system using FSK; RF output: 100 milliwatts on business frequency band</td>
</tr>
</tbody>
</table>
| **Memory system**              | Magnetic Core: Random access, nonvolatile, capacity: minimum of 500 word, 32 bits/word  
Semiconductor: Random access, volatile, capacity: minimum of eight 100 word, 32 bits/word, memory cells |
| **System clock frequency**     | 16 Kilohertz |
| **Information transmission rate** | 1000 Baud |
| **Data entry**                 | Keyboard, numeric and sealed: 10 keys plus 6 function keys; function switches for mode of operation |
| **Data output**                | Sales registers, 9 digit numeric displays; data sent via wires to Waitress Ordering Stations (8) and Beverage Station Consoles (8) |
| **External characteristics**   | Antenna: $\frac{1}{4}$ wave vertical; metal case |
| **Security**                   | Parity check, station name code, circuits immune to noise |
### APPENDIX C

#### KITCHEN CONSOLE

#### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power requirements</td>
<td>115 Vac, 60 Hz., Single Phase, 75 watts</td>
</tr>
<tr>
<td>Integrated circuits</td>
<td>Standard 54/74 Series TTL, MOS and LSI/MOS</td>
</tr>
<tr>
<td>Cooling</td>
<td>Convection</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>40°F to 130°F</td>
</tr>
<tr>
<td>Humidity Range</td>
<td>5% to 95%</td>
</tr>
<tr>
<td>Information transmission rate</td>
<td>1000 characters/second</td>
</tr>
<tr>
<td>Data entry</td>
<td>From Central Processor via wires; ASCII; keyboard, numeric and sealed: 10 keys plus two function keys</td>
</tr>
<tr>
<td>Data output</td>
<td>Printer: alphanumeric, 30 columns, fan-folded paper tickets, print speed: 60 lines/minute</td>
</tr>
<tr>
<td>External characteristics</td>
<td>Durable, plastic molded case</td>
</tr>
</tbody>
</table>
APPENDIX D

BEVERAGE STATION CONSOLE

SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
</table>
| Power requirements         | + 5 Vdc, 2.5 A.  
|                            | + 30 Vdc, 0.1 A.  
|                            | - 12 Vdc, 0.5 A.  
|                            | - 250 Vdc, 0.1 A. |
| Integrated circuits         | MOS, Bipolar |
| Cooling                    | Convection |
| Temperature Range          | 40° F to 130° F |
| Humidity Range             | 5% to 85% |
| Information transmission rate| 1000 characters/second |
| Data entry                 | From Central Processor via wires ASCII; control switch |
| Data output                | Visual display, 5 X 7 dot matrix for character format; 8 rows, 32 characters/row |
| External characteristics   | Durable, plastic molded case |
APPENDIX E

LETTER

DR. J. WELCH TO MR. T. ROMAN

October 25, 1971
Mr. Thomas A. Roman
Research Fellow
South Dakota State University
Dept. of Electrical Engineering
Brookings, South Dakota 57006

Dear Mr. Roman:

A copy of your letter of September 8th and the accompanying prospectus for the development of an electronic ordering system, addressed to Dr. W. P. Donahoo, Secretary of the Society for the Advancement of Food Service Research, was referred by him to Miss Jessie Alice Cline, of this City, an Honorary Director of the National Restaurant Association, and by her to me.

With respect to your questions:

1. Both the National Cash Register Co. and the American Machine and Foundry Co. have developed sophisticated computer type consoles. In these devices the input of the customer order is delivered to the console operator either by direct voice or telephone. The console operator records the order by depressing relevant keys on the console. This procedure:
   a. Records the order for each item and directions for its production.
   b. Transmits production instructions to the production complex (which, in the case of the American Machine & Foundry operation, consists of a complex system of machinery which actually produces up to some sixteen standard menu items without human participation other than supplying raw materials, and delivers the proportioned menu item to a single packer-cashier for inspection, packing, delivery to the customer and collection).
   c. Prices items ordered, totals the check, prints it, and transmits it to the packer-cashier for collection.
   d. Records menu item count and charges by item and other data useful in accounting and control.

This system can be augmented by telephones either at automobile parking spaces or at individual tables in a dining room (as in the case of King's Food Hosts and others). The order may either be delivered by the packer to the customer or by car-hopps or waitresses.
2. Both of the above companies and several others are continuing their research in an endeavor to reduce the complexity and cost of their systems. At present, these are so expensive that they are practical only in large volume operations, and, in the case of the American Machine and Foundry Company's completely automated restaurant, require a relatively continuous flow of orders to maximize the use of the production machinery to the point of economic feasibility.

3. I believe that the above answers your third question. For volume sales it will be necessary to greatly simplify the system, reduce its cost, reduce its complexity (and thus its cost of maintenance and the skills required to maintain its components, which constitutes a major problem at present).

4. On the point of research funds available, your guess is as good as mine. The large companies which are already in this field have highly competent research staffs, and, for competitive reasons, seem to prefer that they do their own research and development.

The above is, of course, my own personal assessment of the situation as it exists at present. With respect to your additional question regarding exactly what is meant by a "fully automated ordering system", I also have some ideas of my own, based on some fifty years experience in the food service field, which I am glad to share with you.

A major factor in the commercial food service business is that it is a "people" business. It is a social event to eat out. The customer enters a food service establishment with the idea of being served. He has an "ego appetite" at least as important as his physical appetite. He expects service from everyone with whom he comes in contact in the establishment. He is, in effect, employing all personnel therein to serve him. Hence, he expects his relationship with all personnel to be that of employer (himself) to employee. That is one reason why the fully automated restaurant has made so little headway (remember the "boom-and-bust" in food vending machine expectations?). The customer wants to see the people who serve him - and wants some evidence of his ego position as boss, even if it costs him for "dead time" (the genesis of the titles "Waiter and Waitress" indicate the major reason for the low productivity of the food service industry). Further, he wants that service at his convenience - normally more-or-less about three times a day - which provides the peaks and valleys of activity which further reduce the industry productivity index.

This point-of-sale personal contact is, however, expensive in other areas than time. The traditional system of writing customer orders, placing them on the kitchen, pricing, adding checks and so on is fraught with opportunities for error and waste of time and material.
May I, therefore, give you my idea of a feasible "fully automated ordering system" which will give the customer the service contact he desires but will, at the same time, reduce to a minimum the time and costly errors inherent in serving him under the present system?

First, I believe that research and development on an order console of the type presently made by the National Cash Register Co. has advanced to the point where it would be feasible to make it the core of a "completely automated ordering system".

I propose to do this by eliminating the console operator entirely and modifying the console to make it the receiver of electronically transmitted orders from the waiter, car hop, order packer, or other contact employee and transmitter to the production complex (either automated or conventional).

I suggest that this can be done simply by replacing the present order pad or check with a simple microwave transmitter of very limited range (maximum from 200 to 300 feet), and approximately the same size as the present guest check. A suggested format for such a device is shown on the enclosed sketch.

The contact employee - or salesperson - would make the customer contact in the normal way - present menu, water, etc. She would then transmit the customers' order to the console, which, in addition to making the records at present, would further transmit the order as given electronically to a check printer in the production complex. Were the order would be prep ref., and when ready, the information would be flashed on a visible call-board (already developed) giving waitress or salesperson number and order number of the ready order. Alternatively, the order could be delivered directly to the table or counter or car by runner from the production complex or by mechanical means.

Details of each order would be stored in a memory cell (note that everything is in numbers, the language of the computer). When the order is delivered, the priced, totaled and printed check is delivered with it. To waiting for the check or taking the salesperson's time to price and total it - and without error! Also, adequate records for popularity indices, cost control, and forecasting could be provided while enabling each salesperson to give complete attention to many more customers - thus reducing the number of salespersons - and consequent "dead time" in service.

The following is a sample of how this system would work:

1. Salesperson seats guests, serves water and presents menu.
2. When guest is ready to order he activates "call light" on table or counter.
3. Salesperson responds, answers any guest questions, records order on order matrix as follows:
   a. Transmits check number by pressing point of stylus in labeled receptor, followed by check numbers in sequence, similarly indicated, then "transmit". This activates
a memory cell in a console which will follow this particular order until the salesperson signals "Total check & Clear".

b. In a similar manner, transmits salesperson's number, number of guests, table, seat, or parking space number.

c. Transmits menu items by code numbers, with preparation directions for each menu item (where applicable) following the menu item, also in code, number of portions of each item in code, and any other information required, in a similar manner.

d. Should a guest wish to cancel or change a menu item, salesperson inserts stylus in "Cancel menu item No. receptor, followed by code no. of item cancelled and "transmit"; then "Menu Item No." followed by code no. for replacement item and "transmit".

e. When complete order has been given, alternative procedures may be specified:
(1) "Total check & clear" may be transmitted, in which case the check printed on the check printer in the production complex will be totaled and delivered with the finished order, or

(2) "Hold" may be transmitted, in which case the totalizing of the check may be held open for the addition of other items, as desserts. In this case, salesperson transmits "Guest check No." and menu items, number of portions, etc. which are added to the check by the printer, or, if nothing further is ordered, transmits "Total Check & clear", in which case the totaled check is delivered to a convenient pick-up spot in the service area instantly.

This is, of course, a rough outline, as many other possible combinations are possible as well.

Note that the transmitter matrix is very simple to operate so training in its use should be accomplished rapidly. Actually its operation involves only three steps:

1. For each transmission, insert stylus in printed direction labeled receptor.

2. Follow with code numbers in sequence

3. Concluded with "transmit"

Memory cells are cleared when "total check & clear" is indicated. It is believed that the total code for most menus, as well as the code for "Preparation Directions" can be indicated on a replaceable "Code Card", inserted in the small portable transmitter as indicated on the enclosed drawing.
To recapitulate, the "total electronic ordering system" which I propose consists of the following elements:

1. Individual microwave, mini-range transmitting matrices for salespersons.

2. A console incorporating microwave reception for the salespersons transmitting matrices, recording, computing, pricing and transmitting (wire or microwave) elements.

3. Receiving check printers in the production complex plus
   a. A system to deliver printed and totaled checks instantly to a convenient pick-up area in the service area, where the "hold" system is used rather than delivery of check with order (as in drive-ins).

It should be noted that the essential components of this system are already well developed. It is only necessary to assemble and test them for feasibility.

I would welcome your comments.

Sincerely,

[Signature]

cc: Miss Jessie Alice Cline
    Dr. W. P. Donahoo
    Dr. Dee M. Graham

1 - Encl. - Drawing

John M. Welch, Ph.D., R.D., R.S.,
FAPLA, FESI(Sr), FCPA(Sr)
Professor and Acting Director
Course in Food Service and Lodging Management, Department of Food Science and Nutrition, College of Agriculture, University of Missouri at Columbia
**EXCLOSURE NO. 1**

**SUGGESTED FORMAT AND APPROXIMATE SIZE** FOR

**FOOD SERVICE SALESPERSON'S PORTABLE ELECTRONIC ORDER MATRIX**

<table>
<thead>
<tr>
<th>Directives</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Guest check No.</td>
<td>0 1</td>
</tr>
<tr>
<td>0 Salesperson's No.</td>
<td>0 2</td>
</tr>
<tr>
<td>0 Table or location No.</td>
<td>0 3</td>
</tr>
<tr>
<td>0 No. of guests</td>
<td>0 4</td>
</tr>
<tr>
<td>0 Menu item code No.</td>
<td>0 5</td>
</tr>
<tr>
<td>0 No. of portions, above</td>
<td>0 6</td>
</tr>
<tr>
<td>0 Preparation direction code</td>
<td>0 6</td>
</tr>
<tr>
<td>0 Cancel menu item code No.</td>
<td>0 7</td>
</tr>
<tr>
<td>0 HOLD for additional items</td>
<td>0 8</td>
</tr>
<tr>
<td>0 TOTAL check &amp; clear</td>
<td>0 9</td>
</tr>
<tr>
<td>0 TRANSMIT</td>
<td>0 0</td>
</tr>
</tbody>
</table>

**Menu Code Card (inserted)**
APPENDIX F

LIST OF PREPARATION INSTRUCTION CODES

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Method of Preparing/Different Types</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Eggs</td>
<td>1. Sunny Side Up (SSU)</td>
<td>01</td>
</tr>
<tr>
<td></td>
<td>2. Over Easy (OE)</td>
<td>02</td>
</tr>
<tr>
<td></td>
<td>3. Basted (BA)</td>
<td>03</td>
</tr>
<tr>
<td></td>
<td>4. Scrambled (SCR)</td>
<td>04</td>
</tr>
<tr>
<td></td>
<td>5. Hard (HD)</td>
<td>05</td>
</tr>
<tr>
<td></td>
<td>6. Boiled-Hard (B/HD)</td>
<td>06</td>
</tr>
<tr>
<td></td>
<td>7. Boiled-Soft (B/S)</td>
<td>07</td>
</tr>
<tr>
<td>2. Hamburger,</td>
<td>1. Rare (R)</td>
<td>08</td>
</tr>
<tr>
<td>Steak,</td>
<td>2. Medium Rare (MR)</td>
<td>09</td>
</tr>
<tr>
<td>Cheeseburger</td>
<td>3. Medium (M)</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>4. Medium Well (Mw)</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>5. Well Done (WD)</td>
<td>15</td>
</tr>
<tr>
<td>3. Potatoes</td>
<td>1. Hash Browns (HB)</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>2. American Fries (AF)</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>3. Baked (BK)</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>4. French Fries (FF)</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>5. Whipped Potatoes (WP)</td>
<td>17</td>
</tr>
<tr>
<td>4. Beverages</td>
<td>1. Hot Coffee (Cof)</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>2. Hot Tea (Te)</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>3. Sanka (S)</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>4. Milk (M)</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>5. Chocolate Milk (CM)</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>6. Hot Chocolate Milk (HCM)</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>7. Coca Cola (CC)</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>8. Root Beer (RB)</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>9. Sprite (Sp)</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>10. Lemonade (Le)</td>
<td>27</td>
</tr>
<tr>
<td>5. Desserts: Pie</td>
<td>1. Peach (Pe)</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>2. Apple (Ap)</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>3. Coconut Cream (CC)</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>4. Dutch Apple (DA)</td>
<td>46</td>
</tr>
<tr>
<td>Item Description</td>
<td>Method of Preparing/Different Types</td>
<td>Code</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td><strong>5. Desserts: Sodas</strong></td>
<td>1. Root Beer (RB)</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>2. Sprite (SP)</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>3. Coca Cola (CC)</td>
<td>70</td>
</tr>
<tr>
<td>Ice Cream</td>
<td>1. Chocolate (C)</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>2. Strawberry (St)</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>3. Butter Brickle (BBR)</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>4. Vanilla (V)</td>
<td>85</td>
</tr>
<tr>
<td>sherbert</td>
<td>1. Orange (Or)</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>2. Lime (Li)</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>3. Raspberry (Ra)</td>
<td>88</td>
</tr>
<tr>
<td>Small Sundae</td>
<td>1. Chocolate (C)</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>2. Strawberry (St)</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>3. Butter Rum (BR)</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>4. Creme de Menthe (CdM)</td>
<td>78</td>
</tr>
<tr>
<td><strong>6. Toast</strong></td>
<td>1. With Jelly (J)</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>2. With Peanut Butter (P)</td>
<td>48</td>
</tr>
<tr>
<td><strong>7. Homemade Rolls</strong></td>
<td>1. Carmel (Car)</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>2. Frosted (Fr)</td>
<td>50</td>
</tr>
<tr>
<td><strong>8. Breakfast Cereals</strong></td>
<td>1. Oatmeal With Half &amp; Half (OH)</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>...With Milk (CH)</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>2. Cream of Wheat With Half &amp; Half (CH)</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>...With Milk (CM)</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>3. Cereal #1</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>4. Cereal #2</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>5. Cereal #3</td>
<td>81</td>
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<tr>
<td></td>
<td>6. Cereal #4</td>
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<td>7. Cereal #5</td>
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<td>8. Cereal #6</td>
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<td>9. Cereal #7</td>
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<td></td>
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<td>42</td>
</tr>
<tr>
<td>Item Description</td>
<td>Method of Preparing/Different Types</td>
<td>Code</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td><strong>9. Tossed Salad</strong></td>
<td>1. With Thousand Island Dressing (TI)</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>2. With Roquefort Dressing (Rq)</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>3. With French Dressing (Fr)</td>
<td>65</td>
</tr>
<tr>
<td><strong>10. Juices</strong></td>
<td>1. Orange ..Small (OS)</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>..Large (OL)</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>2. Tomato ..Small (TS)</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>..Large (TL)</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td>3. Grapefruit ..Small (GS)</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>..Large (GL)</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>4. Prune ..Small (PS)</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>..Large (PL)</td>
<td>97</td>
</tr>
</tbody>
</table>

Note: For those menu items that do not require a preparation instruction code, the numbers "00" are used. This must be done in order for the device to work properly as it has been designed.
M.S. THESIS PROPOSAL

"U-ORDER: AN ELECTRONIC ORDERING SYSTEM"

THOMAS A. ROMAN
SOUTH DAKOTA STATE UNIVERSITY
August 29, 1971
M.S. THESIS PROPOSAL
"U-ORDER: AN ELECTRONIC ORDERING SYSTEM"

Submitted by: Roman, Thomas A.                         August 20, 1971
INTRODUCTION

Everyone, including myself, has gone into a restaurant to get a quick lunch or snack, but has come away dissatisfied and frustrated because of the slow service. Slow service is the most annoying to customers in restaurants. In the May 1971 issue of Fast Food, the Customer Attitude Survey says:

"Not surprisingly, the most frequently mentioned complaints had to do with slow service—to order, to be served and, finally, to get the check and be able to leave." 1.

People want fast service in coffeeshops, department store lunch rooms, roadside restaurants and luncheonettes. They also want polite, patient, pleasant waitresses, who are well-trained. Rudeness and impatience of servers were the second most-mentioned annoyances in the same survey as was mentioned above. Price doesn't seem to be a big problem, as long as good food and quick, pleasant service are available. Every restaurant owner and/or manager knows quite well the high wages demanded by well-trained waitresses today, but a well-trained waitress is a very valuable person to restaurant operation. Thus the biggest problem of restaurant operation is to provide fast, pleasant and inexpensive service along with good food. This research proposal aims to solve this slow service problem by means of an electronic ordering system, called "U-ORDER".

PROPOSED RESEARCH

The object of "U-ORDER" is to eliminate slow service in an economical and efficient way. The basic concept of "U-ORDER" is illustrated in Figure 1 below.

![Basic Block Diagram of "U-ORDER"](image)

FIGURE 1: BASIC BLOCK DIAGRAM OF "U-ORDER".

It will operate in the following manner. The hungry customer will order his food by selecting it from the ordering panel. Back in the kitchen, the cook and/or waitress will receive a printed check with the customer's order on it. After the food has been prepared, the waitress will deliver it to the customer who will also receive his check at the same time.

By doing this research I hope to answer the following questions:

1. Is this idea new? Has it been tried before? If it has, what form has it taken? Why was it a success or failure?
2. Does this electronic ordering system actually eliminate slow service?
3. Does this system attract more customers?
4. Will this system save the restaurant owner and/or manager any money?
5. What is the most economical and efficient way to implement this idea in terms of electronic systems and materials?

A more thorough literature search, which I am doing at the present time, will provide me with the answer to the first question.
It will also give me a broader and deeper look at this problem of slow service and possibly lead to a more refined idea.

The second question can be answered after the system is built. However, the opinions and suggestions of restaurant owners and managers are being sought in order to design a system that they want.

Since slow service is the most annoying to customers, I believe that this electronic ordering system will be welcomed by customers who may also come more often because of such a system. If it is attractive, reliable and efficient, I believe that it will not only eliminate slow service but that it will relieve the pressure put on waitresses by demanding customers who are in a hurry to order. The waitresses will not be angered and annoyed into becoming rude and impatient.

The last two questions have to be answered together. The savings to the restaurant owner and manager will depend upon the design and the cost of the materials to implement that design. With the diversity of electronic materials and systems available today, I believe that an electronic ordering system can be designed and built in such a way as to provide fast, efficient, economical service. Beyond the basic cost of an attractive, reliable system the expenses should be relatively low. Besides, such a system will pay for itself by attracting more customers who will then be more satisfied with the improved service.
BIBLIOGRAPHY


APPENDIX H

TRAINING EXPERIMENT

H.1 CONDITIONS OF THE EXPERIMENT

a. The number of subjects who took part in this experiment was five. Five female, freshman college students volunteered.

b. The Purdue Pegboard, Manipulative Dexterity Test was administered to each of the subjects and their scores were recorded.

c. Calculating machines (with the same numeric keyboard format as the Waitress Ordering Station) were used to simulate the Waitress Ordering Station.

d. Twenty minutes was allotted for instructing the subjects about the method of operating the Waitress Ordering Station. Each subject had a Lunch Menu and its corresponding code card (See Figure 3.5 and 3.5, pp. 64-66) in front of them.

e. Two sets of five meal orders were called out aloud to the five subjects who were all seated at a table. The calculating machines were in front of each one of the subjects.

f. Each set of meal orders was repeated three times. Each time the subjects were allowed a lesser time to complete the entry of the order (one to eight items, each with a five digit code). Successive times for completion were 30 seconds, 15 seconds and 10 seconds.

g. Location of experiment: Catholic Campus Parish Library, Brookings, South Dakota.
h. Date of the experiment: March 6, 1972; 10:30 to 11:30 A.M.

H.2 RESULTS OF THE EXPERIMENT

a. Scores for each subject are shown in Table H.1. One point was allotted for each correct digit entered.

b. Two of the subjects who had waitress experience liked the method of ordering but indicated that more training was necessary.

c. All the subjects entered the first item of each order with more than 85% accuracy. When more than one item was called out aloud all at once in succession, the subjects remembered only two of the items of the order.

H.3 CONCLUSIONS

a. Not enough subjects were used to obtain data that was statistically meaningful. Nevertheless, this experiment was only intended to be a "rough" estimate of the time needed for training unfamiliar people in the use of the electronic ordering system.

b. In general, one half-hour would be needed to train prospective waitresses to use the electronic ordering system. They should be allowed to memorize the menu code cards prior to training.

c. The Purdue Pegboard, Manipulative Dexterity Test scores were not directly related to a high score in the test with the simulated Waitress Ordering Stations. The scores appeared to be inversely related. See Table H.1.
d. Managers of restaurants must take time to train their waitresses no matter what type of ordering system is used, if they want them to be more productive.

e. This experiment should have been designed differently. Calling out the orders aloud, one to eight items, in quick succession was unreal compared to the ordering by a customer in a restaurant. Usually the customer gives his order, item by item, allowing the waitress time to write it down on her guest check. If items were called out in this manner, greater accuracy could be expected in the entering of the digital menu codes into the Waitress Ordering Station. To give an indication of this, we analyzed how well each subject entered the first item of each order given. Table H.1 shows that all the subjects attained 85% or greater accuracy in entering the codes for the first item of each order.
TABLE H.1  Percent of Correct Entries of Digital Menu Codes

<table>
<thead>
<tr>
<th>Subject</th>
<th>Waitress Ordering Station Test*</th>
<th>Purdue Pegboard Manipulative Dexterity Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First Item Only**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Raw Score</td>
<td>%</td>
</tr>
<tr>
<td>1</td>
<td>128</td>
<td>85.5</td>
</tr>
<tr>
<td>2</td>
<td>148</td>
<td>98.5</td>
</tr>
<tr>
<td>3</td>
<td>140</td>
<td>93.4</td>
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<td>4</td>
<td>131</td>
<td>87.3</td>
</tr>
<tr>
<td>5</td>
<td>132</td>
<td>88.0</td>
</tr>
</tbody>
</table>

* Raw scores were given for two sets of five orders each. Each order contained one to eight items; each item had a five digit code. Each of the two sets of orders was repeated three times. The subjects were allowed, on each successive repetition, 30 seconds, 15 seconds and 10 seconds to complete the entry of the digital menu codes.

** The first item only of each order was scored. Maximum possible raw score was 150.

*** All items of each order were scored. Maximum possible raw score was 600.
APPENDIX I

Traditional formats. . . . . . . . . . . . . . . . . . . . . "gap fillers"

**DRIVE-INS**
- Low check size
- Rising costs
- Excess stores
- Finger foods

**DRIVE-IN COFFEE SHOP**
- Self service
- Dinner platters
- High speed
- Lower prices

**COFFEE SHOPS**
- Slow service
- Tipping
- Formula foods
- Burdensome staffs
- Large menus

**COFFEE SHOP PLUS**
- Small menu, mid-price dinnerhouse
- Signature foods
- Do-it-yourself
- Limited menus
- $1.50 - $5 checks

**MID-PRICE FAMILY RESTAURANTS**
- Boring food
- Dull image
- Undermerchandised

**MINI-MENU DINNERHOUSE**
- Under ten items
- Informality
- Do-it-yourself
- Striking decor

**TRADITIONAL SERVICE RESTAURANTS**
- Full menu
- Overpriced
- Underserviced
- Rigid formality

Source: Nation's Restaurant News, January 18, 1971

**FIGURE B: CHANGING FORMATS IN THE NEIGHBORHOOD MARKET**

(TAKEN FROM FOOD SERVICE INDUSTRY 1971, BALTIMORE: ALEX. BROWN & SONS, 1971)