Development of an Intelligent Smart Shopping Cart System

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***Abstract*— It has been observed that Supermarkets witness long queues during the peak of shopping period. These long queues have resulted in the loss of time both for the shoppers and the mall attendants. Hence, the goal of this paper is to design and develop an Intelligent Smart Shopping Cart with the sole objectives of minimizing shopping time and to maximize shopping experience in a supermarket. This paper presents an Intelligent Smart Shopping Cart System where the total amount the shopper wants to spend is imputed into the mini system embedded in the smart shopping cart. Each product picked has an RFID tag which has an assigned price. When the products dropped in the smart shopping cart reaches the maximum input amount or exceeds the maximum input amount, the red visual indicator starts to blink and the buzzer beeps to notify the shoppers of exceeding the price limit while shopping. The green visual indicator also blinks when a shopper shops below the imputed amount. If any product is removed from the smart shopping cart, the amount is deducted from the developed mini system embedded in the smart shopping cart and the buzzer also beeps to notify the Shopper of the deduction. The components used for this research are RFID Tag, RFID Reader, Liquid Crystal Display (LCD), Push buttons/Switch, Reset button, Visual Indicator, Wi-Fi module, and a PIC microcontroller.**

***Index Terms*—RFID Tags, Reader, LCD, Wi-Fi Module, Microcontroller,**

I. Introduction

Nowadays, supermarkets experience long queues while shoppers conduct transactions. The purpose of this research paper is to reduce the time it takes shoppers on queue to pay the total price for their products. This paper presents the development of an Intelligent Shopping Cart System where the total amount the shopper wants to spend is imputed into mini system on the smart shopping cart. Each product picked has an RFID tag which has its price attached to it. When products dropped in the intelligent shopping cart reaches or exceeds the maximum input amount, the red indicator starts to blink and the buzzer keeps beeping. When a shopper spends below the imputed amount, the green visual indicator blinks and the buzzer beeps once. Any product removed from the intelligent shopping cart also amounts to its price being removed from the developed mini system on the intelligent shopping cart and the buzzer also beeps. The billing is done on the trolley itself. Information of product is gotten through the RFID reader and displayed on the LCD which is in turn interfaced with the PIC microcontroller. Each shopping cart has a Product Identification Device (PID). The Product Identification device is made up of a PIC microcontroller, an RFID reader, LCD, Wi-Fi module [1]. RFID Tag carries the price information of the tag, RFID Reader reads product information, Liquid Crystal Display displays product information, Push button/Switch is switched on before a shopping cart is used, Motion detector sensors senses the product, then allows the RFID reader to either add or remove price and a PIC microcontroller conducts the activities of the whole system [2], [7]. Each product Identification device is assigned a tag number for easy identification. While shoppers shop, details of products shopped for is transferred to the main system via the Wi-Fi module. The Product Identification device can also be monitored while shopping is in progress from the main system though the Wi-Fi module. Once the intelligent shopping cart has been used, the switch button is pressed to pave way for a new shopper to use.

The contribution of this paper is the development of a smart shopping cart that leads to an improved shopping experience by eliminating the need for shoppers to queue at the counter so that the total amount of items purchased can be calculated by the cashier. In this work, RFID tags will be used to identify each product rather than the use of barcodes obtainable in most grocery stores.

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II. LITERATURE REVIEW

[1], [2] aimed at providing a centralized and automated billing system using ZigBee and RFID. Each product had an RFID tag for identification, each cart had a PID (Product Identification Device) which housed the LCD, RFID reader, EEPROM, and ZigBee Module. This purpose of this research paper was to eliminate the challenge of long queues in shopping centers or supermarkets.

[3] aimed at solving the challenge of long queues. This research was carried out using Raspberry pi which was used for wirelessly communicating with the server, infrared sensors, RFID tags for product identification, a web application to display amount to be paid. RFID readers are used to wirelessly read the RFID tag attached to the product

[4], [5] was carried out using a RFID reader, LCD,

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switches, Motion detector Sensor, push buttons and a ZigBee. The start button is pressed when the smart trolley is to be used. When products are put inside the smart cart, the RFID reader reads its tag and the cost of the product is added. When a product put inside the cart is not wanted anymore and is removed, the removed product code will be detected and automatically removed while the buzzer beeps. When shopping is finished, the counter with the least number of queues is detected and displayed on the cart LCD while the final bill is transferred to the counter also using ZigBee.

III. MATERIALS

The materials involved in the smart shopping cart system involve the following electronics components:

A. RFID Reader

B. Liquid Crystal Display (LCD)

C. Push buttons/Switch

D. Reset button

E. Wi-Fi module

F. PIC microcontroller

G. Cart

H. Microsoft windows

I. Visual Indicator (Red and Green LEDs)

IV. METHODS

The intelligent smart shopping cart system is linked with devices listed in the materials above. The start button is pressed when a shopper wants to buy products. Products are automatically scanned as they are dropped in the smart shopping cart via their RFID tag. The shopper inputs the total amount to be spent. As products are dropped in, prices for each product are added up and displayed on the LCD screen. When the price reaches the maximum inputted amount or exceeds it, the red indicator starts to blink and the buzzer starts beeping. The green indicator also blinks when the shopper shops below the imputed amount. When the shopper is done shopping, the end button is pressed while the list is sent to the server computer via the Wi-Fi module where a receipt is generated for the shopper. Fig 1 shows the system architecture for the smart cart while Fig 2 presents the architecture of the server system that transmits cart information to the cashier. Fig 3 is a snapshot of the C program written into the microcontroller.

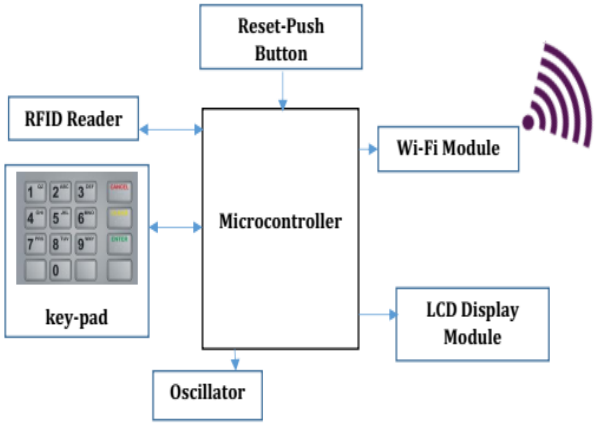

Fig.1: System Architecture for the smart cart

Fig.2: System Architecture server system/ cashier

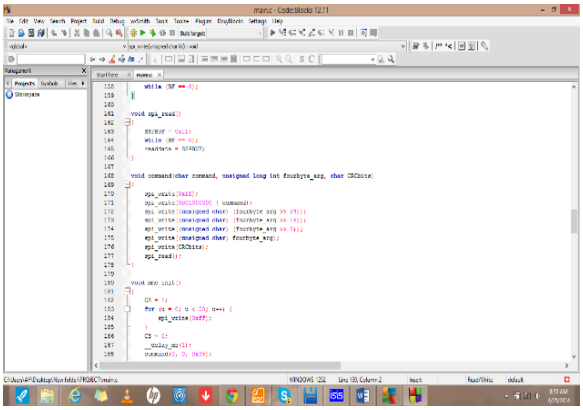

Fig.3: Screenshot for programming language for the PIC18F45K22

The flowchart in Fig 4 describes the operation of the smart cart system. Items placed into the cart or removed from the cart will result in the update of price while at the same time sent to the cashier

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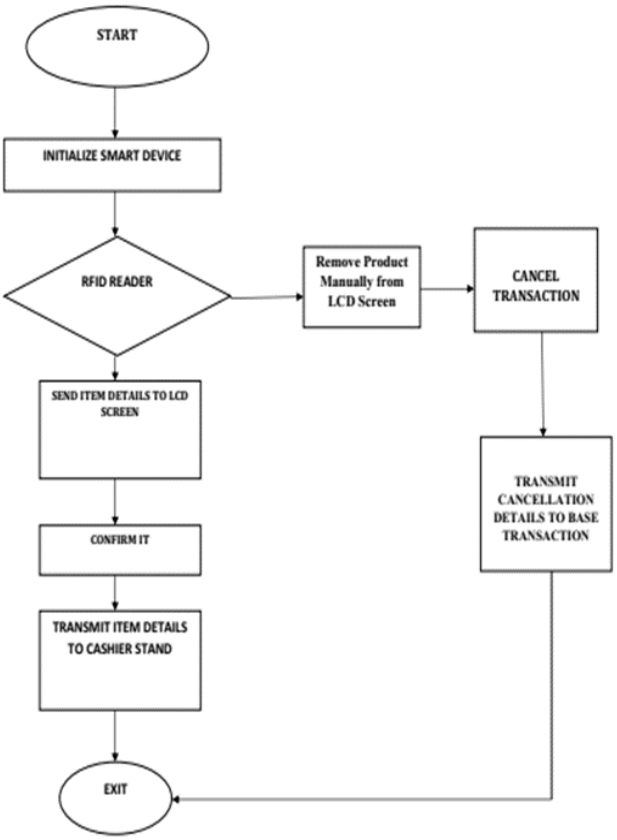

Fig. 4: System Flowchart for the system

V. RESULTS

A working prototype for an intelligent smart shopping cart system was constructed based on the circuit diagram shown in Fig.7and all parts functioned as intended. The diagram of the constructed prototype is displayed in Fig 6 in stages. The circuit components for the smart shopping cart system includes a voltage regulator, RFID reader, Buzzer, Keypad, LCD display and PIC18 Microcontroller. The microcontroller is where control algorithms are written to control the operation of the shopping cart system.

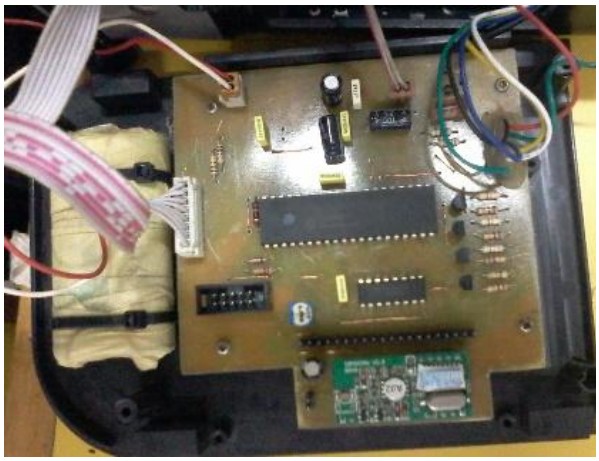

Fig. 5. First diagram of the Cart Modules.

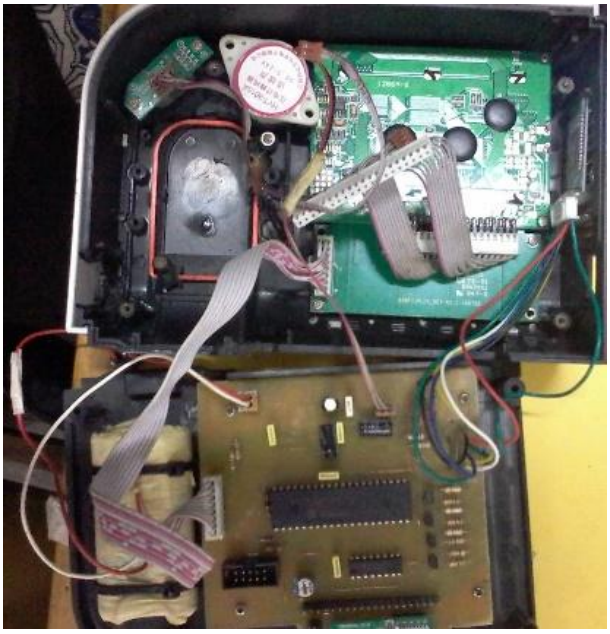

Fig.6: Diagram of the Cart Modules

VI. CONCLUSION

An intelligent smart shopping cart system was developed and worked as intended. The system developed can be integrated into grocery stores or shopping malls to create a smart shopping experience for customers.

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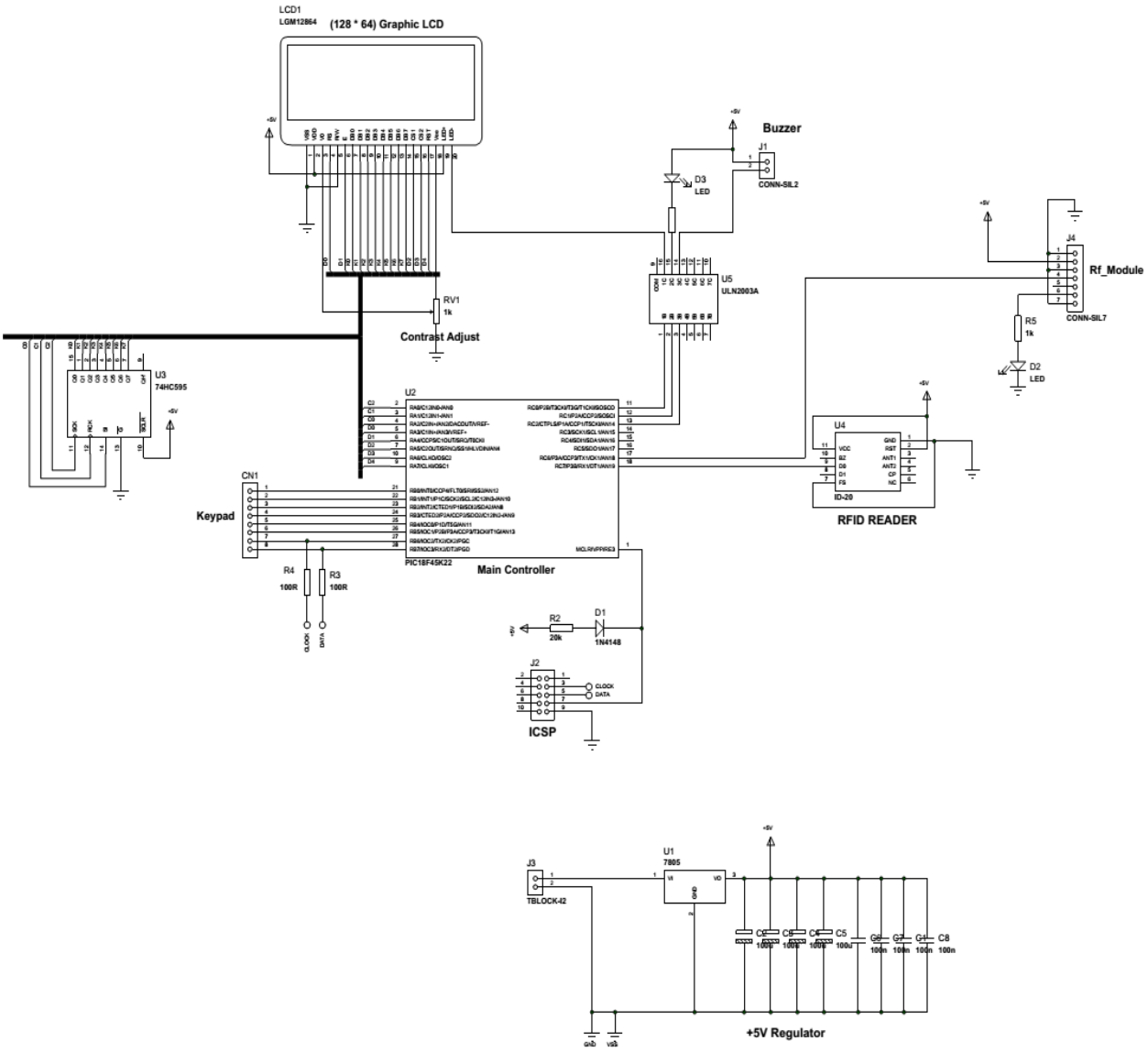

Fig. 7. Circuit diagram for the developed system

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