DESIGN AND APPLICATION OF WIRELESS E-MENU RESTAURANT ORDERING SYSTEM

BY

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A RESEARCH REPORT SUBMITTED TO THE SCHOOL OF ENGINEERING SCIENCES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF BACHELORS OF SCIENCE IN ELECTRICAL ENGINEERING OF KAMPALA INTERNATIONAL UNIVERSITY.

MARCH 2023

DECLARATION

I **Aliaa Adam Elaze Gibreell** declare that this research report is an original work and that where other authorities or texts have been used, it has been clearly acknowledged. To the best of our knowledge, this research has not been submitted for any award of Degree or Diploma in any institution or university.

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APPROVAL

I clarify that I have supervised and read this research report and that in our opinion; it conforms to acceptable standards of scholarly presentation and is fully adequate in scope and quality as a dissertation for partial fulfillment for the award of Degree Bachelor of science in Electrical Engineering of Kampala International University.

Signature……………………… Date…………………………

MR. BALIRUNO SIMON, Supervisor

DEDICATION

This piece of work is dedicated to my beloved family who have been very instrumental and confident as well as my best friends and to my dear parents for their Financial and moral support they have offered me throughout years of study.

ACKNOWLEDGEMENT

Various people have been of great support and inspiration during the time of my study.

First and foremost, I am truly thankful to the Almighty Allah for the gift of life, wisdom and supportive parents. Without him none of this work would have been possible.

My sincere appreciation goes to my entire family, my dear loving parents for their financial, moral as well as spiritual support given to me throughout my years of study.

Lastly but not least, special thanks go to my supervisor Mr. Baliruno Simon for his guidance and assistance that has made me research work easier and less hectic.

ABSTRACT

Automation plays a very important role in every field of human life. This project presents a simple design and implementation of a Wireless E-menu Restaurant Ordering System in which the traditional paper-based menu is replaced by a user friendly Matrix keypad-based menu. The system has Atmega 328P microcontroller which is interfaced with the input and output modules. The input module is the matrix keypad sensor which is placed on LCD (Graphical Liquid Crystal Display) to have a graphic image display, which takes the input from the user and provides the same information to the microcontroller. The output module is a RF TX module which is used for communication between the system at the customers' table (transmitter section) and system for receiving section. Microcontroller also displays the menu items on the LCD. At the receiving end the selected items will be displayed on the LCD and by using the conveyer belt the received order will be sent to the particular table.

The overview of this report is as follows:

Chapter one-Introduction: It gives a brief introduction and background of the project.

Chapter two-Literature review: It gives an overview of the existing technologies and devices used.

Chapter three-Methodology: It explains the system design i.e. architecture and interfacing of the devices used.

Chapter four-Results and discussion: Describes the results and output of the system.

Chapter five-Conclusions and Future Scope: It gives the conclusions drawn from the project and brief ideas about future development works that can be undertaken.

Finally, **references** and **appendices**.

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ABBREVIATIONS

ADC	Analog-to-Digital Conversion
ALU	Arithmetic Logic Unit
EPROM	Electrically Programmable Read-only Memory
GSM	Global System for Mobile Communication
IEEE	Institute of Electrical and Electronics Engineers
IR	Infrared
LCD	Liquid Crystal Display
MCU	Microcontroller
MHz	Mega Hertz
RAM	Read Only memory
RISC	Reduced Instruction Set Computer
RX	Receiver
TX	Transmitter
USART	Universal Synchronous Asynchronous Receiver Transmitter

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter will give a brief introduction and background of this project.

1.1 Background

Nowadays more and more people are willing to spend money on restaurant foods. Very often people find themselves standing in long queues to place their orders in fast food restaurants. Having placed their orders, the customers wait near the counter until their order is ready for collection. In order to solve this issue, this project presents an idea of a Matrix keypad-based ordering system for restaurants. The goal is to develop a user friendly matrix keypad-based menu card which will be placed on every table at the customer side. Now the customer will need to select the menu items by pressing on items displayed on the LCD and the order is sent wirelessly using a RF TX. The order is then received by the receiver section (kitchen section) and by using the conveyor belt; the ordered items will be supplied to the customer. After the whole order is placed, bill is displayed in the billing section.

1.2 Problem Statement

In these modern days the number of restaurants are increasing. They also require very fast processing for serving food to the customers. With the increasing number of customers, it would require more man power, since the current situation has become hectic for the restaurants. Also changes in the hardcopy of the menu can't happen.

1.3 Objectives of the Project

1.3.1 Main Objective

To design and implement a user friendly, low-cost Wireless E-Menu Restaurant Ordering System to be used in the restaurant for fast food ordering to avoid the long waiting and long queues experienced in the restaurants to improve customer experience.

1.3.2 Specific Objectives

i. To design the transmitter section (customer end) by interfacing a Matrix keypad, RF TX, LCD with Atmega 328P Microcontroller unit.
ii. To design the receiver section (kitchen end) by interfacing a RF RX, LCD, Reset switch with Atmega 328P Microcontroller unit
iii. To program the system to capture customer order placed on the transmitter section (customer end) and send wirelessly to be displayed on the LCD in the receiver section (kitchen end).
iv. To test and implement the designed Wireless E-menu Restaurant Ordering System.

1.3.3 Research Questions

i. How to design the transmitter section (customer end) by interfacing a Matrix keypad, RF TX, LCD with Atmega 328P Microcontroller unit.
ii. How to design the receiver section (kitchen end) by interfacing a RF RX, LCD, Reset switch with Atmega 328P Microcontroller unit
iii. How to program the system to capture customer order placed on the transmitter section (customer end) and send wirelessly to be displayed on the LCD in the receiver section (kitchen end).
iv. How to test and implement the designed Wireless E-menu Restaurant Ordering System.

1.4 Significance of the project

- Low power consumption.
- No need of a person to take order from the table.
- Long life.
- Highly sensitive
- Easy to install because of wireless interface.
- RF wireless transmission
- Fast response.

- Efficient and low cost design.

1.5 Scope of the Project

1.5.1 Content Scope

The major scope of the project is enhancing the visual experience by replacing paper menu cards with electronic menu cards. To avoid delays in the ordering process, wireless communication is used here to replace the waiter who manually delivers the order to kitchen. Currently due to the increased literacy, awareness of advanced communication technologies among people, they are eager to automate their routine tasks. So introducing new technology and new approach in conventional food ordering system will lead to improved customer experience.

1.5.2 Time Scope

The project took approximately four months from inception stage to its full completion. For more details (Refer to project time frame in appendix).

CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

This chapter will discuss an overview of the existing systems and devices used.

2.1 Existing Systems

Starting from the time when it was realized that hospitality and service have great impact on restaurant business transactions, many new ordering and serving schemes have been proposed up till now. These menu ordering techniques include:

1) Paper based menu cards.
2) Self-service food ordering.

2.1.1 Traditional Ordering System (Paper Based Menu Card)

It is the method in which customers specify their desired menu to the waiter who takes the order on a paper. Personally he/she then takes the order to the kitchen department and then he/she supplies the food item to the customer. So it was a time consuming process. It leads to wastage of paper and also it requires reprinting of all menu cards. Also, in many cases for small change to be made in menu card, it is not convenient to print all menu cards again and again. Simply the menu card once printed can't be changed. After some days the menu card loses its worthy look and attractiveness.

2.1.2 Self Service

Self-service or self-ordering systems in restaurants refer to the restaurants taking order from customers using technologies such as the internet, kiosks etc. Usually the users prefer self-service because of speed and convenience in making order and transaction while minimizing the miscommunication. The advantage is that there are no money related issues as the transactions are done online. The disadvantage is that high installation cost, authorization cost and the development of custom software.

2.2 Related Works

The previous method involves the study about the wireless technologies in the market, alternatives for display methods and also about the bill processing. There are various wireless technologies available in their category of communication ranges and they include:

- **Using Bluetooth** -- But it is limited to short range.
- **Using ZigBee/ IEEE802.15.4** -- Range is up to only few Kilometres maximum.
- **Using Wi-Fi** -- Requires costly equipment setup and high power consumption.
- **Using GSM**

All the technologies above are quite expensive and complex to implement.

While choosing a communication technology for implementation, the first concern to make is the need of communication ranges. The communication technology to be used should always be capable of providing the range of communication as per the application needed and the frequency band should be carried by the hardware.

The next concern is to choose the less expensive technology which will also satisfy the frequency range. Apart from this, one more concern is about the modulation technique used in the communication technology. The modulation technique will affect the service quality in data exchange.

The next step of research is about the interface/display technologies, the interface which involves displaying the menu items on any output device. Since the proposed system consists of a portable device for menu display at every table, It should be less expensive and user friendly [1].

2.2.1 Bluetooth Technology

Bluetooth Technology is a radio frequency (RF)-based, short-range connectivity technology that promises to change the face of computing and wireless communication. It is designed to be an inexpensive, wireless networking system for all classes of portable devices. The projected cost of the Radio chip was around $5.

A complete Bluetooth system will require these elements:

- An RF portion for receiving and transmitting data includes short-range radio transceiver, an external antenna, and a clock reference (required for synchronization)
- A module with a baseband microprocessor
- Memory
- An interface to the host device (such as a mobile phone)

Its normal range of operation is 10m (at 1mW transmit power) and can be increased up to 100m by increasing the transmit power to 100mW. The system operate in unlicensed 2.4 GHz frequency band, hence it can be used worldwide without any licensing issues. It provides an aggregate bit rate of approximately 1Mbps.

2.2.2 ZigBee Technology

The ZigBee radio specification designed for low cost and power consumption than Bluetooth. The specification is based on IEEE 802.15.4 standard. The radio operates in the same ISM band as Bluetooth and is capable of connecting 255 devices per network. The specification supports data rates of up to 250Kbps at a range of up to 30m. These data rates are slower than Bluetooth, but in exchange the radio consumes significantly with low power with a large transmission range. The goal of ZigBee is to provide radio operation for months or years without recharging, thereby targeting applications such as sensor networks and inventory tags.

The beauty of ZigBee is that devices from different manufacturers will be able to work together, as long as all are compliant to the standard. It has been suggested that the name evokes the haphazard paths that bees follow as they harvest pollen, similar to the way packets would move through a mesh network.

ZigBee is standardized at two levels – the radio chips must follow certain design rules, and the protocol layers that actually make the network function are defined and controlled by the ZigBee Alliance. Advantages are: Reliable and self-healing, Supports large number of nodes, Easy to deploy, Very long battery life, Secure and Low cost.

2.2.3 Wi-Fi Technology

Wi-Fi is the name given by the Wi-Fi Alliance to the IEEE 802.11 suite of standards. 802.11 defined the initial standard for wireless local area networks (WLANs).

But because of its costly equipment setup and high power consumption this technology is not preferred.

2.2.4 GSM Technology

GSM (Global System for Mobile communication) is a digital mobile telephone system that is widely used in Europe and other parts of the world. GSM uses a variation of Time Division Multiple Access (TDMA) and is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1,800 MHz frequency band. The disadvantage is that the communication quality depends on the public GSM network traffic.

2.3 RF Wireless Communication Technology

Radio frequency (RF) is any of the electromagnetic wave frequencies that lie in the range extending from around 3 kHz to 300 GHz, which include those frequencies used for communications or radar signals. RF usually refers to electrical rather than mechanical oscillations. However, mechanical RF systems do exist. Although radio frequency is a rate of oscillation, the term "radio frequency" or its abbreviation "RF" are used as a synonym for radio – i.e., to describe the use of wireless communication, as opposed to communication via electric wires. To receive radio signals an antenna must be used. However, since the antenna will pick up thousands of radio signals at a time, a radio tuner is necessary to tune into a particular frequency (or frequency range). This is typically done via a resonator – in its simplest form, a circuit with a capacitor and an inductor form a tuned circuit. The resonator amplifies oscillations within a particular frequency band, while reducing oscillations at other frequencies outside the band. Another method to isolate a particular radio frequency is by oversampling (which gets a wide range of frequencies) and picking out the frequencies of interest, as done in software defined radio. The distance over which radio communications is useful depends significantly on things other than wavelength, such as transmitter power, receiver quality, type, size, and height of antenna, mode of transmission, noise, and interfering signals. Ground waves, tropospheric scatter and sky waves can all achieve greater ranges than line-of-sight propagation. The study of radio propagation allows estimates of useful range to be made.

The Radio frequency wireless link consists of a transmitter with antenna, a transmission path and the receiver with antenna. Parameters of interest are the output power of the transmitter and the sensitivity of the receiver

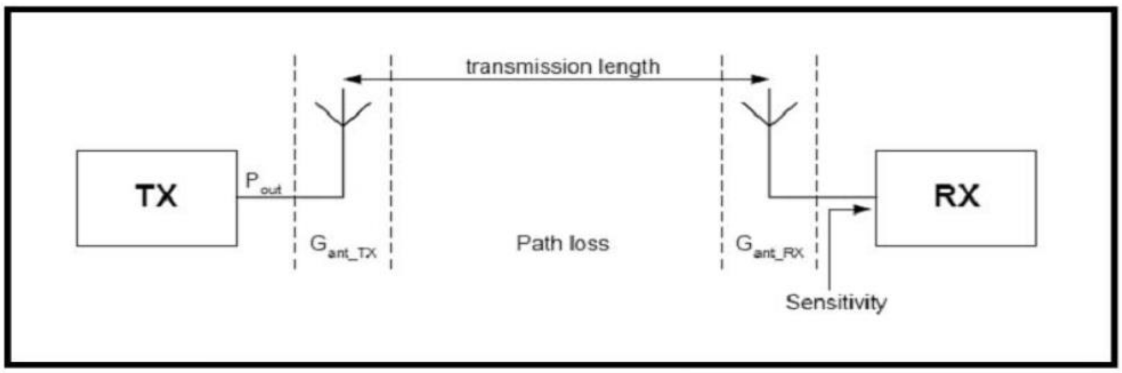

Figure 1: RF Wireless link

Sensitivity is the minimum received power that results in a satisfactory Bit Error Rate (BER, usually 1×103) at the received data output (i.e. correct demodulation). The difference between received signal power and sensitivity is the transmission link margin also known as "headroom‟. Headroom is reduced by a number of factors such as transmission path length, antenna efficiency, carrier frequency and physical characteristics of obstructions in the transmission path.

2.4 Overview of the Devices Used

2.4.1 RF TX/RX Module

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK)

Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources. This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter [5]. The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder. HT12E-HT12D, HT640-HT648, etc. are some commonly used encoder/decoder pair ICs.

Specifications

Transmitter:

Working voltage: 3V - 12V for max. power use 12V

Working current: max Less than 40mA max, and min 9mA

Resonance mode: (SAW)

Modulation mode: ASK

Working frequency: Eve 315MHz Or 433MHz

Transmission power: 25mW (315MHz at 12V)

Frequency error: +150 kHz (max)

Velocity: less than 10Kbps so this module will transmit up to 90m in open area.

Receiver:

Working voltage: 5.0VDC +0.5V

Working current: ≤5.5mA max

Working method: OOK/ASK

Working frequency: 315MHz-433.92MHz

Bandwidth: 2MHz

Sensitivity: excel –100dBm (50Ω)

Transmitting velocity: <9.6Kbps (at 315MHz and -95dBm) the use of an optional antenna will increase the effectiveness of your wireless communication. A simple wire will do the trick.

2.4.2 LCD JHD162A

A liquid-crystal display is a flat panel, electronic visual display that uses the light modulating properties of liquid crystals. Liquid crystal does not emit light directly. The working of LCD depend on two sheets of polarizing material with a liquid crystal solution in between them. When an electric current is passed through the liquid, it causes the crystals to align so that it blocks out light and does not allow it to pass [10]. Each crystal behaves like a shutter, it either allows light to pass through or blocks the light. It can function properly in the temperature range of -10℃ to 60℃ and has operating lifetime of longer than 50000 hours (at room temperature without direct irradiation of sunlight).

Features of LCD JHD162A

- Display Mode………………………TN/STN
- Number of data line…………………8-bit parallel
- Display type………………………..Positive Transflective
- Backlight……………………………LED(B/5.0V)
- Viewing direction…………………..6 o’clock
- Operating Temperature……………...Indoor

- Driving Voltage……………………. Single power
- Type……………………………...COB (Chip On Board)
- Connector…………………… …..Pin
- Driving method……………………..1/16 duty,1/5 bias
- Display construction………………..16 Characters * 2 Lines

Figure 2: LCD

2.4.3 Arduino Atmega 328P

Arduino is a tool for making computers that can sense and control more of the physical world than the desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.

Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can communicate with software running on your computer (e.g. Flash, Processing, and MaxMSP). The boards can be assembled by hand or purchased preassembled. Arduino simplifies the process of working with microcontrollers.

Arduino offers some advantages over other systems:

- Inexpensive
- Cross-platform
- Simple clear programming environment
- Open source and extensible software

- Open source and extensible hardware

Features of Atmega 328P

Arduino is a microcontroller board based on the Atmega 328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

2.4.4 Matrix Keypad

A Matrix keypad consists of a set of pushbuttons which are interconnected. In this project, a 4X4 matrix keypad in which there are 4 rows and 4 columns is used.

Figure 3: Matrix keypad (4X4)

2.4.5 Signalling element

A piezoelectric buzzer/beeper is used in this project as a signalling element on the receiver side because of its portability and low power consumption.

Figure 4: Signalling element (Buzzer)

2.4.6 Power Supply

The microcontroller and other devices get power supply from AC to Dc adapter through 7805, 5 volts regulator. The adapter output voltage will be 12V DC non-regulated. The 7805/7812 voltage regulators are used to convert 12 V to 5V/12V DC.

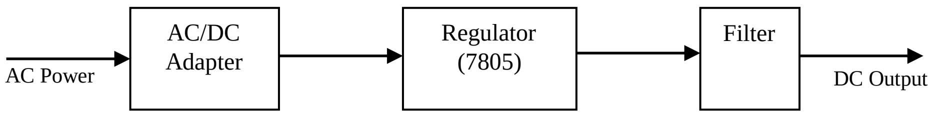

Figure 5: AC-to-DC conversion

CHAPTER THREE
METHODOLOGY

3.0 Introduction

This chapter will explain the system design i.e. architecture and interfacing of the devices used in this project.

3.1 System Design

In this project an attempt has been made to develop a Wireless E-Menu Restaurant Ordering System. Traditional paper-based menu card ordering system is very time consuming and is prone to mismatch of orders due to human errors. The problem with this system is that self-service restaurants are more popular in metro cities. So the developing cities or underdeveloped cities are mostly lagging from this technology. Many times these self-service systems take unreasonable amount of delays to deliver the order.

Nowadays Radio Frequency is widely used wireless communication technology, with low power, low cost and more reliable.
The Central Processing Unit for the proposed system is developed using the Atmega 328P microcontroller which is a low cost and efficient controller used in many applications.

Here the embedded system technology is combined with the wireless technology. This project consists of two sections; Transmitter section and Receiver section. On the transmitter side, a Matrix keypad is used for selecting food orders and the orders are displayed on an LCD screen. The RF wireless communication technology is then used for transmitting order signals to the receiver side. On the receiver side, the order is received and displayed on another LCD screen.

Figure 6: System model

3.2 System Block Diagram

The system consists of two sections, the transmitter section and the receiver section. The transmitter section consists of 4X4 Matrix keypad, 16X2 LCD, RF TX interfaced to the microcontroller. The receiver section consists of RF RX, 16X2 LCD, signaling element (buzzer) and reset switch interfaced to microcontroller.

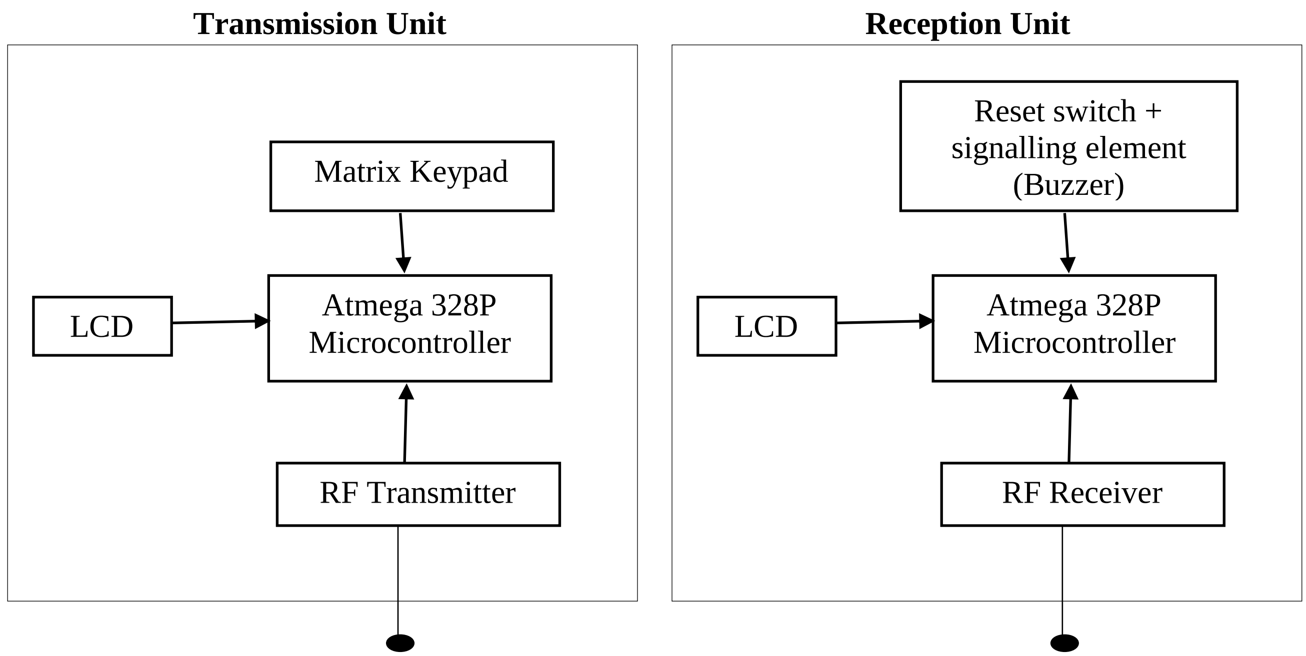

Figure 7: System block diagram

The RF module operates at Radio Frequency. The corresponding frequency range varies between 30 KHz & 300 GHz. This RF module comprises of an RF Transmitter and an RF Receiver. This wireless data is the easiest to use, lowest cost RF link. The RF module is often used along with a pair of encoder/decoder. HT12E-HT12D, HT640-HT648, etc are some commonly used encoder/decoder pair ICs.

The transmission unit consists of Matrix keypad (4X4) as input, Atmega 328P microcontroller, LCD (16X2), RF encoder and RF transmitter for transmission.

The reception unit consists of LCD (16X2), Atmega 328P microcontroller, RF decoder, Signalling element (buzzer), reset switch and RF receiver for reception.

3.3 Schematic Diagram

Transmitter section

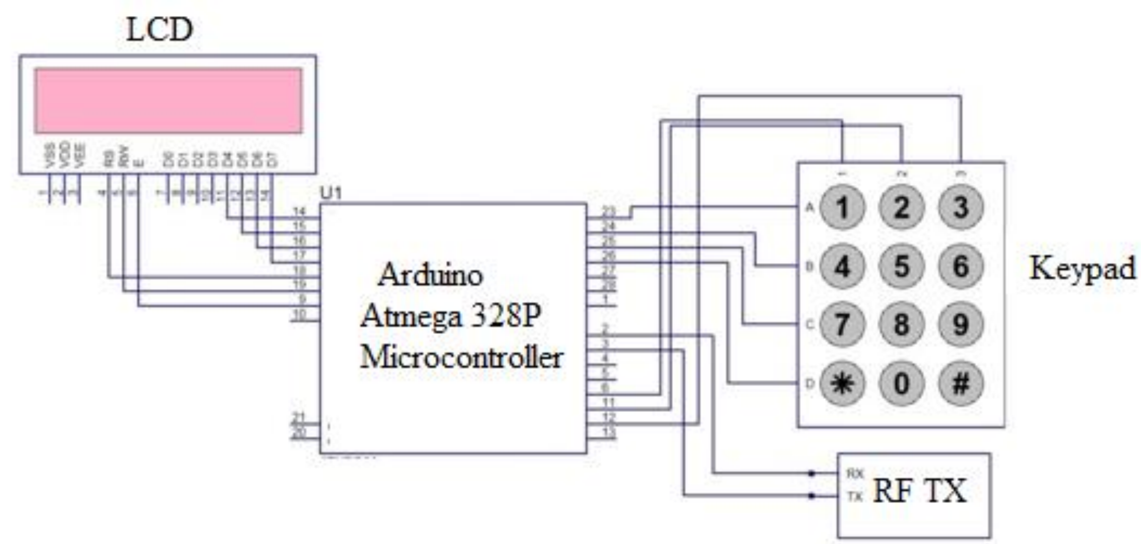

Figure 8: Transmitter schematic diagram

Receiver section

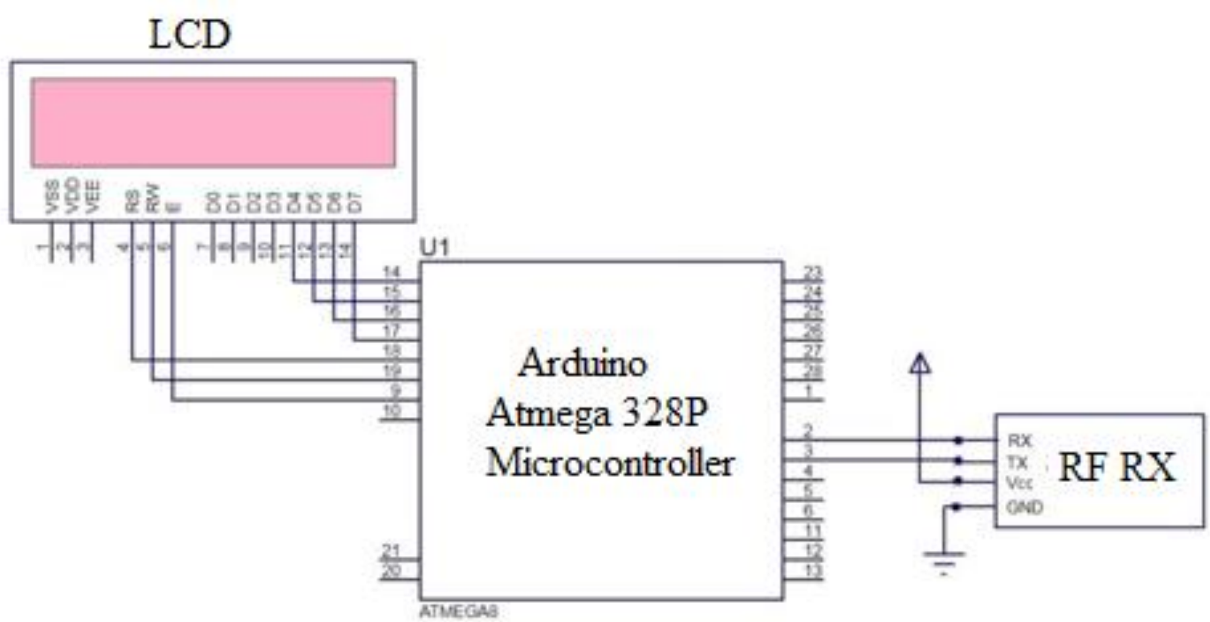

Figure 9: Receiver schematic diagram

3.4 Interfacing of Devices Used

3.4.1 Arduino Atmega 328P Microcontroller

The ATmega328P is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the Atmega328P achieves throughputs approaching 1 MIPS per MHz allowing the system design to optimize power consumption versus processing speed. The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

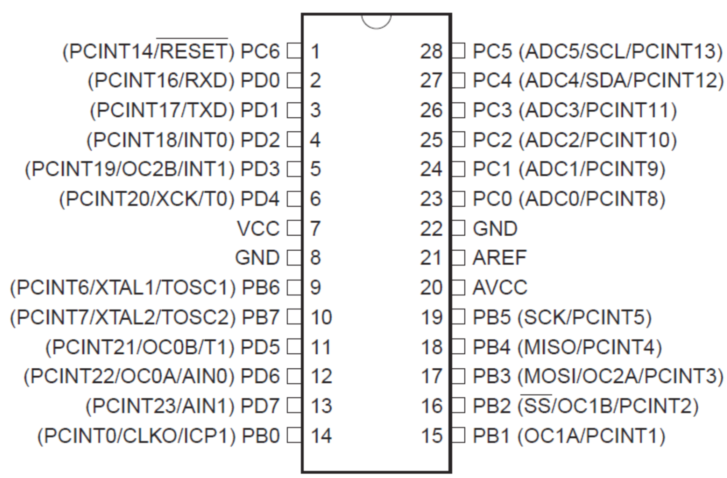

Figure 10: Atmega 328P pin diagram

The Atmega328P provides the following features: 32Kbytes of In-System Programmable Flash with Read-While-Write capabilities, 1Kbytes EEPROM, 2Kbytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible Timer/Counters with compare modes, internal and external interrupts, a serial programmable USART, a byte-oriented 2-wire Serial Interface, an SPI serial port, a 6-channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages), a programmable Watchdog Timer with internal Oscillator, and five software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, USART, 2-wire Serial Interface, SPI port, and interrupt system to continue functioning.

3.4.2 Encoder interfacing with Atmega 328P

The encoder has four input lines. These lines are used to give input which we want to encode. The encoded data (food order) is transmitted out from the 'Data out" pin. The transmission medium can be a regular wire or wireless. The input given to data pin is in parallel form which is being transmitted into serial form from the data output pin.

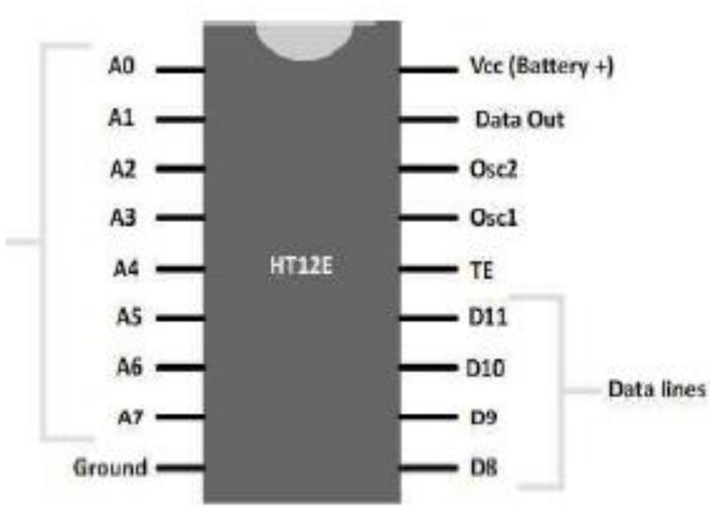

Figure 11: RF Encoder (HT12E)

3.4.3 Transmission Unit

An RF transmitter rceives serial data containg food order and transmits it wirelessly through RF by an antenna. The transmission occurs at the rate of 1 Kbps – 10 Kbps.

The 434MHz transmitter work with the RF links at 434MHz at either baud rate. Only one 434MHz transmitter will work within the same location. These modules have up to 500 ft. range in open space. The transmitter operates from 2-12V. the higher the voltage, greater will be the range. These components can be used to transmit position data, temperature data, and even current program register values wirelessly to the receiver.

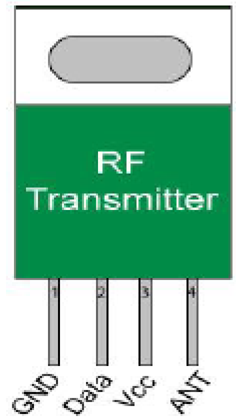

Figure 12: RF Transmitter (A-434)

3.4.4 Reception Unit

This unit consists of RF Receiver, RF decoder and output elements like buzzer as alert and reset switch for clearing order.

The encoded data which is coming from the transmitter side goes into the data in (Din) pin. The data which was in serial order gets decoded and the output is generated at the data line pins in same order as that on transmitter pin. When there is no input at the data in pin, the output pins i.e. data lines remains high both in transmier and receiver.

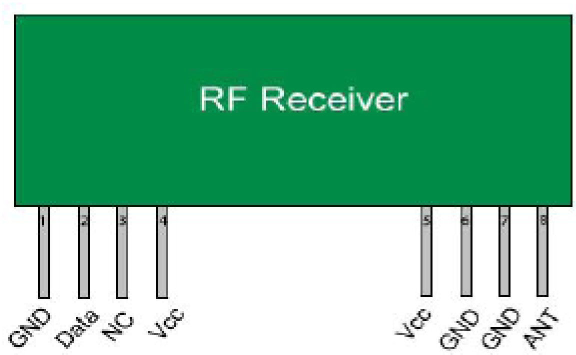

Figure 14: RF receiver

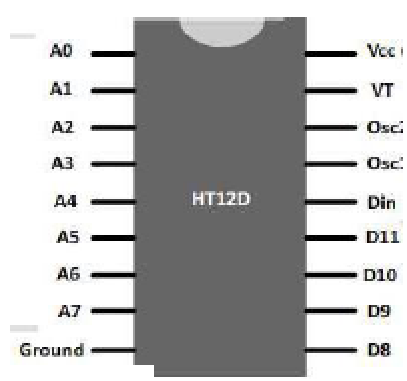

Figure 13: Decoder

3.4.5 LCD interfacing with Atmega 328P

JHD162A is a 16×2 LCD module based on the **HD44780 driver from Hitachi**.

The JHD162A LCD module has 16 pins and can be operated in 4-bit mode or 8-bit mode. Here we are using the LCD module in 4-bit mode. Before going in to the details of the project, let’s have a look at the JHD162A LCD module. The schematic of a JHD162A LCD pin diagram is given below.

Figure 15: LCD pin diagram (16X2)

The name and functions of each pin of the 16×2 LCD module is given below.

Pin1 (V_{SS}): Ground pin of the LCD module.

Pin2 (V_{CC}): Power to LCD module (+5V supply is given to this pin)

Pin3 (V_{EE}): Contrast adjustment pin. This is done by connecting the ends of a 10K potentiometer to +5V and ground and then connecting the slider pin to the V_{EE} pin. The voltage at the V_{EE} pin defines the contrast. The normal setting is between 0.4 and 0.9V.

Pin4 (RS): Register select pin. The JHD162A has two registers namely command register and data register. Logic HIGH at RS pin selects data register and logic LOW at RS pin selects command register. If we make the RS pin HIGH and feed an input to the data lines (DB0 to

DB7), this input will be treated as data to display on LCD screen. If we make the RS pin LOW and feed an input to the data lines, then this will be treated as a command (a command to be written to LCD controller – like positioning cursor or clear screen or scroll).

Pin5(R/W): Read/Write modes. This pin is used for selecting between read and write modes. Logic HIGH at this pin activates read mode and logic LOW at this pin activates write mode.

Pin6 (E): This pin is meant for enabling the LCD module. A HIGH to LOW signal at this pin will enable the module.

Pin7 (DB0) to Pin14 (DB7): These are data pins. The commands and data are fed to the LCD module though these pins.

Pin15 (LED+): Anode of the back light LED. When operated on 5V, a 560 ohm resistor should be connected in series to this pin. In Arduino based projects the back light LED can be powered from the 3.3V source on the Arduino board.

Pin16 (LED-): Cathode of the back light LED.

RS pin of the LCD module is connected to PB1. R/W pin of the LCD is grounded. Enable pin of the LCD module is connected to PB2. In this project, the **LCD module and AVR controller are interfaced in the 4-bit mode**. This means only four of the digital input lines (DB4 to DB7) of the LCD are used. This method is very simple, requires less connections and you can almost utilize the full potential of the LCD module. Digital lines DB4, DB5, DB6 and DB7 are interfaced to digital pins PD5, PD6, PD7, and PB0. The 10K potentiometer is used for adjusting the contrast of the display.

3.4.6 Software development

The Arduino programming language is an implementation of wiring, a similar physical computing platform, which is based on the Processing Multimedia Programming environment.

Arduino programs are written in C, C++ and JAVA.

The software Arduino IDE was used in embedded C language. The Embedded C language is used to write a source codes for the Arduino Atmega 328P which is then compiled.

3.5 System Flow Chart

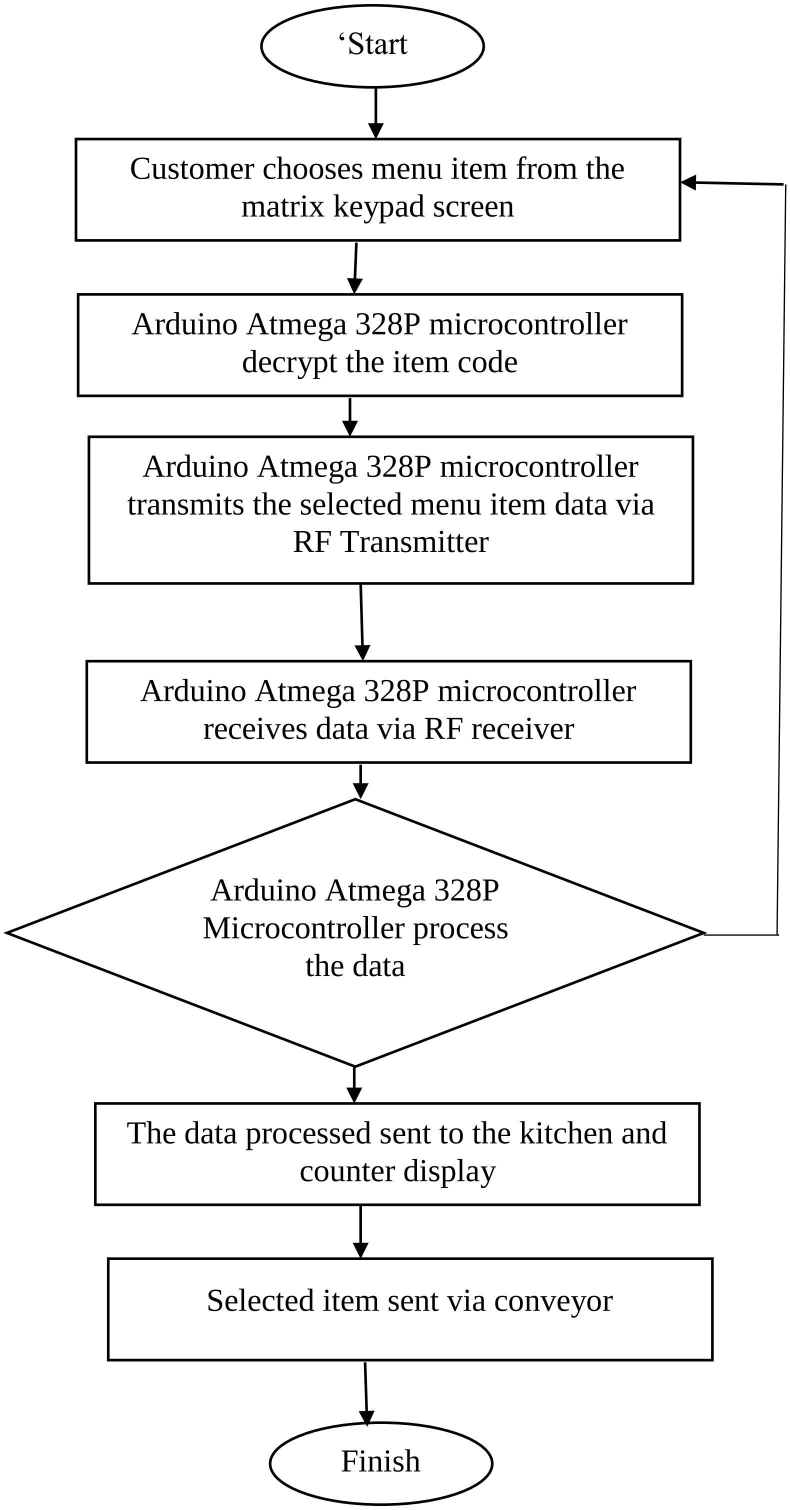

Figure 16: System flow chart

CHAPTER FOUR

TESTS AND RESULTS

4.0 Introduction

This chapter will describe the system testing, results (output) of the system design.

4.1 Tests

The Wireless E-Menu Restaurant Ordering system was designed and tested to evaluate its functionality and efficiency.

Transmitter

- Transmitter section is used for ordering from the menu.
- A 4X4 keypad is used to select the items.
- RF transmitter is connected to the transmit and receive pins of the microcontroller. Here the transmitter pin of the microcontroller is connected to the transmitter of the RF transmitter module. No need of connecting receive pin, as the module only transmits the data.
- LCD is also connected in order to view the selected items. Here LCD is used in 4 bit mode.

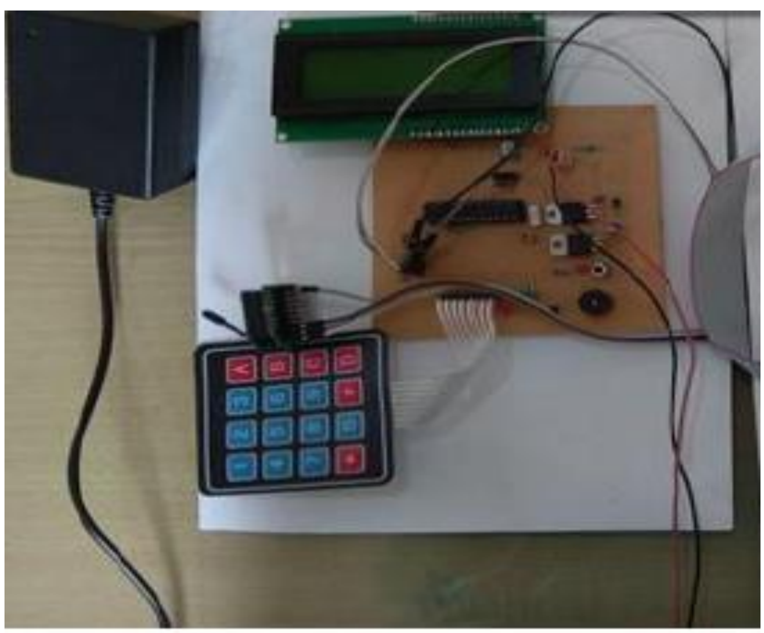

Figure 17: Transmitter side

Receiver

- The receiver section is connected in the kitchen. The order placed by the customer is received by the RF receiver. In real one can form a RF network in which single receiver is used to receive data from different transmitters.
- Thus received data is decoded and is displayed on the LCD

4.2 Results

The working of the system is as described below.

- The menu is displayed on the LCD on the customer side or table.

Figure 18: Menu items

- User should press the corresponding number of the selected item from the display.
- In real time one can use EEPROM of the microcontroller to store the menu.
- Items are selected using keypad provided. For example in order to select “1. Ice cream” press 1 (one) from the keypad. Similarly select your items and press ‘#’.

Figure 19: Status when no input is given

- Pressing ‘#’ will transmit the order to the receiver.

Figure 20: Order received for water

CHAPTER FIVE

CONCLUSION, LIMITATION AND FUTURE SCOPE OF WORK

5.0 Introduction

This chapter will give the recommendations, conclusions drawn from this project and brief ideas about future development works that can be undertaken.

5.1 Conclusion

Wireless technology is very useful as it is faster, easy to access and cost efficient. RF based menu ordering system will definitely help to save time and easy access to food. It will increase the revenue of restaurants.

5.2 Limitation

The system design has some limitations which include:

- Status and feedback of order is not obtained.
- Limited distance (Generally confined to a hall).

5.3 Future Scope

For further improvements we can use graphical LCD to display charts and graphs, can display estimated time of customer order, new schemes & offers can be displayed on GLCD.

This project can further be improved using tabs and help in development of more efficient food ordering system.

Also feedback of order can be implemented to improve the efficiency of the system by implementing more advanced technologies.

The data transfer using light is possible, this idea can be used in the development of Li-Fi technology. This method of data transmission can be applied where optic fibre and radiation prohibited areas such as chemical plants. Space shuttles are used for wireless communication. For the future development of visible light communication systems this study can be used. This can be applied at the chemical plants where the RF waves and OFC cannot be used. This system you can used into the school, college, lab, hospital, aircraft, air plane, to commanding the robot, mobile to mobile communication, etc. where the RF is ban on some areas and RF is strictly unused on that range like petrol pump which is RF is cause the explosion on this areas.

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APPENDIX

Appendix A: Project Time-Frame

Table 1: Project time frame

SN	ACTIVITY/TASK	PERIOD 2019			
		JAN	FEB	MAR	APR
1.	Team meeting -Project organisation -Divide task				
2.	Research				
3.	Choosing material component and budget				
4.	Project implementation -Technical drawing -Circuit design -Fabrication -Assembling -Programming -Testing -Analysis				
5.	Report				
6.	Presentation				
7.	Launching the system				
8.	User’s feedback				

Appendix B: Project Budget

Table 2: Project budget

NO	ITEM	QUANTITY	COST (UGX)
1	Software modules	N/A	100,000/=
2	Hardware components (RF TX/RX module, Encoder/Decoder ICs, Breadboard, Arduino board, Atmega 328P microcontroller, LCD screen, Relays, Transformer, Plugs, Connecting cables, USB Jack cables, Capacitors, keypad, Wire antennas, Crystal oscillator, Transistors, Voltage Regulator, PCB, Jumpers wires, soldering lead, soldering gun, Digital Multimeter, lead Sucker and Packaging materials.	N/A	600,000/=
6	Stationary	N/A	80,000/=
9	Miscellaneous	N/A	200,000/=
		TOTAL	**980,000/=**