Smart Restaurant Based on Embedded System

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Abstract: In most of the restaurants meal ordering is relying on the interaction with waiters to place order into the kitchen .In busy hours of restaurant this coordination is a challenge result in un-satisfaction to the customer. To realize this, Smart Restaurant System is designed. The system covers the whole order process of a restaurant includes the interaction between customer, the waiter, the kitchen and the cashier through wireless devices.

I. INTRODUCTION

Now a day's not only developed countries but even developing countries like India are facing shortage of trained staff in hotel and hospitality industry. The problem is even adverse in countries with relatively lower population. Attrition rate of the staff in this industry is also significantly high. Ever increasing demands for higher pay and facilities has plagued the industry. In most of the restaurants food ordering and serving process is manual and involves human efforts. The waiter has to note down orders from customers, take these orders to kitchen, update them in the database and again make bill. Even though this system is simple, it involves a lot of human errors in noting down the orders serving them to the right table and calculating bills. Besides these errors arguments with customers, behavioral problem absentees due to medical and personal reasons are other major issues. Many of the hotel and food joints have put their shutter down because of these issues.

Our system is aimed to provide a magical solution to all these problems. It will considerably reduce human efforts. Customers will be able to place their orders automatically with the help of the ordering system and a menu can be seen on the table. The processing module that has been used for the proposed system is Arduino Uno based. Once the customer places the order it will be wirelessly transmitted to the monitor inside the kitchen using X Bee antennas. After the chef prepares the order, it will be placed on the conveyor belt, which takes the food to the customers table.

II. . LITERATURE SURVEY & PROBLEM STATEMENT

2.1 LITERATURE SURVEY

1**. Jun Zheng and Abbas Jamalipour, "Introduction to Wireless Sensor Networks" Wiley-IEEE Press, 2009**

This research work aims to design and develop a wireless food ordering system in the restaurant. The project presents in-depth on the technical operation of the Wireless Ordering System (WOS) including systems architecture, function, limitations and recommendations. It is believed that with the increasing use of handheld device e.g. PDAs in restaurants, pervasive application will become an important tool for restaurants to improve the management aspect by utilizing PDAs to coordinate food ordering could increase efficiency for restaurants and caterers by saving time, reducing human errors and by providing higher quality customer service.

2**. Soon Nyean Cheong, Wei Wing Chiew, Wen Jiun Yap, "Design and Development of Multi-Touchable E-Restaurant Management System" December 5 - 7, 2010, Kuala Lumpur, Malaysia**

This paper highlights some of the limitations of the PDA-based food ordering system and proposed the Multi-touchable Restaurant Management System as a solution. The system consists of the multi-touchable interactive dining menu that allows customers to make order conveniently on the developed multi-touchable dining table during the busy hours using their fingers. Orders made by the customers will be updated instantly to a centralized database and subsequently reach the cashier and the kitchen module respectively. Management staff could use the system to manage the restaurant operations digitally, starting from the creation of food items for the multi-touchable interactive dining menu to deleting it or to manage orders from customers all the way to billing it. The system was built using Adobe Flash Action Script PHP scripting and My SQL data base on top of Zend Framework.

3. **Shweta Shashikant Tanpure, Priyanka R. Shidankar, Madhura M. Joshi, "Automated Food Ordering System with Real-Time Customer Feedback" February 2013**

The Rampant growth of wireless technology and Mobile devices in this era is creating a great impact on our lives. Some early efforts has been made to combine and utilize both of these technologies in advancement of hospitality industry. This research work aims to automate the food ordering process in restaurant and improve the dining experience of customers. In this paper, we discuss about the design & implementation of automated food ordering system with real time customer feedback (AOS-RTF) for restaurants. This system, implements wireless data access to servers. The android application on user's mobile will have all the menu details. The order details from customer's mobile are wirelessly updated in central database and subsequently sent to kitchen and cashier respectively. The restaurant owner can manage the menu modifications easily. The wireless application on mobile devices provide a means of convenience, improving efficiency and accuracy for restaurants by saving time, reducing human errors and real-time customer feedback. This system successfully over comes the drawbacks in earlier PDA based food ordering system and is less expensive and more effective than the multi-touchable restaurant management systems.

4. **Ashutosh Bhargave, Niranjan Jadhav, Apurva Joshi, PrachiOke, Prof. Mr. S. R Lahane, "Digital Ordering System for Restaurant using Android" April 2013**

Nowadays web services technology is widely used to integrate heterogeneous systems and develop new applications. Here an application of integration of hotel management systems by web services technology is presented. Digital Hotel Management integrates many systems of hotel industry such as Ordering System Kitchen Order Ticket (KOT), Billing System, Customer Relationship Management system (CRM) together. This integration solution can add or expand hotel software system in any size of hotel chains environment. This system increases quality and speed of service and it increases attraction of place for large range of customers. Implementing this system gives a cost-efficient opportunity to give your customers a personalized service experience where they are in control choosing what they

want, when they want it – from dining to ordering to payment and feedback.

2.2 PROBLEM STATEMENT

The traditional food ordering system is totally a manual process that includes pen, paper and waiters. The customers are always waiting for waiter to take the order. The waiters note-down the order from the customer. These orders provide to the kitchen department, update them in records and again make the manual bills. This system is very simple, but it includes the errors while note down the orders and also making the calculations. It is sometimes difficult to translate the handwriting of waiter.

To overcome these cons prose in manual system, the ordering system is more systematic and helps the manager to avoiding human error and increase business development with the help of this system. In this system, order transaction is systematic process to make transaction more efficient and system can helps the staff to avoid any order mistake. The transaction between customer to waiter and cashier will be more efficient. Other than, this system gives the better quality of service to customer and attracts the more customers to get this quality of service.

III. INTRODUCTION TO ATMEGA328 MICROCONTROLLER

The primary role of the embedded microcontrollers is to provide inexpensive, programmable logic control and interfacing to external devices. This means that they are typically not required to provide highly complex functions—they cannot replace the Opteron processor in your ISP's server. They are well suited to monitoring a variety of inputs, including digital signals, button presses, and analog inputs, and responding to them using the preprogrammed instructions an embedded microcontroller can respond to these inputs with a wide variety of outputs that are appropriate for different devices. These capabilities are available to you at a very reasonable cost without a lot of effort. This chapter will introduce you to the functions and features that you should look for when choosing a microcontroller for a specific target application.

3.1 ARDUINO UNO & ATMEGA328 MICROCONTROLLER

ARDUINO UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards and other circuits.

ATMEGA328 MICROCONTROLLER

Atmega328 is a high performance, low power controller from microchip. It is a 8-bit microcontroller based on AVR RISC architecture. It is most popular of all AVR Controller and it is used in ARDUINO boards.

IV PROPOSED SYSTEM

4.1 Flow Diagram of Smart Restaurant Based On Embedded System

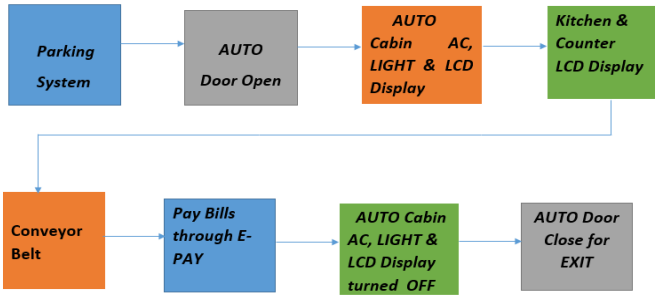

Fig: 4.1.1 Flow Diagram of Smart Restaurant Based on Embedded System

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Now a day we see advancement of technology in all the sectors and the main purpose of our project is to show how the technology can be used in a restaurants and bring change in the conventional form of ordering and serving food.

We are making use of restaurant for demo purpose the complete project kits set up using Arduino UNO boards. Restaurant is completely automated and it consists of parking slot for four vehicles, 2 cabins (tables), one kitchen, 1counter (reception).

As soon as the customer arrives at the restaurant then at the parking slot in seven segment display we can see the number of vacant slot with the help of LDR to detect the presences of vehicles so as the customer can park his/her vehicles in the vacant slot. When customer arrives at the main entrance, door is opened and closed automatically during entrance and exit of the customer by sensing the presence of the person using an PIR sensor, as it can detect the presence of the person as well as any obstacles.

Both the cabins have a wireless connectivity through Zigbee, when the customer enters the cabin; automatic light/fan is turned ON. The menu is displayed on the LCD display which of 16x2 and the order is placed by the customer is displayed in the kitchen. Once the ordered food is ready, it is sent from the kitchen to the ordered placed cabin (table) through a conveyor belt. Conveyor is rotated with the help of DC motor. After the conveyor reaches to the ordered placed cabin, a buzzer is given to notify the customer. The customer can pay their bill at the counter/cashier or online transaction can be done. When the customer leaves the cabin, the lights/fan is turned OFF. At the main entrance, the door is opened / closed automatically for exits.

4.2 METHODOLOGY

4.2.1 PARKING SYSTEM

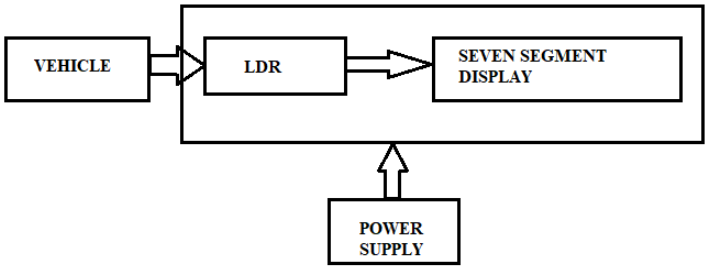


Fig: 4.2.1.1 Block diagram of parking system

In the above figure when customer arrives at the restaurant, a customer can easily find out the vacant slot with the help of LDR.

4.2.2 AUTOMATED DOOR OPEN/CLOSE SYSTEM

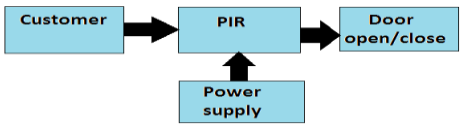
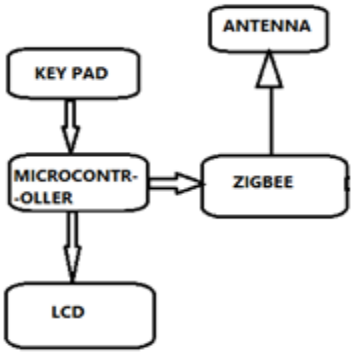


Fig: 4.2.2.1 Block Diagram of Automated Door Open/Close System

When customer arrives at the main entrance, door is opened and closed automatically during entrance and exit of the customer by sensing the presence of the person using an PIR sensor.

4.2.3 ORDERING SYSTEM

Fig.4.2.3.1 Block Diagram of Ordering System



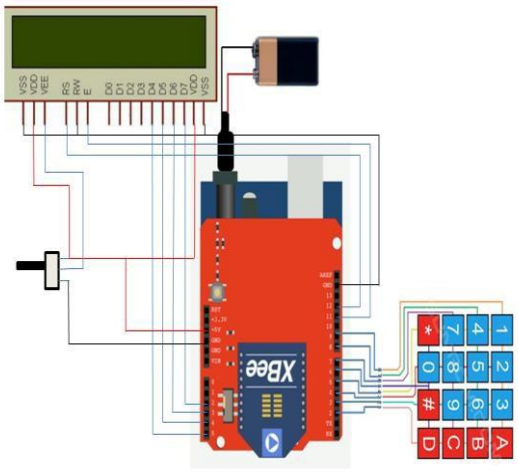


Fig.4.2.3.2 Circuit Diagram of Ordering System

This paper has shown the concept of an automatic self-ordering system directly given to the chefs by the customer. The real time ordered data is send wirelessly using Zigbee technology. Automatic Restaurant Ordering System using Zigbee - This paper provides a low-cost, convenient and easy to use system for automating order placement system for restaurants.

Each table of restaurant has a menu display unit, which is powered by microcontroller. . The client will scroll menu list using keypad. Customer could order his food or drink just using this keypad. Each table will consist of a microcontroller based order placement unit. The unit shall have a keypad to browse through the menu. The menu items, their cost and information has displayed on the LCD connected to microcontroller. User can navigate through menu using keypad provided. The menu for the data can be written on an EEPROM connected to each such as microcontroller-based unit, so that portable data updating is possible (by changing only the EEPROM). Upon finalizing the order, the user will be able to place it using keypad.

The order placed shall be transmitted to the central server (microcontroller) which will also have a ZIGBEE module connected to it for data reception. The alignment of the tables will be based on the setup of the restaurant. Each table will have a menu card and an Microcontroller device which will consist of a 16X2 LCD display, and a keypad. The menu card will have items each with a unique code and respective prices. Customer will place their order using the keypad by entering the unique code of the food item they wish to have and their orders will be displayed using the LCD display on their table and then transmitted wirelessly using XBee S2 antennas, which are interfaced with the Microcontroller devices using the Microcontroller Zigbee wireless shield.

4.2.4SERVING SYSTEM

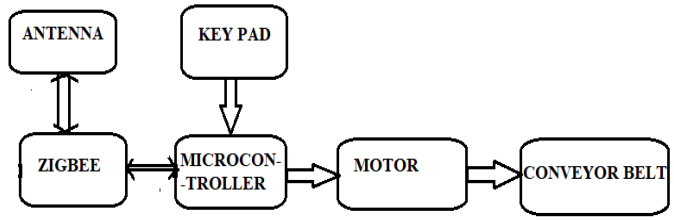


Fig. 4.2.4.1 Block Diagram of Serving System

Fig. 4.2.4.2 Circuit Diagram of Serving System

The list of orders along with the table number from which it was ordered will be displayed on the LCD to which the chefs will prepare the food and place it on the conveyor belt. This conveyor belt will be controlled by an Microcontroller which will have a keypad. This Microcontroller will be fed with the distance of each table from the kitchen so that it knows for how long it has to rotate the motor in order to reach a particular table. The chef will simply have to press the respective table number from which the food was ordered and the conveyor belt will deliver the order to the desired table.

4.3 FLOW CHART

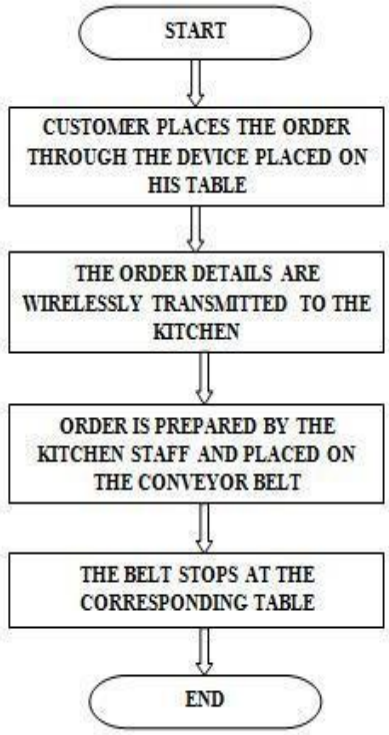


Fig.4.3.1 Flow Chart

V COMPONENTS

HARDWARE	SOFTWARE
Regulator	Arduino UNO IDE ()
Atmega328 Microcontroller	
Liquid Crystal Display (LCD)	
Zigbee (CC2500)	
Motors	
Light Dependent Resistor (LDR)	
Passive Infrared Sensor (PIR)	
Buzzer	
Seven Segment Display	

VI HARDWARE DESCRIPTION

6.1 REGULATOR It is an Electronic device maintains the voltage of a power sources within acceptable limits.

Type number	Regulation voltage	Maximum voltage	Minimum voltage
7805	+5V	1A	+7V

Table 6.1.1 Regulator Voltage Representation

6.2 ATMEGA328 MICROCONTROLLER

Atmega328 is a high performance, low power controller from microchip. It is a 8-bit microcontroller based on AVR RISC architecture. It is most popular of all AVR Controller and it is used in ARDUINO boards.

FEATURES

- High performance, low power AVR® 8-bit microcontroller
- Advanced RISC architecture
  131 powerful instructions – most single clock cycle execution
- 32 x 8 general purpose working registers
- Fully static operation
- Up to 16MIPS throughput at 16MHz
- 32K bytes of in-system self-programmable flash program memory
- 1Kbytes EEPROM
- 2Kbytes internal SRAM
- Six PWM channels

6.3 LIQUID CRYSTAL DISPLAY (LCD)

LCD is a flat panel display or other electronically modulated optical device these are used in digital watches and many portable computers. An LCD is made up of two pieces of polarized glass (also called substrate) these contain a liquid crystal material between them.

PIN	Symbol	I/O	Description
1	V_{SS}	-	Ground
2	V_{CC}	-	+5V Power Supply
3	V_{EE}	-	Power Supply to Contrast
4	RS	I	RS = 0, Select Command Register
			RS = 1, Select Data Register
5	R/W	I	R/W = 0 for Write
			R/W = 1 for Read
6	EN	I/O	Enable
7	DB0	I/O	The 8 bit Data Bus
8	DB1	I/O	The 8 bit Data Bus
9	DB2	I/O	The 8 bit Data Bus
10	DB3	I/O	The 8 bit Data Bus
11	DB4	I/O	The 8 bit Data Bus
12	DB5	I/O	The 8 bit Data Bus
13	DB6	I/O	The 8 bit Data Bus
14	DB7	I/O	The 8 bit Data Bus

Table: 6.3.1 Pin Description of LCD

6.4 ZIGBEE

Fig.6.4.1 Zigbee Module

FEATURES

- Low power consumption.
- Integrated bit synchronizer.
- Integrated IF and data filters.
- High sensitivity (type -104dBm)
- Programmable output power -20dBm~1dBm
- Available frequency at : 2.4~2.483 GHz
- Small size (QLP 4x4 mm package, 20 pins)

6.5 MOTORS

Motor is a device that creates motion, not an engine and usually it refers to an electrical motor or an internal combustion engine. It may also refer to DC motor, an electric motor that runs on direct current electricity

1) Brushed DC electric motor, an internally commutated electric motor designed to be run from a direct current power source
2) Brushless DC motor, a synchronous electric motor which is powered by direct current electricity and has an electronically controlled commutation system, instead of a mechanical commutation system based on brushes.

6.6 LIGHT EMITTING DIODE (LED)

Fig. 6.6.1 Symbol of LDR

LDR are light sensitive device that emits light when an electrical current is passed through it. LED are commonly used for indicator light (such as power on/off lights) an electronic devices.

6.7 PASSIVE INFRARED SENSOR (PIR)

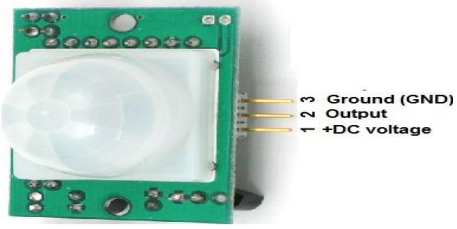


Fig.6.7.1 PIR Module

PIR is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are commonly used in security alarms and automatic lighting applications.

6.8 BUZZER

Apiece of buzzer is basically a tiny speaker that we can connect directly to an Arduino , from Arduino we can make sound with a buzzer by using tone.

FEATURES

- Black in color
- With internal drive circuit
- Sealed structure

6.9 SEVEN-SEGEMENT DISPLAY

7-Segment display is a form of electronic device for displaying decimal numerals that is an alternative to the more complex dot matrix displays.

FEATURES

- Available in two modes Common Cathode (CC) and Common Anode (CA)
- Available in many different sizes like 9.14mm,14.20mm,20.40mm,38.10mm,57.0mm and 100mm (Commonly used/available size is 14.20mm)
- Available colors: White, Blue, Red, Yellow and Green (Res is commonly used)
- Low current operation
- Current consumption: 30mA / segment
- Peak current: 70mA

VII RESULT

Fig 7.1 Smart Restaurant Model

Fig 7.2 Smart Restaurant Model

LVIII ADVANTAGES & DISADVANTAGES

ADVANTAGES

- Wastage of paper is avoided as our implementation is working just on tablet and does not need any paper work for taking the order.
- Saves time: A customer going to restaurant does not have to wait for the waiters to take order. As soon as he occupies a seat, he would order whatever he needs.
- Fast delivery: As soon as the order is ready, it would be notified to the customer. So, there would not be any issues of late delivery in spite of the food being ready.
- Large number of orders can placed at a time
- Human errors are avoided
- Saves labor cost

DISADVANTAGES

- Initially Installation cost is high: tablet would cost us more as they are more costly the simple paper.
- If we compare our system with traditional paper based system, more maintenance would be needed. Some technical assistance would also be needed
- .Operation awareness

IX APPLICATIONS

- In canteens: The same system of automation and food ordering concept can be used.
- In factories: The conveyor belt system can be used to pass products and also update can be made using desktops from employees to managers.
- In Industries: Manufactured products can be passed on conveyor belts and also the list of products can be updated using software easily.
- In corporate: The same exact setup can be made in order to reduce the man power and ease the work.

X CONCLUSION

Smart Restaurant based on Embedded System will work as a link between man machine to provide optimum quick and effective and almost effortless services to the hotel and hospitality industry. It is a low power system which will not only reduce man power required but also reduce the possibility of human errors. It is cost effective as it involves one time investment. The maintenance cost will be considerably low as compared to the salary of the waiters. Smart Restaurant based on Embedded System will revolutionize the hotel industry.

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