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IMPLEMENTATION OF SMART TROLLEY SYSTEM IN MALLS

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Abstract - *A supermarket is a place where a wide variety of items are available. People purchase things in supermarkets in order to satisfy their basic needs but gets frustrated while waiting in the queue for billing and gets confused while comparing the total price with the budget in pocket. This paper suggests implementing a smart trolley system based on RFID in order to reduce the billing time by creating two modes-Auto and manual mode. Auto mode guides and moves forward before the customers to find product when they are new to the supermarket and in the manual mode customers have to drag the trolley. In addition to this, the smart trolley is capable of recognizing the product with the help of RFID reader, adds or reducts and displays its count, weight and price with the product name and calculates the final amount after purchasing. The RFID reader scans, adds and sends the final price of the purchased products to the cashier or server with trolley number for cash settlement using wireless transmission reducing the wastage of time in the queue.*

Keywords: Shopping trolley, PIC microcontroller, Modes, RFID, Billing, Bluetooth transmission.

I. INTRODUCTION

People have a list of items which they want to buy. The advancement in technology changes the way of shopping over the last decade. The owners of malls and supermarkets are working to improve the facilities for customers to make sure the customers are satisfied with the shopping experience and at the same time factors such as providing the customer's needs and to meet the expected sales growth and profit are also considered. The primary thing is to eliminate the waiting time taken for billing the items and in addition to this consumers prefer to have a then and there checking of the increasing count, weight and rate of each and every item that is added into the smart trolley. The customers prefer to have glimpse of quantity and price level to make purchase decisions. Anyways, increase in capital cost and accuracy when the shopping trolley is full with items are the major drawbacks of this smart trolley system. The RFID based smart shopping trolleys are trending in recent times. The implementation consists of RFID reader module which reads the unique Id of the RFID tags sticked to the items. Passive tags are cost efficient than active tags to use in each product in massive shopping malls. This smart shopping trolley is further provided with two different modes of operation. The primary is the auto-mode and the latter works in manual mode. Both the modes calculate and display the count, weight, product rate and the final rate. The important part of this implementation is the development of wireless connection between the server and the smart container in the trolley. The smart shopping trolley in this paper manipulates the capability to integrate all components within the shopping container itself and communicate through low-power Bluetooth module which only uses ¼ of power in contrast to Zigbee, thus increasing the battery life.

II. EXISTING METHODS

The smart trolley implementation is usually constructed using two types of scanners such as Barcode and RFID scanner. Apart from differentiating the scanners many implementations use different wireless communications such as Wi-Fi, Bluetooth, Zigbee, etc between the smart container and the server. The server may be a stable system or mobile reception of the total price. Any microcontrollers can be used such as ARM processors, Atmega microcontrollers (Arduino), Peripheral Interference Controller (PIC), or any other microcontroller. Limitations of the existing systems include

- Scanning difficulties
- Cannot provide long term reliability
- Latency
- Require line of sight scanning
- Read/Write capabilities

III. PROPOSED SYSTEM

In the proposed system, the trolley number, product name, count, amount of product, and easy transfer of the billing amount to the cashier facilities are available. And also

This system has a two method

1. **Automatic mode**
2. **Manual mode**

In **automatic mode,** the trolley guides the customer to the whole supermarket.

In **manual mode,** the trolley is followed by the customer.

This prototype can be operated on both the modes, manual mode is enabled when a customer knows the exact location of the particular product, and auto mode is enabled when the customer is in a new supermarket without knowing the location of the product. At the same time, the smart trolley calculates the additive or reductive quantity and rate for every product and sends the final bill amount to the cashier using the wireless Bluetooth connection. This is the simple automated working of this project.

IV. SYSTEM DESIGN AND DEVELOPMENT

BLOCK DIAGRAM:

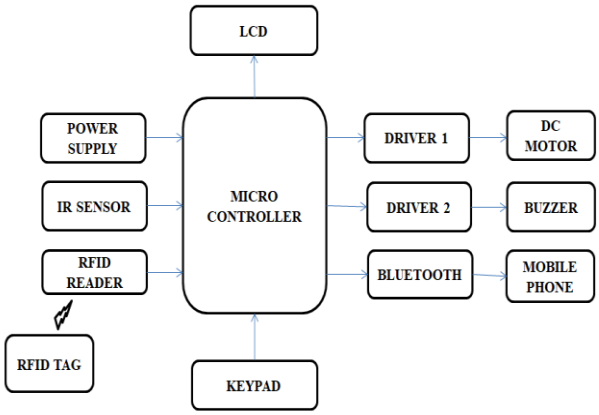

Figure 1: Block Diagram of the Proposed System

HARDWARE MODULES

1) MICROCONTROLLER (PIC) :

Peripheral Interface Controller (PIC) is developed by a Microchip. PIC microcontroller is fast and simple to implement programs compared to other microcontrollers like 8051. The PIC is a microcontroller consists of RAM, ROM, CPU, timer, counter, ADC, DAC. PIC also supports protocols like CAN, SPI, UART for interfacing with additional peripherals.

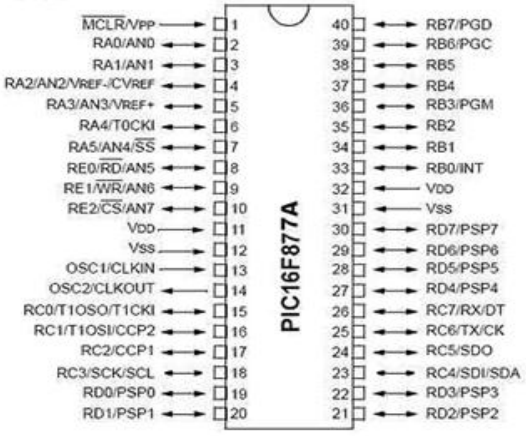

Figure 2 Pin Configuration of PIC16F877A

2) POWER SUPPLY:

The power supply circuits built using filters, rectifiers, and then voltage regulators. Steady dc voltage is obtained by rectifying the ac voltage, then filtering to a dc level, and regulating to obtain a desired fixed dc voltage. The proposed system contains batteries of 6V and 4.5aH.

3) VOLTAGE REGULATOR:

IC7805 voltage regulator is used as a voltage regulator that regulates 5V supply as output to all other components consuming power.

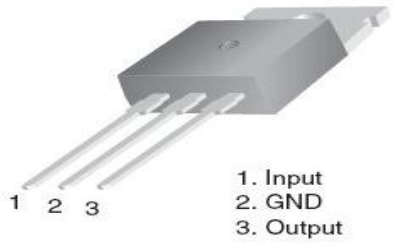

Figure 3 Voltage regulator IC 7805

4) IR SENSOR:

IR Sensor works by using a specific light sensor to detect a light wavelength in the Infra-Red (IR) spectrum. When an object is close to the sensor, the light from the LED bounces off from the object and into the light sensor, and that can be detected using a threshold. IR Sensor includes photodiode and IR LED that play the role of receiver and transmitter respectively.

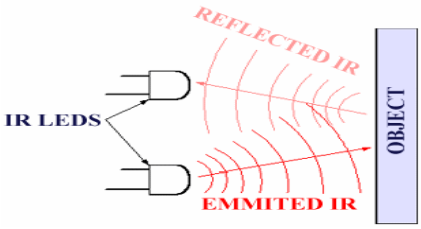

Figure 4 IR sensor

5) RFID MODULE:

The RFID reader used in the proposed system is EM-18 is shown in figure 5.

Figure 5 RFID reader module EM-18

Working of RFID module:

The working of RFID is shown in figure 6.

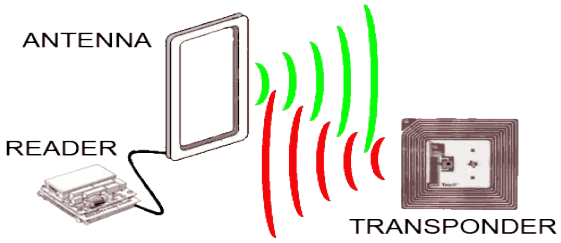

Figure 6 RFID working

6) INDICATOR:

Indicator used in the system with LED to show which mode is selected by the customer either auto-mode or manual mode on the trolley.

7) BUZZER:

A buzzer is an audio signalling device. A buzzer may be mechanical, electromechanical or piezoelectric. Figure 7 shows the buzzer that is used to indicate completion of the purchasing in the proposed system.

Figure 7 Buzzer

8) RELAY:

Relay are simple switches that are used for switching. The switching mechanism is carried out with the help of an electromagnet. In the proposed system, the relay of Single Pole Single Throw (SPST) switch is used with the driver circuit to control the forward and backward movement of the trolley in auto-mode.

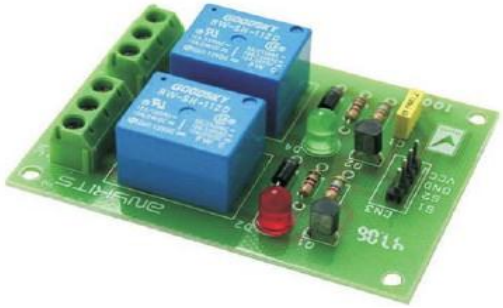

Figure 8 Relay board

9) LCD:

LCD (Liquid Crystal Display) screen is an electronic display module that is used to display the product name, count, weight, and total price on the display.

Figure 9 LCD display

10) KEYPAD:

A keypad is a set of buttons arranged in a block that contains digits, symbols or a complete set of alphabetical letters or numbers. Keypads are used as push-buttons to select mode and items in the auto-mode of the smart trolley system.

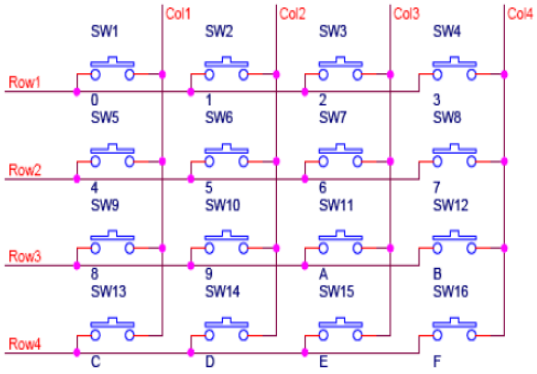

Figure 10 Keypad module and connections

11) DC MOTOR:

DC motors converts electrical energy into mechanical energy in the form of rotation. In this system dc motor of 12V with 30rpm is used. This motor works on the principle of Fleming's Left-hand Rule.

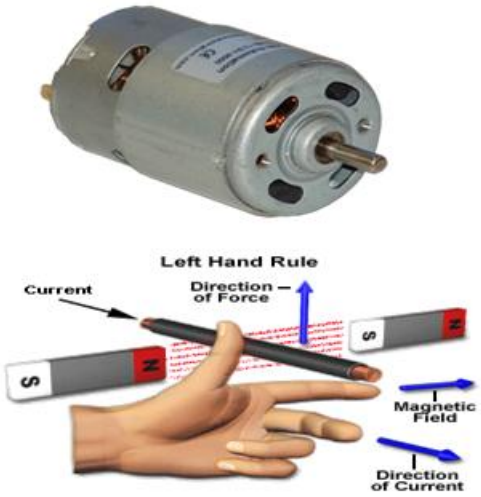

Figure 11 DC motor and its working

12) BLUETOOTH MODULE HC-05:

Bluetooth is a wireless technology for exchanging data over short distances wavelength UHF from fixed and mobile devices and building personal area networks. The communication range is approximately 9 meters (30 feet).

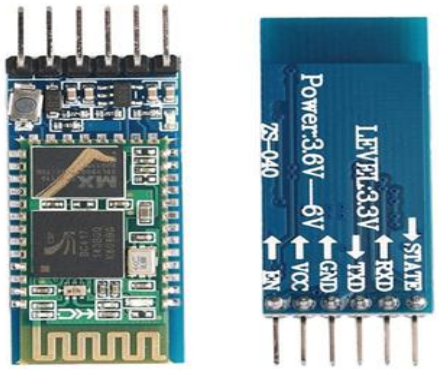

Figure 12 Bluetooth module HC-05

SOFTWARE

- **MPLAB IDE -** Source Code IDE
- **Hi tech compiler -** Compiler to check errors
- **Teraterm –** Terminal emulator that supports telnet and serial port connections

V. IMPLEMENTATION RESULTS AND DISCUSSION

The hardware modules are assembled together and connected together and verified the working of modes, movement of trolley and the total bill calculation and display.

Figure 13 Hardware module of the proposed system

The implementation result of the proposed system is made to display in Bluetooth Electronics Application installed in the server.

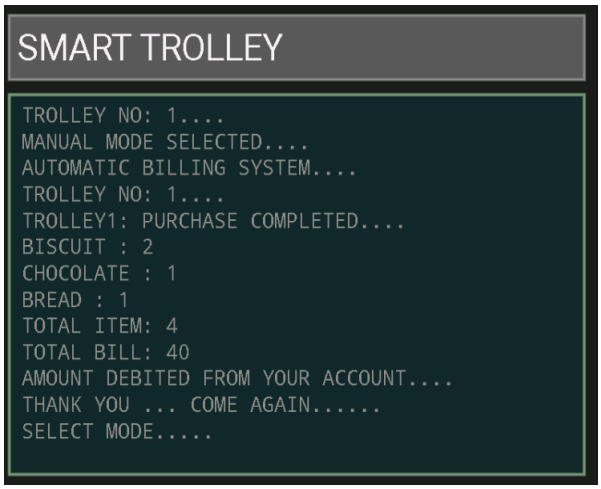

Figure 14 Model Implementation Result

VI. ADVANTAGES AND APPLICATIONS

ADVANTAGES:

- Reduced billing time
- Highly accurate in calculation of bill
- Battery can withstand longer lifetime
- Easy access of trolley at any of the modes
- Read/Write capability of items

APPLICATIONS:

- Shopping mall
- Super market
- Industrial goods carrier

VII. CONCLUSION AND FUTURE SCOPE

As a conclusion, from the market survey conducted, shows the advantages of the smart trolley with suggested innovative RFID technology to reduce the searching time of products or goods and also can control the current budget shopping and also provides information on product details and easy to figure out where the items are located. The future scope for this system can be improved by smart trolley with online payment facilities such as G-Pay and additional features to form an intelligent and complex device for the existence of a long lifetime.

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