ZIGBEE BASED HOTEL MENUCARD ORDERING SYSTEM

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ABSTRACT

The system mainly aims in designing completely automated menu system in restaurants with the help of touch screen sensor and a color graphical LCD to provide a user friendly environment. There is no need of a person to take the order from the customer's table. The menu will be displayed automatically on the customer's table and we can directly order the menu with the help of either touch screen sensor . Touch screens provide fast access to all types of digital media, with no text-bound interface getting in the way. Using a touch interface it can effectively increase operator accuracy, reduce training time, and improve overall operational efficiencies. Transmission of data is through Zig-bee which is a wireless technology developed as an open global standard to address the unique needs of low-cost, low-power, wireless sensor networks.

Keywords— *The ARM Cortex-M3 micro-controller, Touch screen, LCD display module, Zigbee modul*

1. INTRODUCTION

Zigbee based hotel menu card ordering system involves developing a prototype for customer self-ordering system in restaurants. Ordering is a process of the customers specifying what they want, so that the order can be recorded by using a note form, or computer system and many others, followed by passing it to the relevant department for processing and finally the delivery of services or products to the customers based on the order.

Self-ordering system is very successful when applied in different restaurants in many countries and it is proven to benefit most of the investors .This system cuts down the manpower for taking the order from the customer. Touch screens as a popular user interface are more and more common. Applications span from public information systems to Customer self-service terminals. Thus, as a Logical step, more and more devices today Feature this kind of user interface, e.g. Bank Automatic teller machines (ATMs), personal Digital assistants (PADs), mobile phones and displays. A touch screen is a display that can detect the presence and location of a touch within the display area. Let's one do so without requiring any intermediate device, again, such as a stylus that needs to be held in the hand. Such displays can be attached to computers or, as terminals, to its networks. Therefore it is very suitable for restaurant & time saving. It enables one to interact with what is displayed directly on the screen, where it is displayed, rather than indirectly call the waiter & ordered the menu. These devices also allow multiple users to interact with the touch screen simultaneously. Touch based interfaces have been around for a long time in consumer electronic devices, and even longer in research labs, but it has only been recently that the wider public has taken a keen interest in this mode of human-computer interaction.

The touch screen is an assistive technology. This interface can be beneficial because it is time saving. The purpose of this system is to introduce a wireless Zigbee based ordering systems for restaurants. Compared to traditional restaurant system, by using this system customer get faster and better service, restaurant staff co-operates more efficiently with less working mistakes and enterprise owner thus receives more business profit. GLCD-Touchpad Based Restaurant Ordering & Automatic serving System is a concept with a new innovative idea in the field of Hospitality Industry. The concept of this system has conceived in mind on observing take away fast food out lets , M.C. Donald counters, Sub Way counters, Punch screens at various fast food restaurants *etc* The concept is we can browse the menus/sub-menus by jus fingertip.

Automation is the Technology Concerned with Application of Mechanical, electronics & computer based systems to operate & control production. Due to advancement in technology we have seen atomization of many things. We have seen an atomized vending machine which will serve a hot or soft drinks, Chocolates &many things. There is automation of tickets on railway station. So into day's world due increased demand and competition we need to serve the people as user friendly as fast as possible. In restaurants menu cards are available on each table .We can refer it & place our order to waiter. But we never noticed disadvantages of this conventional method. You need to wait for the waiter to attend to you. Even it becomes difficult for the restaurant manager to keep the changing prices on menu card. At the same time adding the new menu to the same card becomes tedious job for anyone who is responsible for this job since changing menu card within less time may result in cost rise.

2. LITERATURE SURVEY

The journey for getting up to the peak of joy and facilities that we are presently experiencing started with initial footstep of a wireless technology. The introductions of basic proposed systems and consequent developments have been mentioned here.In the existing system, order is taken from the customer manually by a written note or by an i-pad which needs a person to go near the table, show the menu card and ask for the order. After placing the order, the person will pass the information to the concerned section and the order is delivered accordingly to the customer [1].

The analysis shows that the scarcity of wireless ordering system for the medium-sized hotels directly leads to promoteslowly. Through comparing with different grades of E-Menu ordering systems, the key difference lies in selection of ordering terminal and wireless communication. In this paper, the development of wireless handheld terminal is based on the Software-hardware platform of ARM7 (LPC2148) and, using ZigBee short-range wireless communication technologies."ZigBee Based E-Menu Ordering System" In This paper a new design scheme of the EMenu ordering terminal applied to middle and small hotel is proposed.[2]

The "Development of wireless ordering systemfor hotel".This work presented in-depth analysis on the technical operation of microcontroller and zigbee module based Wireless Ordering System (WOS) including systems architecture, function and limitations. [3]

In this system"AutomatedRestaurant Management System'' which works as a link between waiters to provide optimum quick and effective and almost effortless services to the hotels and restaurants.[5]

Touch screen based ordering system &displaying system for restaurantIntention of this proposed method is to promote a cost effective system which could work only in small-scale restaurants that are not willing to invest huge amount of fund in these systems.[4]

Implementation of Smart Restaurant withe-menu CardThis paper highlighted the limitations of the existing technologies and proposed the advanced system, which focuses on low cost touch-screen development to enhance the dining experience.[7]

The traditional paper based system was one of the most extensively used systems worldwide. In this system all records need to be stored on paper. However, this system is associated with various problems [6].

Some of the problems are mentioned below:

- The most common stumble is that waiters may make mistakes with customers \ orders. At times, a waiter can forget to add a specific item ordered by the customers and make changes and forget to give the order to the kitchen.
- In order to determine whether the food is ready or not the waiters need to constantly check with the chefs. Conversely, chef needs to make sure waiters know that food is ready. This can cause the food to get cold over time and lead to potential foodpoisoning.
- Customers must rely on the waiter to remember order and specific food details provided by them. In addition to that the food ordered by the customers may take much time to be prepared and served if the waiter has multiple tables.
- Impatient customers also call over the waiters/waitress frequently to find out the status of their order several times during their visit, wasting the waiter's service time.
- Keeping track of empty, clean and reserved tables within a restaurant.
- They also require re-printing of menus when food is not available or a price needs to be changed. This can be costly and timeconsuming

3. HARDWARE DESCRIPTION

The following is a schematic of transmitter section of Design of Restaurant Self-Ordering system based on Zig-bee using ARM.

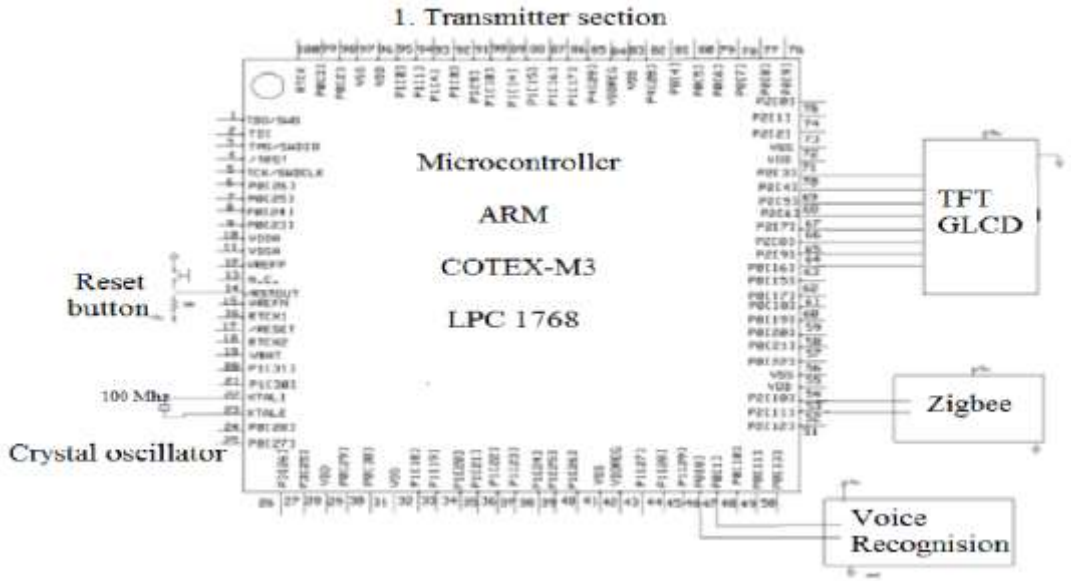

Figure 3.1 : Schematic of transmitter sectionof Design of Restaurant Self-Ordering system based on Zig-bee using ARM.

3.1 ARM Cortex-M3.

The ARM Cortex-M3 32-bit micro-controller has been specifically developed to provide a high-performance, low-cost platform for a broad range of applications, including microcontrollers, automotive body systems, industrial control systems and wireless networking. The Cortex-M3 processor is a 32-bit processor, with a 32-bit wide data path, register bank and memory interface. LPC 1768 has 512 KB flash memory and 64KB data memory.

The processor is a low-power processor that features low gate count, low interrupt latency, and low-cost debug. It is intended for deeply embedded applications that require fast interrupt response features. The processor implements the ARM architecture v7-M.

The processor incorporates: Processor core. A low gate count core, with low latency interrupt processing that features:

- ARMv7-M. A Thumb®-2 Instruction Set Architecture (ISA) subset, consisting of all base Thumb-2 instructions, 16-bit and 32-bit, and excluding blocks for media, Single Instruction Multiple Data (SIMD), enhanced Digital Signal Processor (DSP) instructions (E variants), and ARM system access.
- Banked Stack Pointer (SP) only.
- Hardware divide instructions, SDIV and UDIV (Thumb-2 instructions).
- Handler and Thread modes
- Thumb and Debug states.
- Interruptible-continued LDM/STM, PUSH/POP for low interrupt latency.
- Automatic processor state saving and restoration for low latency Interrupt
-

Table No. 3.1: Specifications of ARM Cortex-M3.

Architecture	Armv7-M Harvard
ISA Support	Thumb/Thumb-2
Pipeline	3-stage
Memory Protection	Optional 8 region MPU with sub regions and background region
Interrupts	Non-maskable Interrupt (NMI) + 1 to 240 physical interrupts

Interrupt Priority Levels	8 to 256 priority levels
Wake-up Interrupt Controller	Up to 240 Wake-up Interrupts
Sleep Modes	Integrated WFI and WFE Instructions and Sleep On Exit capability. Sleep & Deep Sleep Signals. Optional Retention Mode with Arm Power Management Kit
Bit Manipulation	Integrated Instructions & Bit Banding
Enhanced Instructions	Hardware Divide (2-12 Cycles), Single-Cycle (32x32) Multiply, Saturated Math Support
Debug	Optional JTAG and Serial Wire Debug ports. Up to 8 Breakpoints and 4 Watchpoints.
Trace	Optional Instruction and Data Trace (ETM), Data Trace (DWT), and Instrumentation Trace (ITM)

3.2 GLCD (Graphical Liquid Crystal Display)

GLCD is a colored TFT graphical LCD with a touch screen module which enables the customers to select their option through touch. It has 100MHz frequency, 64KB of SRAM and 512KB flash.

The handheld ordering terminal implements human computer interaction by 128x64 GLCD and touch screen. There is a high performance GLCD Controller integrated on chip. CPU transfers pixel data to GLCD screen. The terminal uses 4-wire resistive touch screen. S3C44B0X need sampling to judge whether a touch screen has been touched. FM7843 is a 4-wire resistive touch screen input controller integrated circuit which is widely applied to small portable devices battery powered. The device is a 12-bit analog-to-digital converter with a

Figure3.2 : Graphical LCD

Table No. 3.2: Specifications of GLCD

ITEM	DIMENSION	UNIT
Number of charectors	128 x 64 Dos	-
Module dimension	72.0 x 52.7 x 8.9(Max)	Mm
View area	6.0 x 32.6	Mm
Active area	55.0 x 27.48	Mm
Dot size	0.41 x 0.41	Mm
Dot pitch	0.44 x 0.44	Mm
LCD type	STN Negative, transmissive , blue	
Duty	1/64	

View direction	6 o'clock
Backlight type	Edge LED white

3.3 Zig-bee.

Zig-bee is a wireless device which communicates between transmitter and receiver. Zig-Bee is a standard that defines a set of communication protocols for low data-rate short-range wireless networking. Zig-Bee based wireless device operates in 868 MHz, 915 MHz, and 2.4 GHz frequency bands. The maximum data rate is 250 Kbps.

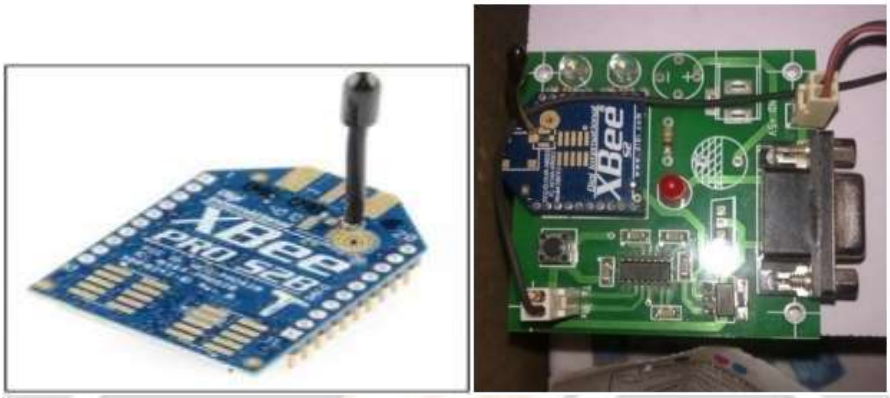

Figure3.3:zigbee module

The ZigBee network is defined by the ZigBee Alliance and based on the IEEE 802.15.4 standard, which is target data RF embedded applications that require a low data rate, long battery life and secure networking. It is intended to operate in the 2.4GHz unlicensed ISM band [1 -2]. There is no large numbers of data which need to convey between the wireless ordering terminal build-in ZigBee module and the center node, and because of having no high requirement of data rate, so ZigBee is well suited for wireless ordering system. Each ZigBee modules includes an IEEE 802.15.4-compliant radio, an 8051 microcontroller, programmable I/O, flexible antenna and range solutions, Transmit range is up to 300m, which can meet the demand of wireless ordering system completely.

ZigBee module can be configured in star, mesh, and cluster tree network topologies. IP-Net includes support for our innovative 'serial mesh mode', allowing RS232/RS485 data streams to be transmitted over multiple hops to improve data reliability and increase transmission range. ZigBee Wireless network of restaurant which is configured in star topology. In this routing topology, data traffic and network commands are routed through a central node. Peripheral nodes require direct radio contact with the central node. An ordering end device acted as a peripheral node in the network is an RFD, it have stringent requirements for low power and memory space. An IEEE 802.15.4 network requires at least one FFD usually line powered to act as a network coordinator. The coordinator sets up a network, initializes a network, manages network nodes, stores network nodes information, and transmits to control center server via RS232.

Table No. 3.3: Specifications of Zigbee Module

RF data rate	250 kbps
Indoor/urban range	133ft. (40 m)
Outdoor/fry line-of-sight range	400 ft. (120 m)
Transmit power	1.25 mw (+1 dB)
Receiver sensitivity (1% per)	97 dBs

Serial data interface	3.3v cmosuart
Configuration method	API or at commands, local or over-the-air
Frequency band:	2.4 GHz
Interference immunity	DSSS (direct sequence spread spectrum)
Serial data rate	1200 bps - 1 mbps
ADC inputs	10-bit ADC inputs
Digital I/O	:10

3.4 Voice Recognition Module.

The VRBot module is designed to easily add versatile voice command functionality to the project. The VRBot can be powered by anywhere between 3.3 and 5.5V, and typically consumes 12mA of current in operation. The VRbot module provides users with 26 built-in Speaker Independent commands that allow basic control of robot movement straight out-of-thebox. The following is a schematic of receiver section of Design of Restaurant Self-Ordering system based on Zig-bee using ARM.

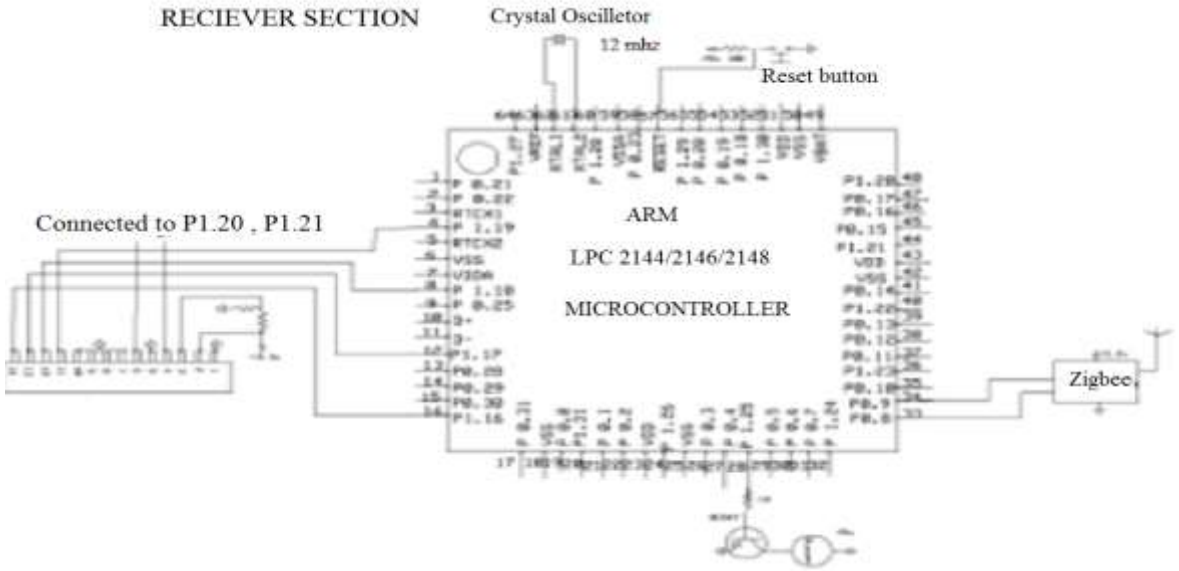

Figure 3.4: Schematic of receiver section of Design of Restaurant Self-Ordering system based on Zig-bee using ARM.

3.5 ARM LPC 2148.

ARM LPC2148 is a 64 pin Micro Controller which comes under ARM 7 version of ARM processors. It comes under the processor core architecture ARM7TDMI-S. It is a 32 bit Micro Controller .This is intended for high end applications involving complex computations. It follows the enhanced RISC architecture. It has high performance and very low power consumption. It has serial communications interfaces ranging from a USB 2.0 Full Speed device, multiple UARTS, SPI, and I2Cs. Various 32-bit timers, dual 10-bit ADC(s), single 10-bit DAC, PWM channels and 45 fast GPIO lines with 9 interrupt pins. 32 + 8 kB of on-chip static RAM and 512 Kb of on-chip flash program memory.

• In-System/In-Application Programming (ISP/IAP) via on-chip boot-loader software. Single flash sector or full chip erase in 400 ms and programming of 256 bytes in 1ms.

• EmbeddedICE RT and Embedded Trace interfaces offer real-time debugging with the on-chip Real Monitor software and high speed tracing of instruction execution.
• One or two 10-bit A/D converters provide a total of 6/14analog inputs, with conversion times as low as 2.44 us per channel.
• Single 10-bit D/A converter provides variable analog output.
• Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog.
• Low power real-time clock with independent power and dedicated 32 kHz clock input.
• Multiple serial interfaces including two UARTs (16C550), two Fast I2C-bus(400 kbit/s), SPI and SSP with buffering and variable data length capabilities.
• Vectored interrupt controller with configurable priorities and vector addresses.
• Up to 45 of 5 V tolerant fast general purpose I/O pins in a tiny LQFP64 package.
• Up to nine edge or level sensitive external interrupt pins available.
• On-chip integrated oscillator operates with an external crystal in range from 1 MHz to30 MHz and with an external oscillator up to 50 MHz.
• Power saving modes include Idle and Power-down.
• Individual enable/disable of peripheral functions as well as peripheral clock scaling foradditional power optimization.
• Processor wake-up from Power-down mode via external interrupt, USB, Brown-Out Detect (BOD) or Real-Time Clock (RTC).

3.6 LCD.

One of the most common devices attached to a micro controller is an LCD display. Some of the most common LCD's connected to the many microcontrollers are 16x2 and 20x2 displays. This means 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively. The LCD requires 3 control lines as well as either 4 or 8 I/O lines for the data bus. The user may select whether the LCD is to operate with a 4-bit data bus or an 8-bit data bus.

3.7 Buzzer.

Basically, buzzer works on the sound source of a piezoelectric sound component. To interface abuzzer the standard transistor interfacing circuit is used. Note that if a different power supply is used for the buzzer, the 0V rails of each power supply must be connected to provide a common reference.

4. SOFTWARE DESCRIPTION

4.1 Keil software
4.2 Embedded 'C'
4.3 Flash magic

We use Kiel software to write the program andexecute it, program is written in the embedded 'c' language, after completion of executing the program hex file program is dumped into the controller using flash magic

4.1 Keil software

It is an IDE for various microcontrollers such as 8051, ARM family microcontrollers. It is an integrated tool with all the requirements for programming of a microcontroller. It is having a text editor for writing the program code in it. It is having a compiler/debugger for error checking. And also having the Hex file generator for converting the code into binary format for writing it into microcontroller . It provides a programming platform for various microcontrollers with all their library headers.

4.2 Embedded C

Embedded C is a set of language extensions for the C programming language by the C Standards Committee to address commonality issues that exist between C extensions for different embedded systems. Historically, embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations.

In 2008, the C Standards Committee extended the C language to address these issues by providing a common standard for all implementations to adhere to.It includes a number of features not available in normal C, such as, fixed-point arithmetic, named address spaces, and basic I/O hardware addressing.Embedded C uses most of the syntax and semantics of standard C, e.g., main() function, variable

definition, datatype declaration, conditional statements (if, switch case), loops (while, for), functions, arrays and strings, structures and union, bit operations, macros, *etc*

4.3 Flash magic

After writing the code in IDE, compiling and debugging will be completed in IDE itself. The next step is to write the binary form of the code into microcontroller's flash memory. Flash magic is the tool that provides the writing Hex file into flash memory through UART interface to the computer's COM port. As the LPC2148 is having the internal ISP feature which enables the programmer write the code directly into the microcontroller without using any extra device.

The additional software tools used for implementation of this system is uC Flash. This is also a programming tool for 8051 microcontrollers but it is very specific to a programming device of that particular manufacturer. We are not giving much description about this tool because of the programming device is chosen by the user availability and the tool will changes according to the device used.

5. WORKING

In the proposed system, Zig-bee is used to transmit the data from transmitter to the receiver. There are two ARM Micro-controllers each at transmitter (customer table) and receiver (kitchen). Whenever a customer comes to a table, they can select their order with the help of a Graphical LCD with touch screen provided. This GLCD displays MENU items with its corresponding images or pictures, so the customer has the choice of selecting the item with its picture. As soon as the customer selects the item, it will be displayed on the LCD provided in the receiver section. A person can also make his selection of the item through voice where the transmitter is provided with a Mic.

In this system, there are two sections
a)System with user or customer
b) System with responder or service provider
a) System with user:

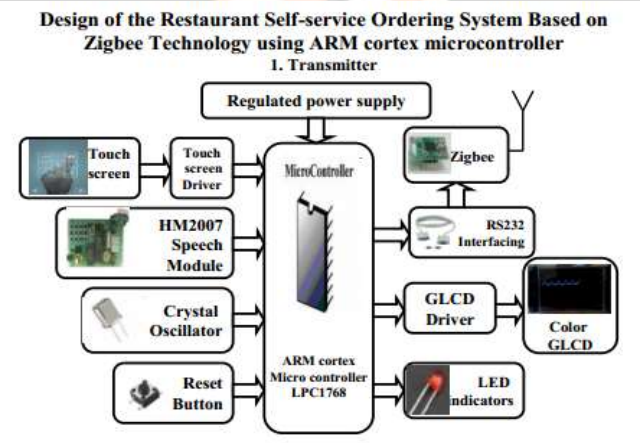

Figure 5.1: Block diagram of transmitter section

When we switch the controller board initially we get the display of food items images on the TFT graphical LCD along with food item numbers. There are two selection enable options at the below end of the TFT graphical LCD. In this system, there are two ways to provide the order. The selection option is used to select whether the input is from voice mode or touch mode. When the user enables the voice mode option, then this system mainly selects the input based upon the speech commands given by the user. So, it is mandatory that the user's voice is to be given clearly and correctly near the microphone. Since the main objective is to transmit the data to the receiver section. When the user is done with the giving of selected item input, the word number corresponding to it is displayed their as confirmation and the same input is transmitted to the receiver section using wireless communication zigbee module.

When the user selects the touch mode then the touch screen module is enabled and when the user selects the food item on the image displayed on TFT graphical LCD, then the item numbers is displayed on it. The corresponding item number selected by the user is transmitted using zigbee module. The intermediate communication module is Zigbee module which makes the communication between the user or customer system at the table end and system at responder or service provider at receiving department.

b) System with the service provider/responder

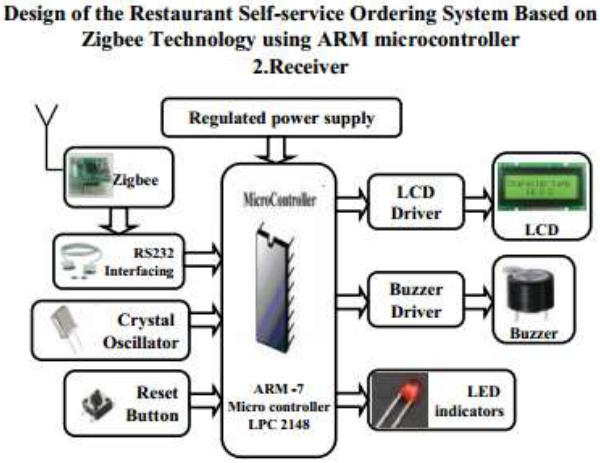

Figure5.2 : Block diagram of receiver section

The Zigbee module present in this system also receives the word that is transmitted by the Zigbee module present in the system with user. As soon as it receives the word, it sends it to the microcontroller. The ARM LPC 2148 micro controller which is at the receiver section takes the responsibility to display the menu items on the LCD. At the receiving end the selected items will be displayed on LCD with user table number

6. ADVANTAGES, DIS-ADVANTAGES AND APPLICATIONS

6.1 Advantages

1. This system cuts down the manpower for taking the order from the customer
2. Compared to traditional restaurant system, by using this system customer get faster and better service, restaurant staff co-operates more efficiently with less working mistakes
3. Enterprise owner thus receives more business profit.
4. It is Cost efficient system than the other hotel ordering system
5. Transmission of data is through Zig-bee which is a wirelesstechnology developed as an open globalstandard to address the unique needs oflow-cost, low-power, wireless sensornetworks.
6. A person can also make his selection of the item through voice where the transmitter is provided with a Mic.

6.2 Dis-Advantage

1.The draw back of the system is that it does not give feed back of the requests to the user.

6.3Application

1. Self-ordering system is very successful in different restaurants,
2. This system also can be used in malls and college canteen

7.FUTURE SCOPE

The main draw back of the system is it does not give the feed back of the requests to the user. This can be eliminated using GSM modem which sends the SMS messages about the requests to the manager when the responder does not respond to the requests of the user.

The system can also extend using smart card technology through which the bill payment can be done based on the smart ATM debit or credit cards directly. The printer can directly issue bills to the customers at tables only. This provides a time saving process and avoids a cash counter for it.

The customer can visualize the order and bill, administrator has the authority to change the menu and has authority to view daily, weekly or monthly report on profits and lastly the kitchen staff can prepare and serve the order. Apart from these functions there are some limitations in this system like Provisions have to be made to accept different types of payment like credit cards, debit cards, checks, tips, donations *etc*. More features could be added like online

9. CONCLUSION

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been successfully implemented. Thus the system has been successfully designed and tested.

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