SMART TROLLEY SYSTEM USING RFID

IOT PROJECT REPORT

Submitted by

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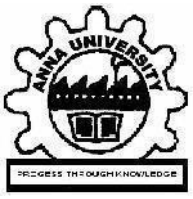

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BONAFIDE CERTIFICATE

Certified that this report title **"**SMART TROLLEY SYSTEM USING RFID**"** is the Bonafide work of **RANJITH KUMAR S (211501077), RASWANTH KT (211501078), SANTHOSH H (211501090)** who carried out the project work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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ABSTRACT

A supermarket or hypermarket is a place where different products are available. These products can be food, drinks, or any household products. The project aims to provide a hands-free and hassle free shopping experience to the users in the supermarket. The users face problems such aschaotic basket movement, overcrowding in one place, standing in the queuefor bill payment and so on. The project addresses these issues and has solutions which include RFID technology. Customers get frustrated while standing in the queue at the billing counter. They also get confused when comparing the total price with the budget in their pocket before billing. In order to overcome these problems, a smart trolley is designed with a smart phone and an Arduino. This trolley eliminates the need for customers to stand in the queue for scanning the product items for the billing purpose. Therefore, our main goal in designing this prototype was to reduce the human effort, eliminate the queue, and eliminate the time spent during billing. It is therefore our primary aim for the creation of this prototype to reduce people's effort, shorten queues and also remove time spent in billing.Our prototype consists of components such as RFID tags, which are used toidentify the products when placed on a conveyer belt and then scan them using an RFID reader while they're being displayed in LCD Displays. Thismeans data is sent to the server at the billing counter.

KEYWORDS: RFID tags, RFID reader, RFID technology , LCD Display

CHAPTER 1

INTRODUCTION

Many changes in innovation and technology have occurred throughout the century, which has influenced our attitudes and expectations. When we're spending most of our time, shopping is a major thing. In our survey, it is estimated that the average human spend approximately 1 to 1.5 hours in a shopping centre and most customers will always get out of lines when the yare long. People suffer from it, but they don't realize that the supermarket isa waste of valuable time needed to focus on their important workschedulesor family. Today, shopping carts and baskets that customers can carry to keep the purchased products are also available at every supermarket or mall. Customers must go into the billing counter when shopping is complete. In this case, the billing process is taking quite a bit of time and requires more human resources to be employed at the collection section. We're deployingan RFID based smart trolley system to reduce the traffic, save time and human effort in order to overcome this problem. There are some improved features on our prototype that will allow us to get through the queue. RFID tags, readers, LCD displays, Arduino Uno, Buzzer or push buttons are also included in the smart trolley system. The product is fitted with an RFID tag. The RFID reader is automatically scanning the products and displaying information about the product name, price or size on the LCD screen when a person places this product in their trolley. Once a customer completes their shopping process, the details will be sent to your serverand you'll just have to make payment and walk away from the counter. It has therefore the potential to enhance customers' pleasure, ease and efficiency in shopping.

CHAPTER 2

LITERATURE SURVEY

Bipin Kumar Yadav (2020); In retail stores, most of the people spend more time in billing queue than the time he spends choosing the items due to long queue in rush time. The average time that customers of any retail store haveto spend in the billing queues has a direct influence on the quality analysis of services. Thus, it is important to think about different ways to reduce the waiting time in a queue in real time scenario. We propose a cart system that distributes the whole billing queue into smaller individual units so that no one has to wait for the billing process at point of sales (PoS) for specific items. This device uses radio- frequency identification (RFID) technology to scan each product. A passive RFID sticker tag is attached with all the products. The sticker tag contains information including name and price of the product. The device includes a 13.56 MHz RFID reader/writer module that reads RFID stickers attached to the products. In this covid-19 alarmed situation, this distributed cart system also helps people to maintain social distance avoiding long queues.T Sarala; It is wireless techniques along with one more communication technology hashelped in making electronic commerece very popular. In this paper we discuss on innovative concept of “Smart Electronic shopping Trolley used in commercial complex which many individual retail stores”. The main purpose here is to assist a person in shopping to reduce time while purchasing a products. Electonic trolley is fitted out with Barcodereader that scanes the identification of outcome and internet connection with shop's server. It is also consists of LCD exhibits that notify the number of items and total amount to customers and Barcode scanner identifies the outcome and updates the bill.

In this paper, we report the performance or administraion of reliable and more efficiency smart trolley shopping using WSN such a trolley is acceptable for supermarkets, it can helps in reducing manpower and creating better shopping occurence for customers.

Kowshika, Madhumitha S, Madhu Varshini , Megha Lakshmi (2021); Eventhrough e-commence and other online applications are growing rapidly the craze for traditional shopping has never stepped back. One difficulty is to follow up in a queue for the billing process. There, arises a demand for easy and quick payment of bills. The proposed Smart Cart in this paper, is capable of generating bill using IoT along with the mobile cart application. With the use of this mobile application and trolley, customer can make billpayment in no time. The smart cart uses the RFID tag and receiver to scan the product, loadcell to prevent theft, LCD display. Along with this the customer canalso log in with the mobile app which will display the list of all the products mentioned and their amount. Once done, the customer can pay the bill through the mobile application.

Tapan Kumar Das, Kathiravan Srinivasan (2020); Shopping is really fascinating and alluring; at the same time, it involves getting tired due to standing in a long queue for the bill and payment process. Hence, it is proposed to design a smart trolley which can take care of shopping and billing. By this, the customer can walk straightaway into the shop, purchase products using the smart trolley and walk out of the shop. He gets the e-bill through the mail, and he can view his purchase details using the shop's website.

P. Chandrasekar and T. Sangeetha(2020), Contemporary embedded systems are habitually based on microcontroller's i.e. CPUs in the company of integrated memory as well as peripheral interfaces but ordinary microprocessors by means of external chips for memory and peripheral interface circuits are also still common, especially in more complex systems. Radio frequency identification (RFID) technology may not only be useful for streamlining inventory and supply chains: it could also make shoppers swarm. ZigBee is based on an IEEE 802.15 standard. ZigBee devices often transmit data over longer distances by passing data through intermediate devices to reach more distant ones, creating a mesh network; i.e., a network with no centralized control or high-power transmitter/receiver able to reach all of the networked devices. This paper provides centralized and automated billing system using RFID and ZigBee communication. Each product of shopping mall, super markets will be provided with a RFID tag, to identify its type. Each shopping cart is designed or implemented with a Product Identification Device (PID) that contains microcontroller, LCD, an RFID reader, EEPROM, and ZigBee module. Purchasing product information will be read through a RFID reader on shopping cart, mean while product information will be stored into EEPROM attached to it and EEPROM data will be send to Central Billing System through ZigBee module. The central billing system gets the cart information and EEPROM data, it access the product database and calculates the total amount of purchasing for that particular cart. Main aim of this paper was to provide an automatic billing to avoid queue in malls and super markets and many of the shopping resource platforms.

CHAPTER 3

3.1. PROBLEM DEFINITION:

1. Shopping is simple but waiting on a bill counter makes shopping too boring anda tedious task.

2. Huge amount of rush plus cashier preparing the bill is too time consuming and results in long que. In this prevailing pandemic standing in queues for billing in mallsor shopping market is not advisable as virus may spread.

3. The present billing system is time consuming process which irritates people bydisturbing their busy schedules.

3.2. SYSTEM DETAILS:

Smart Cart using NodeMCU and RFID is an efficient system when it comesto scanning of products, bill generation and payment. It uses an NodeMCU, a RFID reader, an LCD, buzzers, etc. and also RFID tags to be attached onthe products. The RFID reader shall be used to scan the RFID tags present on the product and all the information received from the tags shall be stored in the NodeMCU. The product can be directly scanned bythe reader and if the customer wishes to remove any product, they just have to again scanthe product, then the product should be deleted .

Also there is weight machine to calculate the product weight if RFID reader fails to calculate weight. After the purchasing product total amount of bill generated and display on LCD of the trolley and also at the billing section. When customer goes to billing section he has to only pay the amount. LCDscreen will show the total bill of theitems present in the cart. System doesnot have a user interface and NodeMCU is usedinstead of WiFi module. The smart shopping with the trolley application state about creating an automated and centralized billing system that can be used in malls and supermarkets. The customers need not wait in the queue at the billing counters for their bill payment because total amount is generated on theLCD, Customer just have to go at billing counter and pay the payment.

3.3. EXISTING SYSTEM:

In general, the existing systems have the following features

1. No more queue for billing hence real customer satisfaction.
2. Bill calculation at trolley itself.
3. Low chance of traffic and mismanagement.
4. Reduction in support staff.
5. Cost efficient.
6. Weight machine to calculate the product weight of products and items.

The stated problems can be met with a number of current and new solutions.The currently available solution in shopping malls is the Barcode method inwhich there are barcode labels on every product which is browsed through barcode readers.

A decoder chip is included in all readers which analyses the picture data from the sensor and sends that barcode content to the scanner's output port.When we choose any product for purchasing, we place it within the trolley and take it to the cashier.

The cashier uses a barcode scanner to scan the product, and then offers it as payment.However, this is a slow process and a lot of products need to be scanned, so the billing process is slow and this results in long lines.

Although there have been improvements in this area, the development and of these applications is still a critical challenge and an expensive one. This is why, in most shops and shopping centres, the barcodescanning method is used.

CHAPTER 4

4.1.PROPOSED SYSTEM AND OBJECTIVES:

Proposed system:

1. An automated smart shopping system is formed by introducing the concept of IoT to connect all items in the grocery shop. In this system, an inexpensive RF-ID tag is embedded within each product.
2. When the product is placed into a smart cart, the product detail such as price and weight are automatically read by the cart equipped with an RF-IDreader.
3. And the details are shown on lcd as well as the webserver.Hence, billing is made From the shopping cart itself preventing customers from waiting in a long queue at checkout.
4. Design of a web portal using sql,html and php for creating a user friendlyinterface for paying bills.
5. Use of NodeMCU so as to simplify communication as it has inbuilt WiFimodule.
6. Display of product details on LCD.
7. Automatic scanning of product in the trolley using RFID.

Objectives:

The objectives are detailed as follows,

- To find an efficient way to implement this cart feesable.To scan
- and update the price of item in webserver.
- To have a detailed bill description.

4.2. BLOCK DIAGRAM AND CICUIT DIAGRAM

BLOCK DIAGRAM:

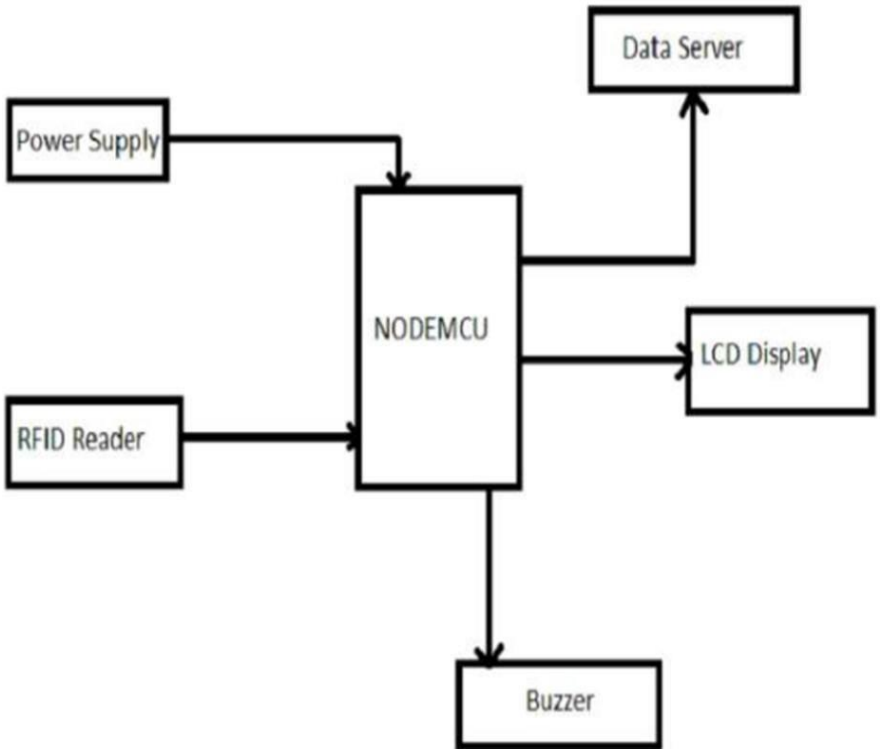

FIG.4.1 BLOCK DIAGRAM

The Fig 4.1 describes This shopping cart uses RFID tags on items to automatically track your purchases. An LCD screen shows the running total, and you can breeze through checkout without waiting in line.

CIRCUIT DIAGRAM:

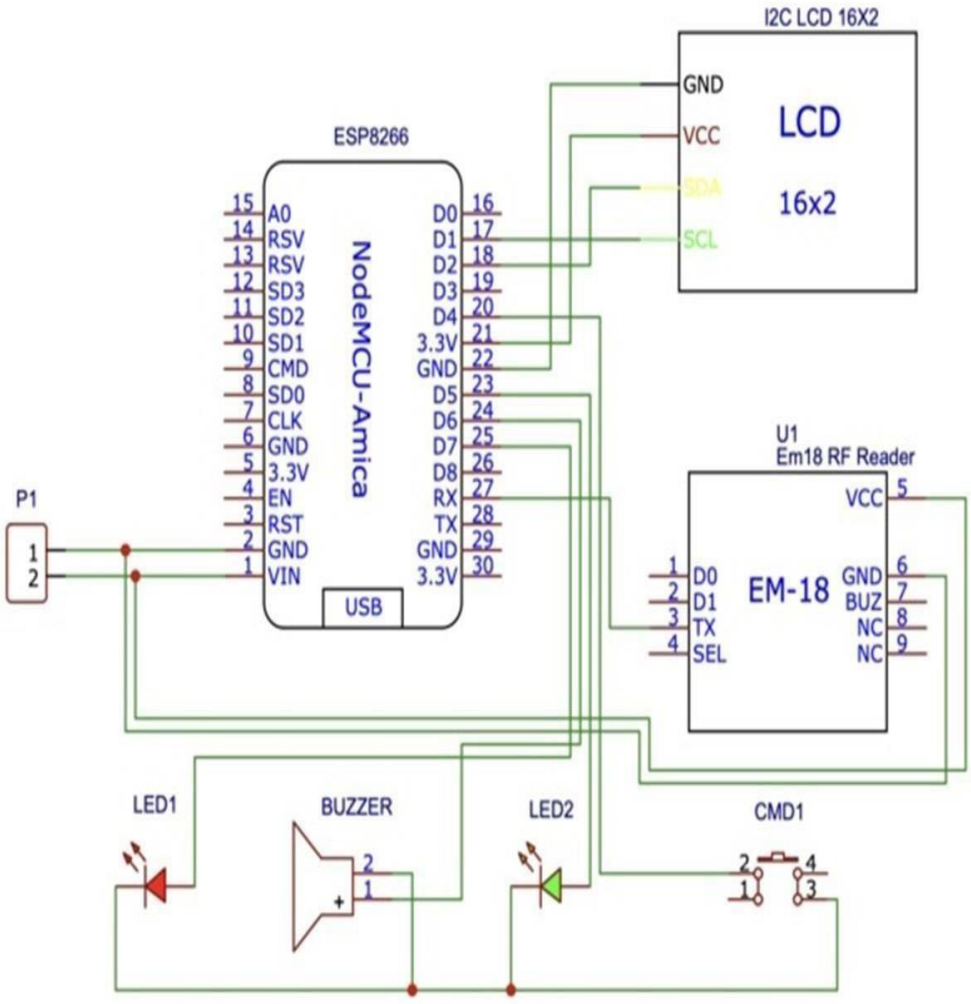

FIG.4.2 CIRCUIT DIAGRAM

The image Fig 4.2 shows a circuit diagram for a NodeMCU-based smart shopping cart system. The system uses RFID tags to identify items and an LCD to display the total price. A buzzer provides audio cues.

4.2. HARDWARE REQUIRED:

- NodeMCU
- LCD Display
- Buzzer
- LED (Red, Green)
- RFID Reader
- RFID tag
- Push Button

SOFTWARE REQUIRED:

- Arduino IDE
- HTML

4.3. FLOWCHART:

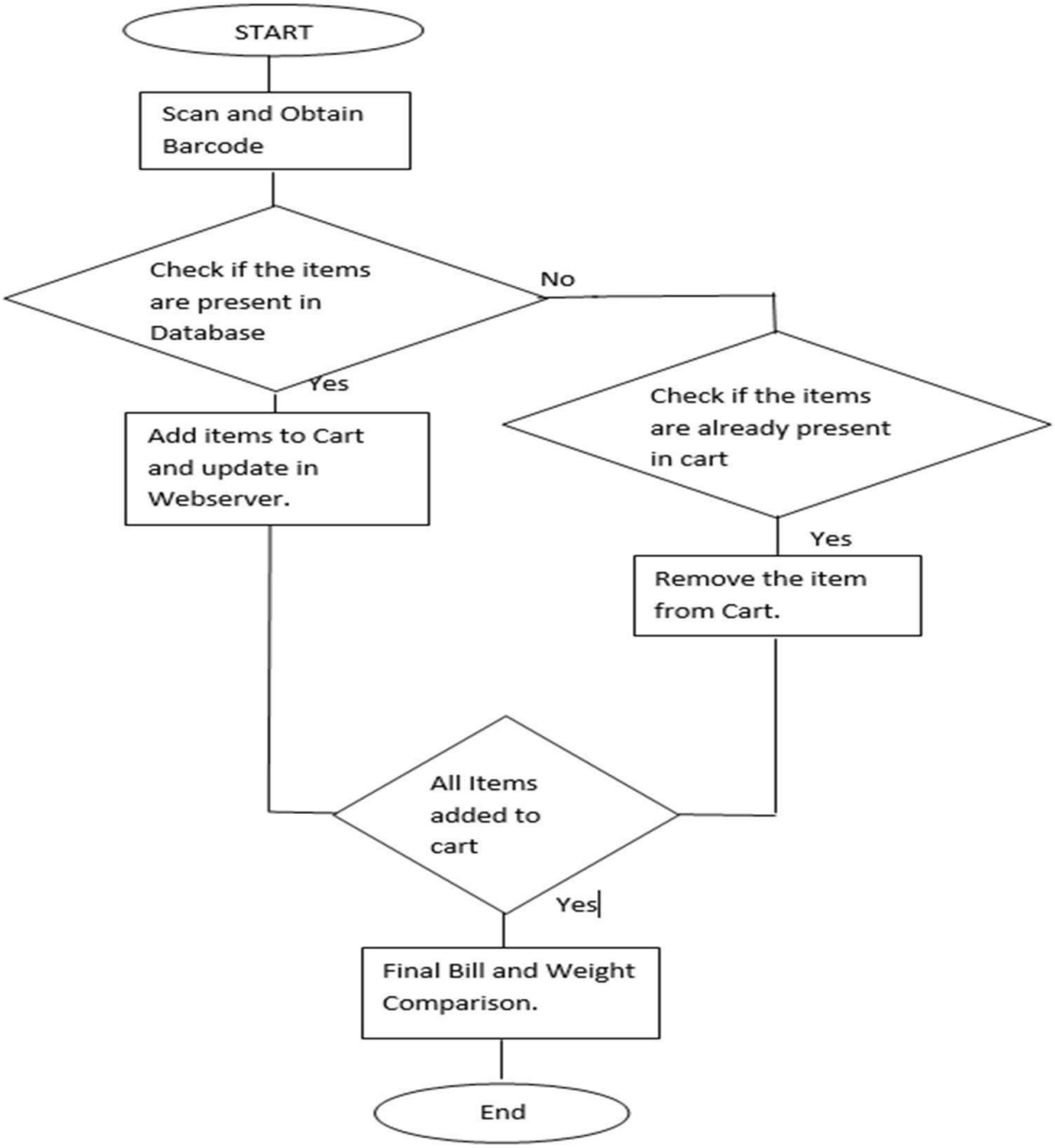

FIG 4.3 FLOWCHART OF THE SYSTEM

The diagram Fig 4.3 depicts a smart shopping cart system built with an NodeMCU microcontroller. It utilizes RFID tags on products to track them as they're added to the cart. An LCD display shows the running total, and a buzzer might signal actions like adding an item.

HARDWARE DESCRIPTION

4.4. RFID Reader:

RFID reader extracts information from tags attached to an item through radio waves, which is then converted into a Digital form. The reader is a transmitter that asks the information about tags and labels, as the receiver passes relevant data to the reader.The RFID Reader can work under various frequencies firstly low frequency range(125kHz-134kHz) with distance of 10cm-30cm,secondly high frequency range(13.56MHz) with distance of 1m,thirdly ultra high frequency(865-928MHz) up to 1.5m-2m . Every RFID system consists of three components: a scanning antenna, a transceiver and a transponder. When the scanning antenna and transceiver are combined, they are referred to as an RFID reader or interrogator. Thereare two types of RFID readers -- fixed readers and mobile readers. The RFID reader is a network-connected device that can be portable or permanently attached. It uses radio waves to transmit signals that activate the tag. Once activated, the tag sends a wave back to the antenna, where it is translated into data.

The transponder is in the RFID tag itself. The read range for RFID tags varies based on factors including the type of tag, type of reader, RFID frequency and interference in the surrounding environment or from other RFID tags and readers. Tags that have a stronger power source also have a longer read range.

FIG.4.4 RFID READER

4.5. RFID Tags:

RFID tags are made up of an integrated circuit (IC), an antenna and a substrate. The part of an RFID tag that encodes identifying information is called the RFID inlay.

There are two main types of RFID tags:

Active RFID. An active RFID tag has its own power source, often a battery.Passive RFID. A passive RFID tag receives its power from the reading antenna, whose electromagnetic wave induces a current in the RFID tag's antenna.There are also semi-passive RFID tags, meaning a battery runs the circuitry while communication is powered by the RFID reader.Low-power,embedded non-volatile memory plays an important role in every RFID system. RFID tags typically hold less than 2,000 KB of data, including a unique identifier/serial number.

The read range for RFID tags varies based on factors including type of tag,type of reader, RFID frequency, and interference in the surrounding environment or from other RFID tags and readers. Active RFID tags have alonger read range than passive RFID tags due to the stronger power source.smart labels are simple RFID tags. These labels have an RFID tag embedded into an adhesive label and feature a barcode. They can also be used by both RFID and barcode readers. Smart labels can be printed on- demand using desktop printers, where RFID tags require more advanced equipment.

FIG.4.5 RFID TAGS

4.6. Server:

Through GSM media, the information stored in the microcontroller istransmitted to the server. The server keeps track of the items stored in the database and the bill paid by customer.

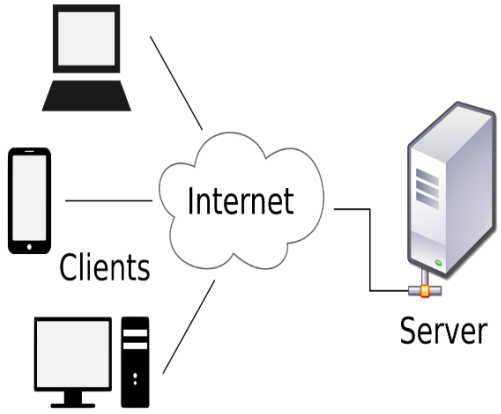

FIG.4.6 BLOCK DIAGRAM OF SERVER

4.7. Liquid Crystal Display:

The output of microcontroller is given to LCD. In one line, it's capable of displaying sixteen characters. It's using a 16*2 display. The customers get the data of item as the items are dropped in trolley by displaying Item name, item quantity, item amount with spacing. When items are dropped they get added otherwise gets subtracted. The information of purchased products will be seen on LCD with clarity .

FIG.4.7.LCD DISPLAY

4.8. NODEMCU:

NodeMCU is an open source IoT platform. It includes firmwarewhich runs on the ESP8266 Wi-Fi SoC from Espressif Systems, andhardware which is based on the ESP-12 module. The term "NodeMCU"by default refers to the firmware rather than the development kits. Thefirmware uses the Lua scripting language. It is based on the eLua project,and built on the Espressif Non-OS SDK for ESP8266.

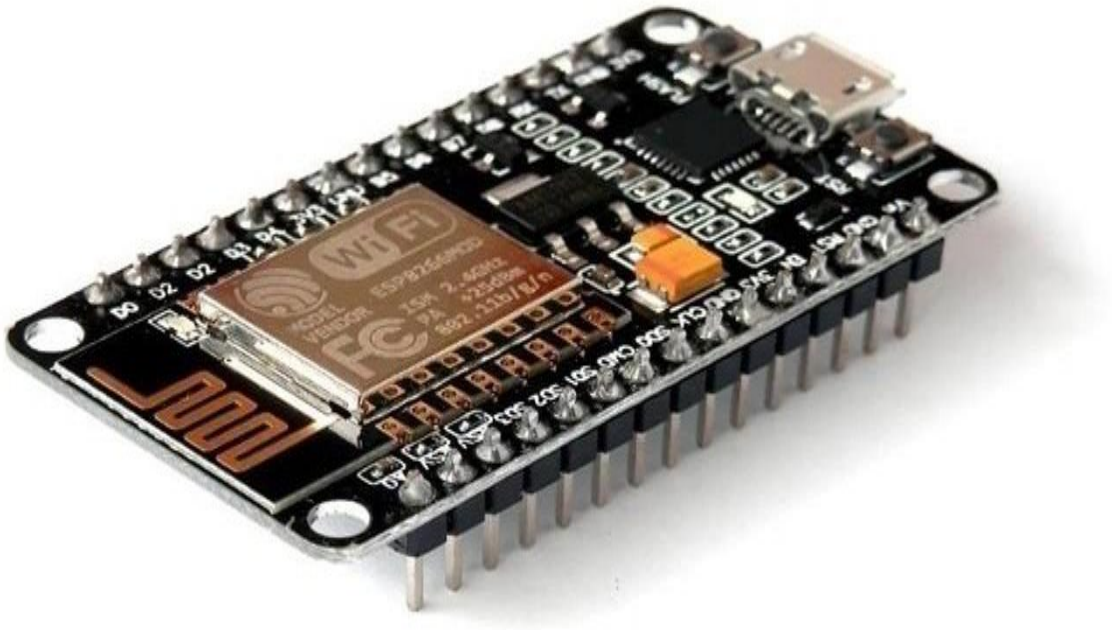

FIG.4.8.NODEMCU

NodeMCU was created shortly after the ESP8266 came out. On December 30, 2013, Espressif Systems began production of the ESP8266. The ESP8266 is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT applications (see related projects). NodeMCU started on 13Oct 2014, when Hong committed thefirst file of nodemcu-firmware to GitHub. Two months later, the projectexpanded to include an open-hardware platform when developer HuangR committed the gerber file of an ESP8266 board, named devkitv0.9.Later that month, Tuan PM ported MQTT client library from Contiki to the ESP8266 SoC platform, and committed to NodeMCU project, then NodeMCU was able to support theMQTT IoT protocol, using Lua to access the MQTT broker. Another important update was made on 30 Jan 2015, when Devsaurus ported the u8glib to NodeMCUproject, enabling NodeMCU to easily drive LCD, Screen, OLED, even VGA displays.

In summer 2015 the creators abandoned the firmware project and a group of independent contributors took over. By summer 2016 the NodeMCU included more than 40 different modules. Due to resource constraints users need to select the modules relevant for their project and build a firmware tailored to their needs.

ESP8266 Arduino Core

As Arduino.cc began developing new MCU boards based on non-AVR processors like the ARM/SAM MCU and used in theArduino Due, they needed to modify the Arduino IDE so that it would be relatively easy tochange the IDE to support alternate toolchains to allow Arduino C/C++ to be compiled for these newprocessors.

They did this with the introduction of the Board Manager and the SAM Core. A "core" is the collection of software. Components required by the Board Manager and the Arduino IDE to compile an Arduino C/C++ source file for the target MCU's machine language. Some ESP8266 enthusiasts developed an Arduino core for the ESP8266 WiFi SoC, popularly called the "ESP8266 Core for the Arduino IDE".[16] This hasbecome a leading software development platform for the various ESP8266- based modules and development boards, including NodeMCUs.

4.9. RFID technology:

RFID or Radio Frequency Identification system consists of two main components, a transponder/tag attached to an object to beidentified, anda Transceiver also known as interrogator/Reader.

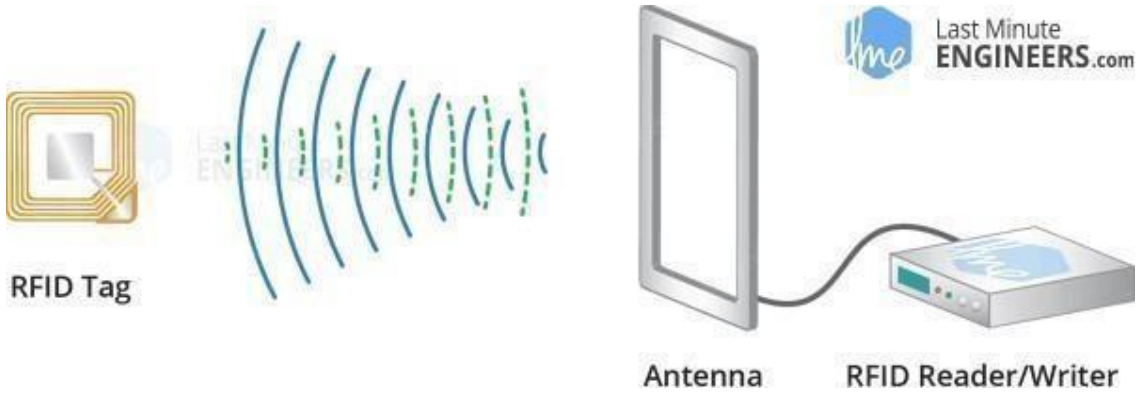

FIG.4.9 BLOCK DIAGRAM OF RFID

A Reader consists of a Radio Frequency module and anantenna which generates high frequency electromagnetic field. On the other hand, the tag is usually a passive device, meaning it doesn't contain a battery. Instead it contains a microchip that stores and processes information, and an antenna to receive andtransmit a signal.

The operation of the RFID tag is described below:

Handshaking with the Reader (interrogator):

i. The reader continuously emits RF carrier signals, and keeps observing the received RF signals for data.

ii. The presence of a tag (for our discussion, we consider only passive tag) modulates the rf field, and the same is detected by the reader.

iii. The passive tag absorbs a small portion of the energy emitted by the reader, and starts sending modulated information when sufficient energy is acquired from the rf field generated by the reader. Note that the data modulation (modulation for 0s and 1s) is accomplished by either direct modulation or FSK or Phase modulation.

iv. The reader demodulates the signals received from the tag antenna, and decodes the same for further processing.

4.10. PROPOSED ALGORITHM:

Step1: Start.

Step 2: In the trolley, insert the product attached to an RFID tag.

Step 3: The information about the tag is read by an RFID reader.

Step 4: The Arduino, using a wireless module, sends this information to theserver.

Step 5: This information is stored on the server in database.

Step 6: The total amount is calculated for the server.

Step 7: The server shows the final amount.

Step 8: Payment of the bill.

Step 9: The database is up to the date.

Step 10: stop.

CHAPTER 5

RESULT AND DISCUSSION:

All the above experiments, in which a proposed system LCD is used to display product cost and weight information, have been discussed. The proposed model is easy to use, does not require any special training and canbe used with ease. There is a reduction of personnel and this will save timethat users spend in the billing queue. It is useful for retailers and customersto have a large number of users available at the same time. This smart billingsystem guarantees the efficiency of time and costs. Smart trolley aims to simplify the billing process by facilitating the creation of a shopping sessionthat lasts until the customer orders it to be cleared and the data of each product to be preserved basket by using RFID tags to make the entry. It will also make it easier for the customer to see the overall cost when buying,thereby keeping the shopping experience under budget.Emerging trend ofonline shopping, which cuts down the hassle, at the same time that shopping at stores introduction of environment friendly smart carts and smart baskets not only help the stores to eliminate the surge but also serve to reduce the usage of paper, the number of employees making it more economical and unnecessarily wasted in printing copies of bills . Therefore, it is of major importance to society or interests and welfare that RFID based smart carts are used. By providing the entire shopping data forandroid phones, the ESP attached to that system will make it much more compatible.

In Liquid Crystal display, the results of shopping done by consumers are displayed as cost, weight, product name and in some cases a display will lead you to expired products where customers need to be careful. As the RFID Reader Scans the items from RFID tag the Item name along withcost and weight are displayed this process continues as when items are added and amount of items is cumulative in process.

Whenever the customer using this cart is adding a productinto the shopping cart the product that is attached with RFID tagis scanned andthe details required are fetched. These details are then fed into the microcontroller and based on the code the microcontroller then produces a bill with required fields in it. Thisbill gets updated within notime the product gets added to it. Thebill is then displayed on lcd screenand also on the webserver which makes customer more comfortable in viewing the detailedbill of products added and then cross check for theproducts to be added. The products can also be removed from cart, when the customer wants to remove a product he can use the push button and scan it so the product is removed from the bill.

FIG.5.1.RESULT OF SERVER

The image Fig 5.1 shows a smart shopping cart with a display. The cart contains groceries, including biscuits, soup, rice, and tea. A display shows the price and weight of these items.

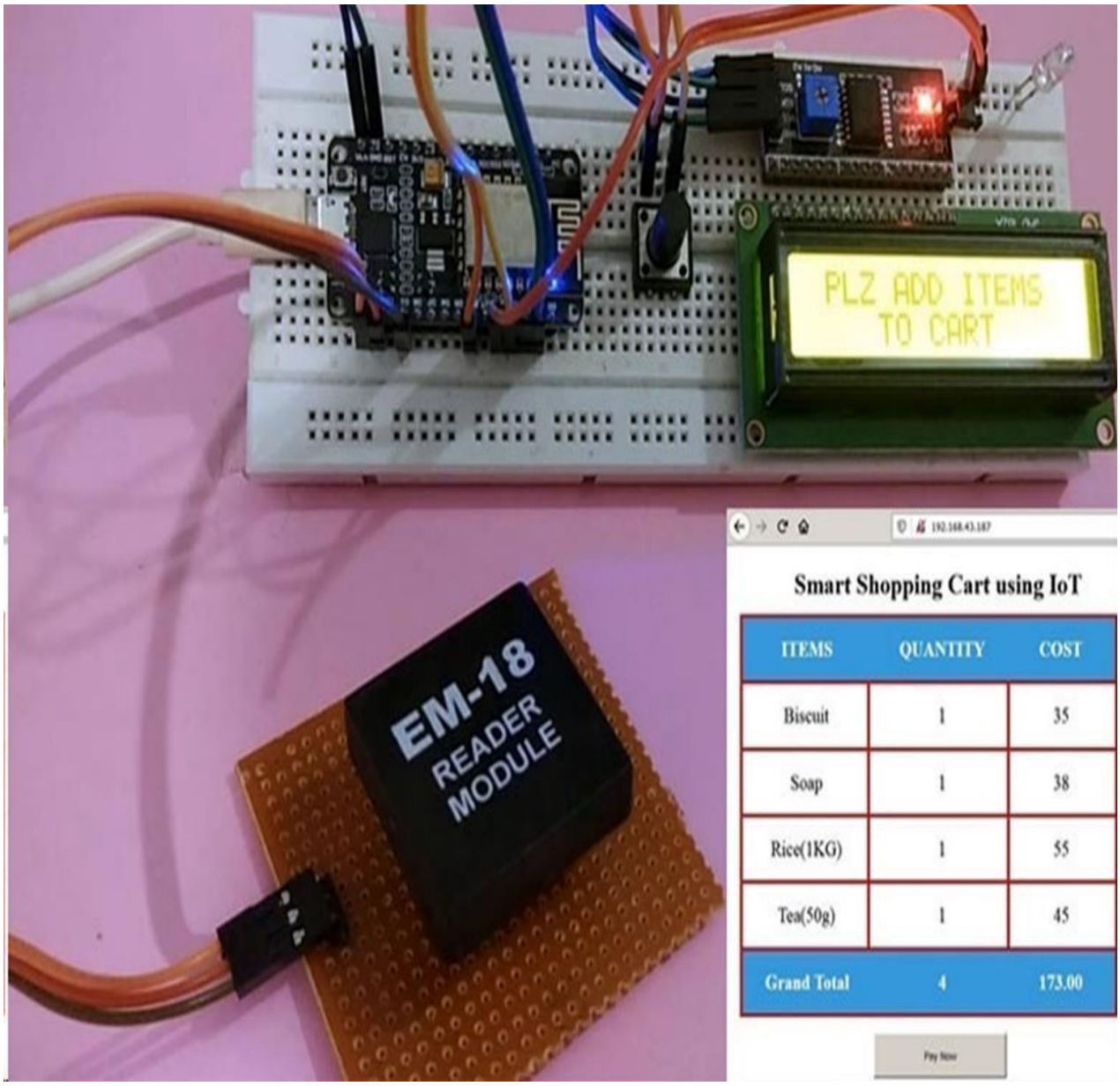

FIG.5.2.RESULT

The image Fig 5.2 shows a prototype of a smart shopping cart system built with electronics. An LCD screen displays a list of scanned items and their prices. An RFID reader module is connected to the breadboard, which likely controls the system.

ADVANTAGES:

1. Reduces time spent at billing counter and increases customer satisfaction.
2. This can reduce the expenses incurred by the management.
3. Users can be aware of the total bill amount during the time of purchasewhich prevent them from over shopping.
4. Increases overall efficiency.
5. Allows quick checkout and eliminates waiting in long queues.

FUTURE SCOPE:

1. Transfer the bill to mobile without printing we can use the GSM module.
2. The trolley itself contain an swapping machine for online transaction ofpayment.
3. Robotics arm also include in it for the picking and dropping of theproduct.
4. We can also include voice assist

CHAPTER 6

CONCLUSION:

This leads us to conclude that in the future, automated product labelling willbe a more viable option through radio frequency identification.

The system based on RFID technique is efficient, compact and has promising performance. Also, RFID is better and faster than barcode reading because the later works on line of sight which is not the case for RFID technique.

That will give a whole new dimension to the shopping experience. Displaysdifferent parameters, e.g. name of the product, item cost, body weight etc. which can be measured by Smart Trolley's System Parameters.

CHAPTER 7

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