Zigbee-Based Smart Ordering System (S.O.S)

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***Abstract*— In the era of information technology, human tend to develop better and more convenient lifestyle. Nowadays, almost all the electronic devices are equipped with wireless technology. A wireless communication network has numerous advantages and becomes an important application. The enhancements provide by the wireless technology gives the ease of control to the users and not least the mobility of the devices within the network. It is use the Zigbee as the wireless modules. The Smart Ordering System introduced current and fast way to order food at a restaurant. The system uses a small keypad to place orders and the order made by inserting the code on the keypad menu. This code comes along with the menu. The signal will be delivered to the order by the Zigbee technology, and it will automatically be displayed on the screen in the kitchen.**

***Keywords*— smart, ordering, S.O.S, Zigbee.**

I. INTRODUCTION

Traditional restaurant management process usually used to take customer's orders is by write it down on a piece of paper. Many mistakes done by these conventional methods such as the worker taking the wrong food order in the message and late to serve food order to the customer. Therefore, the wireless self-service order management has been developed.

This project covers the implementation of Smart Ordering System (S.O.S) by using Zigbee. The IEEE802.15.4 Zigbee protocol is a wireless technology developed as an open global standard to address the unique needs of low cost, low power, wireless sensors network [1]. Zigbee is generally used for home care, digital home control, industrial and security control. The Smart Ordering System is proposed orders using hand tools used to make an order in a restaurant. It is proposed to solve the problems faced by entrepreneur's restaurant in an attempt to organize a restaurant more efficiently trained and capable.

The system uses a small keypad for customers to choose orders. Order made by inserting the code on the keypad menu. This code comes along with the menu. The signal will be delivered to the order by the ZigBee technology, and it will automatically be displayed on the screen in the kitchen. This project will reduce the time spent on ordering and paying bills, where the cost and manpower can also be optimized.

II. RELATED WORK

Some related works for the smart ordering system based on ZigBee are reviewed in this section.

Sun Guiling [2] proposed a design of the Restaurant Self-Service Ordering System Based on Zigbee Technology. This paper discussed about the comparison with the traditional enterprise management mode, wireless self-service ordering management information system realizes the intellectual and information listed restaurant management. The touch screen display of taste and food prices to customers for their input orders directly with touch. This system complete automatically receive data, storage, display, and analysis. Ordering by LCD display device name restaurant food items and by touching the LCD can be distinguished customers the price, taste and sample images food. Customers can order their meals with it immediately.

Instead of using Zigbee, N. M. Z. Hashim [3] developed a smart Ordering System via Bluetooth. In the system, the Bluetooth technology as the communication medium and Peripheral Interface Controller (PIC) as the hardware which implements faster ordering system. It consists of a keypad at customer's table as a remote control and monitor at kitchen or counter to display the ordering information systematically. The system uses a small keyboard which is placed on each table for the customer to make orders. Order is made by inserting the menu code on the small keyboard. This code comes together with the menu. A signal will be sent to the order section by Bluetooth communication, and automatically will be displayed on a screen in the kitchen.

III. BLOCK DIAGRAM OF S.O.S

Fig. 1 shows block diagram of the system. The whole system is divided into three area which are User area, Kitchen area, and Counter area.

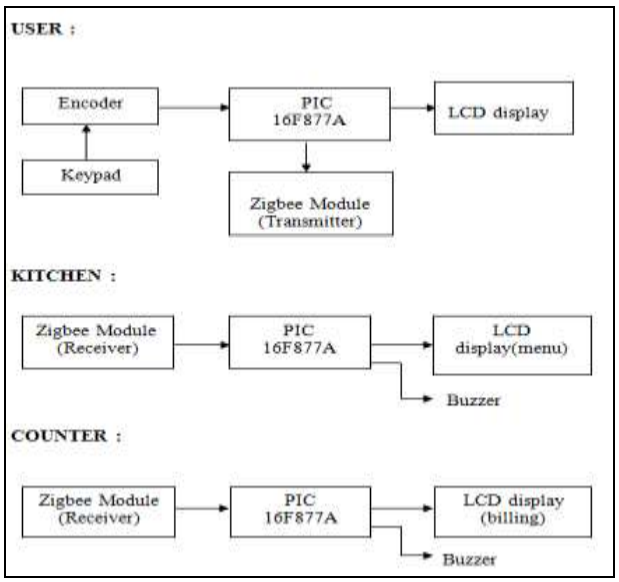

Fig. 1 Block Diagram of Smart Ordering System

The system uses a keypad 4x4 for the customer to make orders. At the User section, the customer will make an order by inserting the menu code on the keypad. This code comes together with the menu. The PIC16F877A will decrypt the data to be sent to the Kitchen section by Zigbee communication. Zigbee module at the Kitchen section received and decodes the data and it will display the menu that had been chosen by a user at the screen in the kitchen. The processed data is to be sent to the kitchen LCD display for ordering purpose, and to the counter LCD display for billing process at the Counter section. This system will be done after the customer completed their orders.

IV. Hardware Component

The main components used in project are:

- Electronic Order Keypad
- Power Supply
- LCD Display
- Zigbee

A. Electronic Order Keypad

The keypad consists of normally open push button switches. A 1k pull-up resistor on each input pin can help eliminate outside noise. The circuit 4x4 keypad is used in particular with the PIC 16F877A microcontroller [4]. It has been designed considering a supply of 5V, 16F877A I/O pins leaking current, the voltage level recognized as a high or low state while in TTL mode when a key is pressed the 16F877A micro detects it and transmits the ASCII character [5]. Each push button defines the ID or special code for difference menus. Fig. 2 shows the Keypad 4x4 Circuit.

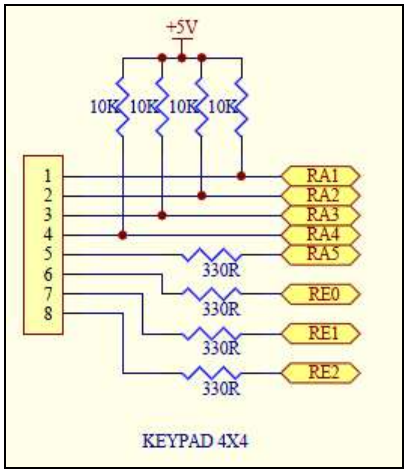

Fig. 2 The Keypad 4x4 Circuit.

B. Power Supply

A power supply is the hardware component that supplies power to the electrical device. It receives power from the electrical outlet and convert the current from AC (Alternating Current) to DC (Direct Current), which is what the computer needs. It also regulates the voltage of sufficient amount, which allows the computer to run smoothly without overheating. Based on Fig. 3, the appropriate components have been used to convert from 12V to 5V and 12V to 3.3V. The voltage regulators are used to step down 12V high voltage to low voltage of 5V, but the ZigBee only use the low voltage, 3.3V. Furthermore, this project using 10V and above to support the LCD display and control the dim conditions.

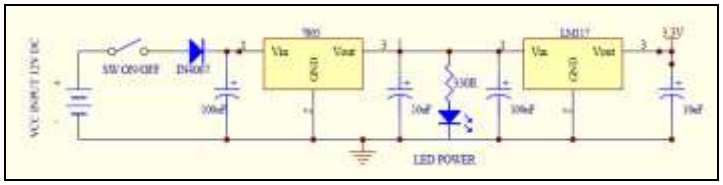

Fig. 3 The Power Supply Circuit.

C. LCD Display

An LCD or liquid crystal display is a type of flat panel display commonly used in digital devices, for example: digital clocks, appliance displays, and portable computers. The completed order will be transmitted to counter or kitchen with ZigBee technology and the information will be displayed at the LCD display. Fig. 4 shows The LCD Display Circuit.

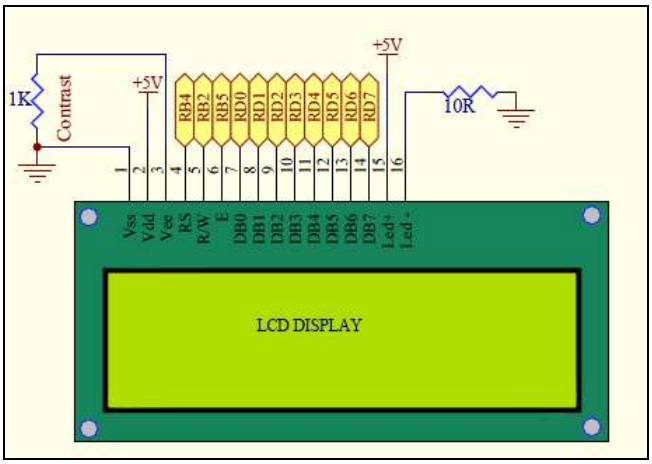

Fig. 4 The LCD Display Circuit

D. Zigbee

This prototype has been implementing by using Zigbee Series 2 module as shown in Fig. 5. The Zigbee Series 2 OEM RF Modules were engineered to operate within the ZigBee protocol and support the unique needs of low-cost, low-power wireless sensor networks. We have configured two Zigbee modules with X-CTU software.

Fig. 5 Zigbee Series 2

V. Software Design

The programming of PIC 16F877A is done in Embedded C using MPLAB Integrated Development Environment (IDE) software. MPLAB IDE is a software program that runs on PC to provide a development environment for embedded

microcontroller design. The system flowcharts are shown in Fig -6.

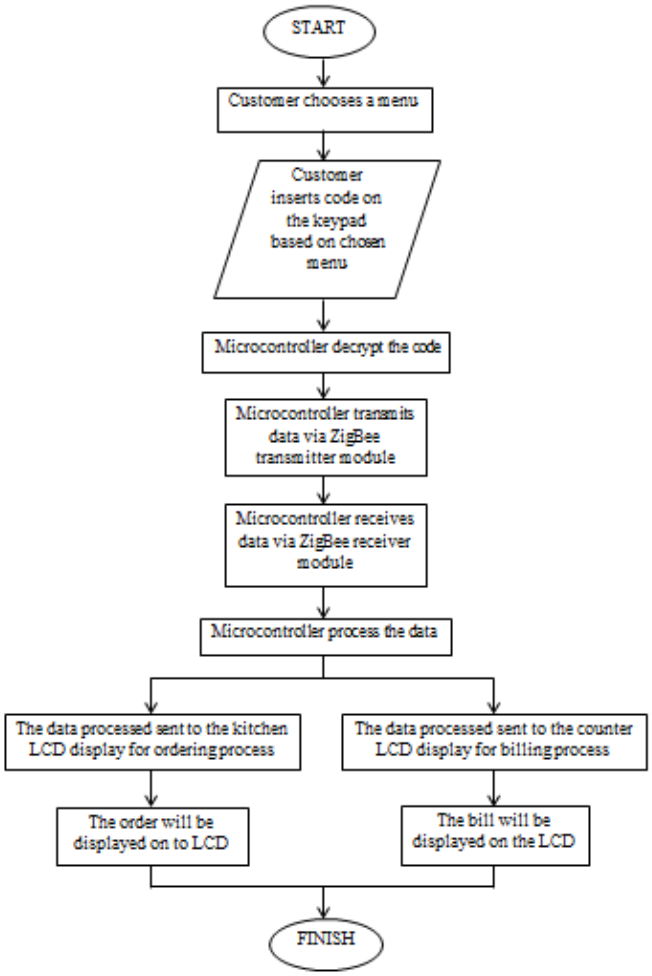

Fig. 6 Status Flowchart

As in Fig. 6, the customer (User section) will choose the menu by inserting the code on the keypad based on chosen menu. The microcontroller will decrypt the code and transmit the data via Zigbee Transmitter module. The microcontroller will receive the data via Zigbee Receiver module and it processes the data to send to the kitchen LCD display for ordering process and to the counter LCD display for billing process. Finally, the order will be displayed on the LCD at the kitchen, and the bill will be displayed on the LCD at the user. This system will be done after the customer completed their orders.

VI. Results

A Zigbee RF chip is the core of the transmission device. This device has powered up by using battery supply. Fig. 7 shows the actual circuit of the S.O.S system. The system was tested to evaluate the functions and effectiveness of the application. The results and analysis are based on functionality and implementation process.

Fig. 7 Overall S.O.S System

A. User Section

The system uses a keypad 4x4 which is placed on each customer table to make an order. Customer need to press the menu by using the keypad for making order. The Fig. 8 below shows the hardware on the User section.

Fig. 8 Hardware at User Section

Table -1 shows the action that been taken by the system after one of the button had been pressed. From the observation, the LCD will display a menu if a push button had been pressed. Fig. 9 shows the example of menu chosen by customers that appear at the LCD display.

TABLE I
OUTPUT FOR KEYPAD BUTTON

Button	Action
When button 'A' is pressed	Change the list of menu
When button 'B' is pressed	To select the sub menu
When button 'C' is pressed	Save item to order
When button 'D' is pressed	Send the order to the kitchen and total billing to the counter.

Fig. 9 Example of Menu Chosen by Customer

B. Kitchen Section

The Fig. 10 below shows the hardware in the kitchen. The completed order will be transmitted to kitchen with Zigbee communication.

Fig. 10 Hardware at Kitchen Section

C. Counter Section

The completed order will be transmitted to the counter for billing process. The Fig. 11 below shows the hardware at the counter.

Fig. 11 Hardware at Counter Section

VII. CONCLUSIONS

This paper proposes a set of smart ordering system based on Zigbee. We designed and developed a prototype system that allows user to make order by inserting the menu by themselves and it solved the problem which is faced by the restaurant's entrepreneur in the attempt to organize the restaurant more efficiently skilled and capable. Furthermore, it also can improve human resource utilization and speed up the management in restaurant. Besides that, it reduces the lateness and the error on ordering foods by the customers by restaurant.

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