

STOCK MANAGEMENT USING IOT

**Submitted in partial fulfillment of the requirements for the award of Bachelor
of Engineering Degree in Electronics and Communication Engineering**

By

SANTHOSH ANTONY RAJAN S (Reg.No: 37130358)

RITVIK JAIN (Reg.No: 37130348)



SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade “A” by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI

CHENNAI – 600119

APRIL - 2021



**DEPARTMENT OF ELECTRONICS AND COMMUNICATION
ENGINEERING**

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **SANTHOSH ANTONY RAJAN S (37130358), RITVIK JAIN (37130348)** who carried out the Project entitled "STOCK MANAGEMENT USING IOT". Under the guidance of **Mrs. R. Sakthi Prabha., M.E., (Ph.D)** during the period NOV 2020 to APR 2021.

INTERNAL GUIDE

Mrs.R.Sakthi Prabha, M.E.,(Ph.D)

HEAD OF THE DEPARTMENT

DR.T.RAVI ,M.E.,Ph.D

Submitted for Viva voce Examination held on _____

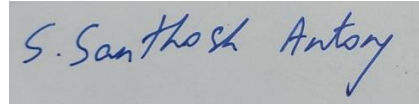
Internal Examiner

External Examiner

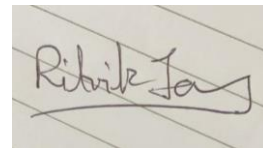
DECLARATION

WE, SANTHOSH ANTONY RAJAN S (37130358), RITVIK JAIN (37130348), Here by declare that the Project report entitled STOCK MANAGEMENT USING IOT is done under the guidance of Mrs.R.Sakthi Prabha, M.E.,(Ph.D.) is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in ELECTRONICS AND COMMUNICATION ENGINEERING.

1.



2.



DATE: 17.4.21

PLACE: Chennai

SIGNATURE OF CANDIDATES.

ACKNOWLEDGEMENT

We pleased to acknowledge my sincere thanks to board Management of **SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY** for their kind encouragement in doing this internship and for completing it successfully. I am grateful to them.

We convey our thanks to **Dr.N.M.NANDHITHA M.E., Ph.D.**, Dean, school of Electrical and Electronics engineering and **Dr.T.RAVI M.E., Ph.D.**, Head of the Department, Electronics and Communication engineering for providing us necessary support and details at the right time during the progressive reviews.

We would like to express our sincere and deep sense of gratitude to our Project Guide **Mrs. R. Sakthi Prabha, M.E.(Ph.D.)**, for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of our Project.

We would like to express our sincere and deep sense of gratitude to our Panel Members **Dr.Rekha Chakravarthi** and **Dr.U.Anitha** for providing us necessary support and details at the right time during the progressive reviews.

We wish to express our thanks to all Teaching and Non-teaching staff members of the Department of Electronics and Communication Engineering who were helpful in many ways for the completion of the project.

ABSTRACT

Stock management is the practice of ordering, storing, tracking, and controlling inventory. Inventory control process is also important for maintaining the right balance of goods in your warehouses and the number of goods sold. You don't want to lose a sale because you didn't have enough inventory to fill an order. It is too hard to maintain the record about the daily intake of the raw material and view the whole details. The improvement in the production cannot be monitored easily when it is done manually. When the products are sold, they must be restored at a rate that finds a healthy balance between the extremes of overstocks and stock outs. If the inventory process is handled manually, then there is a lot of problems faced in keeping track of the inventory with different units of measures and suppliers in various countries. A record about the production when once created is too hard to delete. This stock management and control system can be used to store the details of the products available and sold. We can also update the sold products details; this system can be also used to generate bills and generate sales. This stock management system has only one module Admin. Here admin has authority to add new products, delete the unwanted or expired products and update the existing products list. The stock management system also contains the record of discounts on various products so that the product is offered at discounted price while billing.

CONTENTS

CHAPTER NO.	TITLE	PAGE NO.
	ABSTRACT	iv
	LIST OF FIGURES	viii
	LIST OF TABLES	ix
1	INTRODUCTION	1
	1.1 Stock Management System	1
	1.2 Need for Stock Management System	1
	1.3 History of Stock Management System	2
	1.3.1 Fundamental Analysis of Stock Management System	2
	1.3.2 Technical Analysis of Stock Management System	2
	1.4 Different methods for stock control management	2
	1.4.1 Stock reviews	2
	1.4.2 Fixed-time/fixed-level reordering	2
	1.4.3 Just in time	3
	1.4.4 Economic Order Quantity	3
	1.4.5 First in, first out	3
	1.4.6 Batch control	3
	1.4.7 Vendor-managed inventory	3
	1.3 Benefits of Stock Management System	4
	1.3.1 Tracking Inventory	4
	1.3.2 Control Your Costs	4
	1.3.3 Improve Your Delivery	4
	1.3.4 Manage Planning & Forecasting	4
	1.3.5 Reduce the Time for Managing Inventory	4
	1.3.6 Application of the model	5
2	LITERATURE SURVEY	6
3	AIM AND SCOPE OF PRESENT INVESTIGATION	12
	3.1 EXISTING SYSTEM	12
	3.2 PROPOSED SYSTEM	12

3.3	BLOCK DIAGRAM	13
4	Experimental Methods Used	14
4.1	HARDWARE USED	14
4.2	SOFTWARE USED	14
4.3	EMBEDDED SYSTEMS	14
4.3.1	Overview of embedded systems	14
4.3.2	Block diagram of an embedded system	15
4.3.3	Characteristics of embedded systems	15
4.3.3.1	Application Specific Systems	16
4.3.3.2	Reactive Systems	16
4.3.4	Power Supply	16
4.3.5	Transformer	17
4.3.6	Rectifier	17
4.3.7	Filters	17
4.3.8	Regulators	17
4.3.8.1	Features And Description Of Regulators	17
4.4	NODEMCU ESP8266	18
4.4.1	NODEMCU ESP8266 Pinout	20
4.4.2	NODEMCU ESP8266 Specifications & Features	20
4.4.3	Brief About NODEMCU ESP8266	20
4.4.4	Programming NODEMCU ESP8266 with Arduino IDE	21
4.4.5	UPLOADING YOUR FIRST PROGRAM	21
4.4.6	APPLICATIONS OF NODEMCU	22
4.5	IR (Infrared) Sensor	22
4.5.1	IR Sensor Circuit Diagram and Working Principle	22
4.5.2	IR Sensor circuit	23
4.5.3	Applications on Types of IR Sensors	24
4.5.3.1	Radiation Thermometers	24
4.5.3.2	Flame Monitors	24
4.5.3.3	Moisture Analyzers	24
4.5.3.4	IR Imaging Devices	24
4.6	AURDUINO UNO AND ITS PROGRAMMING	25
4.6.1	OVERVIEW	26

	4.6.2	AURDUINO IDE SOFTWARE	27
	4.6.3	WRITING SKETCHES	27
	4.6.4	SKETCHBOOK	29
	4.6.5	TABS, MULTIPLE FILES, AND COMPILATION	29
	4.6.6	UPLOADING	29
	4.6.12	LIBRARIES	30
	4.6.13	THIRD-PARTY HARDWARE	30
	4.6.14	SERIAL MONITOR	31
	4.6.16	LANGUAGE SUPPORT	31
	4.7	UBIDOTS EXPLORER	31
	4.7.1	WORKING	32
	4.7.2	VALUES	33
	4.7.3	TIMESTAMPS	33
	4.7.4	CONTEXT	33
5		SIMULATION RESULTS	35
	5.1	Comparison of Existing and Proposed System	39
	5.2	OUTPUT	40
6		CONCLUSION	43
		REFERENCES	44

List of Figures

FIG.NO	TITLE	PAGE NO
3.1	Block Diagram of proposed System	13
4.1	Block diagram of a typical embedded system	15
4.2	General Block of Power Supply Unit	16
4.3	NODEMCU ESP8266	18
4.4	NODEMCU ESP8266 PIN EXPLAINATION	19
4.5	BRIEF ABOUT NODEMCU ESP8266	21
4.6	IR Sensor Circuit diagram	23
4.7	IR Imaging Devices	25
4.8	ARDUINO IDE	26
4.9	WORKING OF UBIDOTS	32
4.10	TIME SERIES OF UNIDOTS	34
5.1	HARDWARE SETUP MODEL	35
5.2	Adding of Products in rack	36
5.3	Removing of Products in rack	36
5.4	RFID Tag	37
5.5	Accessing the Customer Using Tag	37
5.6	Billing and Total amount	38
5.7	Display of available quantity in shop on cloud	38
5.8	Comparison of Existing and Proposed System	39
5.9	Accessing of Customers	40
5.10	Total Bill Amount of products	40
5.11	Total Quantity of products available	41
5.12	Adding Stocks in rack	41
5.13	Removing Stocks in rack	42

LIST OF TABLES

TABLE NO	TITLE	PAGE NO
4.1	PIN CONFIGURATION	18
4.2	UBIDOTS DATA HEIRARCHY	32

CHAPTER 1

INTRODUCTION

1.1 Stock Management System

Stock Management System is about maintaining the good number of stocks of product in super market or Warehouse. We can identify the products which are going to over soon. By this, we can prevent losses in shop and loss of customers. It is important to maintain good stocks in super market to prevent losses. By this system we can keep the product in stock, incoming and selling of products and tracking the expiry of product in earlier.

1.2 Need for Stock Management System

The task of stock Management has always been a challenging problem for statistics experts and finance. The main explanation for this prediction is that it involves purchasing stocks that are likely to rise in price and selling stocks that are likely to fall in price. Today is significant for an association to comprehend its stock to accomplish both proficient and quick activities, that as well, at a reasonable expense. A compelling administration of stock aides in diminishing costs which further holds records and funds under wraps. From a client's perspective, it assists you with giving better client administrations through quick conveyance and low delivery charges, thus, meeting client assumptions. Almost 81% of buyers encountered an "unavailable" circumstance in the previous a year, bringing about lost deals for retailers and heaps of frustration for in-store customers. Around the world, retailers recorded misfortunes of an astounding \$1.75 trillion because of fumbled stock. On the off chance that you are as yet dealing with your stock on a bookkeeping page or more awful, not overseeing by any means, at that point your business may be enduring and the opportunity has already come and gone that you smooth out your Stock Administration measures. Overseeing stock can be extremely difficult, and when you are a developing business it tends to be truly excruciating. On the off chance that you are confronting issues in following your stock and on the off chance that it is getting hard for you to advance your distribution centers and storage spaces then you have gone to the perfect spot. Today is essential for an association to comprehend its stock to accomplish both effective and quick activities, that as well, at a reasonable expense. A viable

administration of stock aides in decreasing costs which further holds records and funds within proper limits. From a client's perspective, it assists you with giving better client administrations through quick conveyance and low transportation charges, henceforth, meeting client assumptions.

1.3 History of Stock Management System

1.3.1 Fundamental Analysis of Stock Management System

Generally, there are two ways for stock market prediction. Fundamental analysis is one of them and relies on a company's technique and fundamental information like market position, expenses and annual growth rates.

1.3.2 Technical Analysis of Stock Management System

The second one is the technical analysis method, which concentrates on previous stock prices and values. This analysis uses historical charts and patterns to predict future prices. Business analysts used to be able to forecast stock price movements. With the advancement of learning methods, data scientists have begun to solve prediction problems. In addition, computer scientists have begun to employ machine learning techniques to improve the efficiency of prediction models and improve prediction accuracy.

1.4 Different methods for stock control management

1.4.1 Stock reviews

The business will take standard stock surveys to build up whether new stock should be requested. This considers pre-decided figures that help business pioneers specially make the choice new stock or hold off. Numerous organizations work a base stock level – the absolute bottom stock can go before more is requested.

1.4.2 Fixed-time/fixed-level reordering

This includes requesting new stock either at fixed occasions, fixed levels or both. For instance, an organization may have a standing request for 500 units each third Sunday of the month. This sort of stock control is especially helpful for organizations with fixed agreements and stable interest, with inconsistent unpredictable orders except if they're put with a drawn out conveyance date.

1.4.3 Just in time

This stock control framework started in Japan. As the name proposes, stock is requested as and when it is needed to minimize expenses and liquidity high. In any case, the expanded capital includes some significant pitfalls. The organization should be uncommonly coordinated to guarantee orders are made at the correct time, and providers should be dependable to satisfy prerequisites. There is likewise a danger of running unavailable should a major request be set.

1.4.4 Economic Order Quantity

EOQ is a complex numerical equation that means to keep stock at an ideal level, contingent upon the sort of firm and the business it works inside. EOQ computations can be tedious, so you may think that its simpler to counsel an expert or put resources into stock administration programming which ought to have the option to make out-of-the-case EOQ mini-computers. EOQ can be joined with different types of stock administration where required.

1.4.5 First in, first out

This framework is well known with organizations that work with short-lived stock. It intends to guarantee that stock doesn't fall apart before use. Stock is recognized by when it was gotten and moves onto the following phase of creation before stock got sometime in the future.

1.4.6 Batch control

Clump control isolates stock administration and creation into bunches. This diminishes intricacy in the creation interaction and helps ensure transient targets are met. Cluster control can likewise help minimize expenses as firms just need the crude materials and segments expected to fulfill the requests of an individual clump.

1.4.7 Vendor-managed inventory

Vendor-managed inventory (VMI) is a moderately new model of stock administration that stresses divided danger among the purchaser and provider. The purchaser gives data to the provider about their stock prerequisites; the provider is then liable for keeping a degree of stock at a predetermined area, typically the

purchaser's retail location. VMI lessens the opportunity of under-loading and diminishes the time stock spends in the inventory network.

1.3 Benefits of Stock Management System

1.3.1 Tracking Inventory

A decent framework will help you monitor your stock and offer an incorporated perspective on stock across deals channels – what amount is available, and where. It will likewise permit dispensing stock to explicit deals channels, which is significant in the event that you have stockrooms and dispersion focuses at different areas, consequently, empowering distribution center administration.

1.3.2 Control Your Costs

Keeping reports about your stock assists you with understanding what stocks are progressing nicely, versus which are simply occupying rack room. Absence of the perfect stock at the perfect time can mean delay purchases, abundance stock, and so forth. These drive up costs.

1.3.3 Improve Your Delivery

Late conveyance because of stock-outs will undoubtedly give you an awful standing. For following, it is significant for you to know when the merchant is delivering stock and when it will show up. This assists you with overseeing client assumptions by conveyance as, when and where they need.

1.3.4 Manage Planning & Forecasting

The product can assist you with improving interest determining by breaking down information patterns from well-performing stocks. This limits your holding and taking care of expenses, improves incomes and opens up incomes. Additionally, by arranging and gauging – you follow through on client assumptions better.

1.3.5 Reduce the Time for Managing Inventory

With a decent stock administration arrangement, you can lessen the time taken to monitor every one of the items you have available and on hand. Also, you save the time taken up in stock describes if your records are set up.

1.4 Application of the model

This paper is about maintaining the good number of stocks of product in super market or Warehouse. By this paper we can identify the products which are going to expire soon. The admin or who is having the access of the system will get alert notification when the product is going to expire or going to get over soon. The main Objectives of this project is to keep the product in stock, incoming and selling of products and tracking the expiry of product in earlier.

CHAPTER 2

LITERATURE SURVEY

Souvik Paul, Atrayee Chatterjee; Digbijay Guha proposed their system with RFID and IOT. RFID tags are used filling the information about the product. By using RFID reader, scanned to get the information stored in the RFID tag. In creating endeavors and the consistent requests of the item variety, conventional Stock Administration model can't accomplish that, because of its hefty responsibility and low productivity. This paper presents another kind of clever Stock Administration Framework dependent on the IoT and clarifies the standards and design of it. This framework has incredible benefits contrasted with the conventional mode, and we anticipate great possibilities for its turn of events. Stock Administration is a critical region for client care and cost improvement in any assembling arrangement. As organizations turn worldwide and have a huge number of parts and many stockrooms the stock turns into a bad dream and a great deal of time is spend in following stock and guaranteeing right shipments. Customary frameworks of automated arms for stock pick and drop have been founded on premises of checking spaces of the stockroom and following it. The RFID Antenna catches the wave from the reader to supply energy to tag for operation. The reader uses radio waves, for the operation to get the information from tags. The role of IOT here is to turn the data fetched by RFID reader into corresponding output.[1].

B. Sai Subrahmanya Tejesh , S.Neeraja proposed their system with Open-source framework and IOT. The stockroom stock administration framework is playing a critical perspective in numerous creations and products based procedure. Despite the fact that there are numerous remote correspondence innovations the RFID suits the best for the distribution center stock

administration framework. The label data is moved from the transmitter segment to open source equipment by means of a remote connection with the guide of web. The distribution center stock administration framework based on the design of the Web of Things is created to follow the items joined to the labels with item data and their individual time stamps for additional check. Web page is built for managing the number of stock. RFID tag is used for filling the information about the product. Raspberry Pi is used for receiving the information from system and upload in the web page. When we use Web page for maintain the number. If any server down happens, it will be problem for maintaining and referring the number. [2].

Walaa Hamdy, Noha Mostafa, and Hesham Elawady proposed Smart Warehouse Management by using IOT and Cloud. For information storing about the product, they proposed with using RFID. Warehouse Management Systems (WMSs) have been created for observing, following and controlling the stockroom tasks, yet with the expanding dynamicity of the market, customary frameworks have gotten less effective and unsatisfactory for the present market necessities, that is the reason new innovations have begun to arise to be utilized for such applications. Web of Things (IoT) is a promising innovation that can be utilized with regards to Industry 4.0. In this paper, a brilliant WMS structure dependent on IoT is proposed; this framework helps the stockroom supervisor to accomplish more control and checking of the activities progressively. Raspberry Pi is used for receiving the information from system and upload in the web page. When we use Web page for maintain the number. After scanning and converting to valuable data with IOT. The data is sent to storage device unit with using cloud. [3].

Kunal Singh proposed the smart inventory system with using RFID, Sensors, Load Cells. Author explained about the principle and design of RFID. The data can be received with use of Bluetooth or wireless radio communication. The guideline of activity, Plan and Uses of RFID (Radio Recurrence Distinguishing proof), Burden Cells and Ultrasonic sensor based stock administration frameworks are talked about in detail. Additionally, some new headways in stock administration like three-dimensional examining framework alongside some other sensor based brilliant stock frameworks proposed by the creator have been talked about in detail. Techniques on improving the transportability and proficiency regarding convenience of such frameworks have been examined in detail, which can be accomplished utilizing Bluetooth or remote radio correspondence. [4].

Sifat Rezwan; Wasit Ahmed; Mahrin Alam Mahia; Mohammad Rezaul Islam proposed the system for smart kitchen management system with using sensors, LDR, LED, Arduino Mega and NodeMCU. SIMS is a framework that depends on IoT, which will make overseeing kitchen, medication, café stock more effective and bother free. This won't just advise clients of their present stock yet additionally consequently request for new things if amount gets low. Clients can likewise physically arrange online to get any things conveyed at their doorstep straightforwardly from their SIMS application. Client can likewise create rundown of a given time period so client will actually want to think about their consumption. Furthermore, client can follow their request status and request history through site. With the assistance of Savvy Kitchen Stock (SKI), a piece of SIMS, individuals can disregard the issue of shopping for food as it very well may be worked from anyplace through the site or the android application and

request anything they need whenever they need. The data can receive by using Arduino and NodeMCU and viewed on website and App. [5].

G. SanthoshKumarK, P. Jayarekha proposed the system with using QR code. QR code is attached on different elements. The database is maintained in the local network. The Smart inventory management system is an application which is utilized for the information upkeep of various telecom network components. The primary goal of this stock application is to give productive and simple access, all things considered. QR code is stuck and checked to get the data about the components. The data set can be gotten to by the portable application which is put away in the nearby organization. Portable application is relegated with the public IP (Web convention) address which will divert to private IP address by utilizing network address interpretation. Each data about components which was added by the portable application will be reflected in the web interface. This outcomes in a simple administration of organization components by utilizing the various innovations. The database can be accessed by the mobile application which is stored in the local network. Mobile application will get the data with the help of tomcat server. The data is stored and managed on web interface.[6].

B. Karunakara Rai, J. P. Harshitha, Radhika S. Kalagudi, B. S. Priyanka Chowdary, Palak Hora, B. Sahana, proposed the system for smart trolley. These days, charging is a drawn-out task as clients need to remain in long lines to get their items standardized identification checked. This paper proposes a design of a savvy streetcar which gives a computerized charging, against robbery framework, and works with stock administration through a web application. This is accomplished on a cloud-based stage utilizing RFID and Wi-Fi innovation. The objective of this proposed shrewd streetcar framework is to give effectively

versatile, affordable, and innovation arranged shopping framework consequently lessening lining time, hostile to robbery, and work cost. The authors used cloud, RFID, WIFI for the system. RFID tag is used for storing the data. The Reader is used for scanning the data from the tag and the data is send to cloud with the help of WIFI. [7].

K. Umamaheswari; M. Susneha; B. Sheeba Kala proposed the system with sensor, Raspberry pi and Arduino. Data is collected from Arduino with the help of Raspberry pi. This proto kind fuses an IOT based brilliant cold stockpiling that collaborates with the things put away inside, gathers the data about them and interaction this data into significant information. The articles set inside the shrewd cold stockpiling will be recognized and distinguished utilizing a web camera. Burden cell with HX711 IC driver is utilized to figure the Heaviness of the items. Raspberry Pi-3 B+ gathers information from the ARDUINO and investigate the information utilizing python programming and communicate the stock data to the clients through portable application. It gives an alarm to the clients to put in a request if the weight falls underneath the edge esteem, i.e If there is any deficiency or unavailable of the articles. Sensor is used to monitor the temperature. It sends alert message when the stock is less. The data is sent and managed with mobile application.[8].

Xiong Wei, Anupam Manori, Nandgopal Devnath, Nitin Pasi, and Vivek Kumar proposed the system with QR code. The proposed framework a few two applications, one for creating the QR Code by entering the understudy subtleties and second application for taking the participation and creating the participation in CSV or XLS design. The instructor should filter the QR code of the specific understudy to affirm their participation. The paper talks about how the

framework confirms understudy personality to kill bogus enlistments. The framework manages the administration and assessment of participation, everything being equal. The understudy QR code will be given to teacher for taking their participation. The author used QR code for filling the data and used mobile app for scanning the data. After scanning, the data verifies with the database and give output based on the data filled in QR code and code which we gave. [9].

M MOHAMED SHIRAJ, ALMA SHAMEEM proposed the system with barcode and webpage. This framework is has been produced for a drug organization which keep manual IMS, which has prompted the deferral to obtain stock and having moderate stock on the rack. The organization additionally runs out of some specific stock things that are sought after at significant occasions. To defeat the issue the examination proposed Scanner tag Empowered Stock Administration Frameworks for Drug Organization framework. The targets of this framework are save time in stock administration and make mechanize any remaining related capacities. Data are filled on the barcode. Data are scanned from barcode using scanner and the data is sent to webpage. The data is managed in webpage. [10].

CHAPTER 3

Aim and Scope Of Present Investigation

3.1 Existing System

The existing system is based on cart and was done by RFID reader with microcontroller. By having RFID, we want to add the RFID tags to each product. If the three pieces from one product want to read three times. It is very difficult to monitor. The drawback is there is no way for maintaining the stock of products and finding the expiry date.

When RFID tag is fixed to all products, there may be problem in maintaining the tag when it is fixed to all products. There may problem arise when we are scanning the same products for n number of times there may be confusion arise if we return the products back to rack. There may be technical issues arise because this is totally automated. So, if any problems arise, we want to verify each point of system.

3.2 Proposed System

The developed Warehouse inventory management system is very efficient, it can perform dynamic data Updation and Real Time search operations from the database with the help of cloud. Thus, the implementation of scanning System of this proposed methodology is not bounded to prototype or laboratory setup, but can also work efficiently in Real world application.

The total implementation cost of the developed warehouse inventory management system is very low compared with the present existing models in the marketplace. With this system we can track the expiry of the product also. By tracking the expiry date, we can sell that products soon. We will receive alert message when the product is going to get over soon and when the product is expiry soon.

3.3 BLOCK DIAGRAM

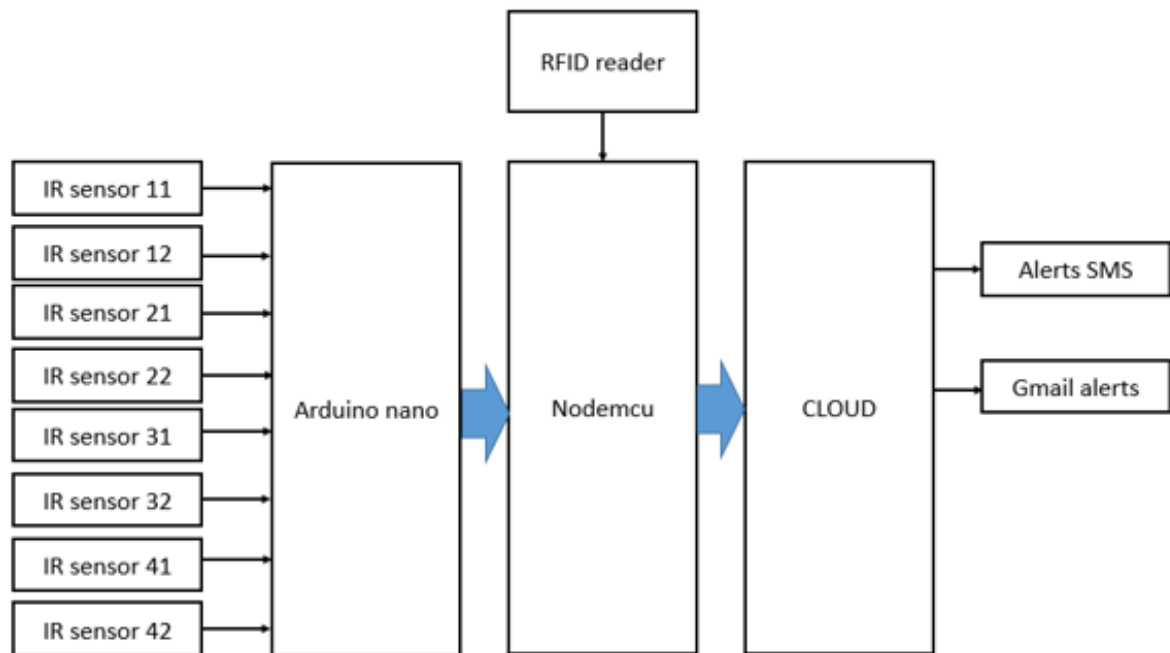


Fig: 3.1: Block Diagram Of Proposed System

Fig 3.1 describes about the proposed system of stock management system. The setup consists of IR sensor, Arduino nano, Nodemcu, RFID Tag. All the data are sent to cloud and managed in cloud. Alerts SMS and Gmail Alerts are sent when necessary. Data is sent to Arduino nano and then to cloud.

CHAPTER 4

Experimental Methods Used

4.1 HARDWARE USED

- IR sensor
- Arduino nano
- Nodemcu
- RFID reader

4.2 SOFTWARE USED

- Arduino IDE

4.3 EMBEDDED SYSTEMS

4.3.1 Overview of embedded systems

A special-purpose computer machine designed to execute one or a few dedicated operations, often with real-time computational limitations, is known as an embedded system. It's normally used as part of a larger device that includes both hardware and mechanical components. A general-purpose computer, such as a personal computer, on the other hand, can perform a wide range of tasks depending on the programming. Embedded systems have become increasingly relevant in today's world, as they power all of the gadgets we use on a daily basis. Since the embedded device is committed to a particular purpose, design engineers may customise it to reduce the product's size and expense while also improving its reliability and efficiency. Embedded devices are often mass-produced to take advantage of economies of scale. Embedded systems can vary in size from small handheld devices like digital watches and MP3 players to massive stationary structures like traffic lights, factory controls, and nuclear power plant control systems. With a single microcontroller chip, complexity is low; with multiple modules, peripherals, and networks installed within a massive chassis or enclosure, complexity is very high.

4.3.2 Block diagram of an embedded system

An embedded processor is normally found in a device. Embedded devices are used in many equipment with a wireless interface, such as microwaves, VCRs, and automobiles. An operating system is used in some embedded systems. Others are highly specialised, culminating in the implementation of the whole logic as a single application. These devices are integrated into a computer for a special use other than general-purpose computing. A typical embedded system is shown in Fig 1.1

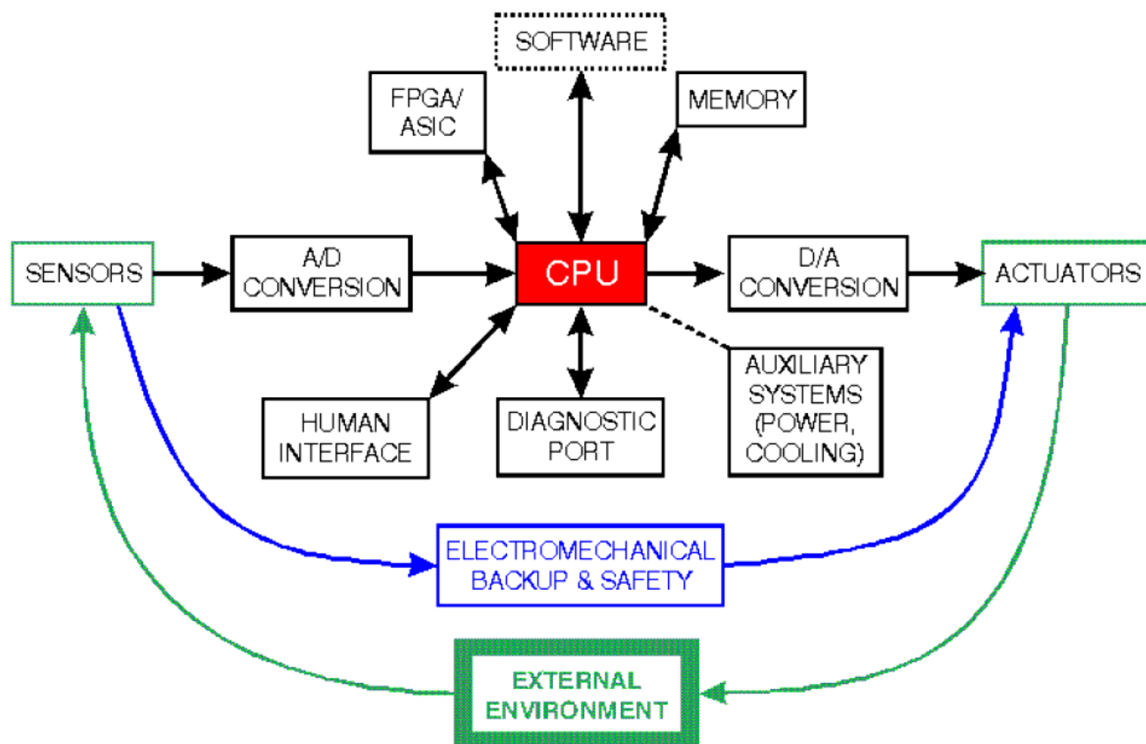


Fig: 4.1: Block diagram of a typical embedded system

4.3.3 Characteristics of embedded systems

Embedded systems are characterized by a unique set of characteristics. Each of these characteristics imposed a specific set of design constraints on embedded systems designers. The challenge to designing embedded systems is to conform to the specific set of constraints for the application.

4.3.3.1 Application Specific Systems

Embedded systems are not general-purpose computers. Embedded system designs are optimized for a specific application. Many of the job characteristics are known before the hardware is designed. This allows the designer to focus on the specific design constraints of a well-defined application. As such, there is limited user reprogrammability. Some embedded systems, however, require the flexibility of reprogrammability. Programmable DSPs are common for such applications.

4.3.3.2 Reactive Systems

As previously said, a standard embedded systems model uses sensors to react to the environment and actuators to control the environment. This necessitates embedded systems running at the same rate as their surroundings. The term "reactive" describes this feature of embedded systems. The machine (primarily the software component) operates in response to external events, which is known as reactive computation.

4.3.4 Power Supply

Since all electronic circuits operate at low DC voltages, we need a power supply unit to provide the correct voltage supply for them to perform properly. The transformer, rectifier, filter, and regulator are all part of this unit. A transformer voltage down to the level of the desired ac voltage is attached to an AC voltage of normally 230 volts rms. A full-wave rectified voltage is provided by a diode rectifier, which is then filtered by a simple capacitor filter to produce a dc voltage. There is typically some ripple or ac voltage difference in the resulting dc voltage. This dc input can be used by a regulator circuit to generate dc voltage that not only has less ripple, but still maintains the same dc value even though the dc voltage varies slightly or the load attached to the output dc voltages changes.

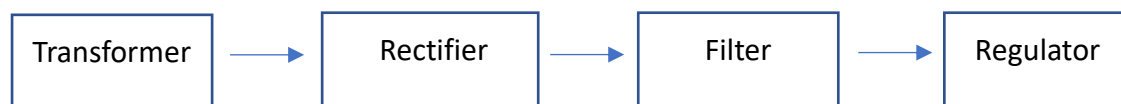


Fig: 4.2: General Block of Power Supply Unit

4.3.5 Transformer

A transformer is a static component that converts electric power from one circuit to electric power from another circuit at the same frequency. It has the ability to increase or decrease the voltage in the circuit, but it does so at the expense of a decrease or increase in current. It operates on the reciprocal induction principle. A step down transformer is used in our project to provide the required supply for the electronic circuits. We're converting 230 volts ac to 12 volts ac here.

4.3.6 Rectifier

A process known as full wave rectification will increase a dc level obtained from a sinusoidal input by 100%. For full wave rectification, we use a bridge rectifier in our project. During the time $t = 0$ to $T/2$, two diodes (say D2 & D3) conduct while the other two diodes (D1 & D4) are in the off state, as seen in the simple bridge setup. The conducting diodes for the negative loop of the input are D1 and D4. As a result, the polarity is consistent in the load.

The diodes used in the bridge rectifier can be of various forms, such as 1N4001, 1N4003, 1N4004, 1N4005, 1N4007, and so on. However, we'll use 1N4007 because it can handle 1000 volts.

4.3.7 Filters

We'll need to use a low pass filter to get a dc voltage of 0 Hz. As a result, a capacitive filter circuit is used, with a capacitor attached to the rectifier output and a dc obtained through it. The filtered waveform is basically a dc voltage with minimal ripples, and it is fed to the load at the end.

4.3.8 Regulators

The capacitor's output voltage is filtered and eventually regulated. The voltage regulator is a system that keeps the output voltage constant regardless of input differences, load variations, or temperature variations. We're going to use the LM7805, which is a fixed voltage regulator. The IC LM7805 is a microcontroller regulator that operates at 5 volts.

4.3.8.1 Features And Description Of Regulators

- Output Current up to 1A

- Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24V
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area Protection

4.4 NodeMCU ESP8266

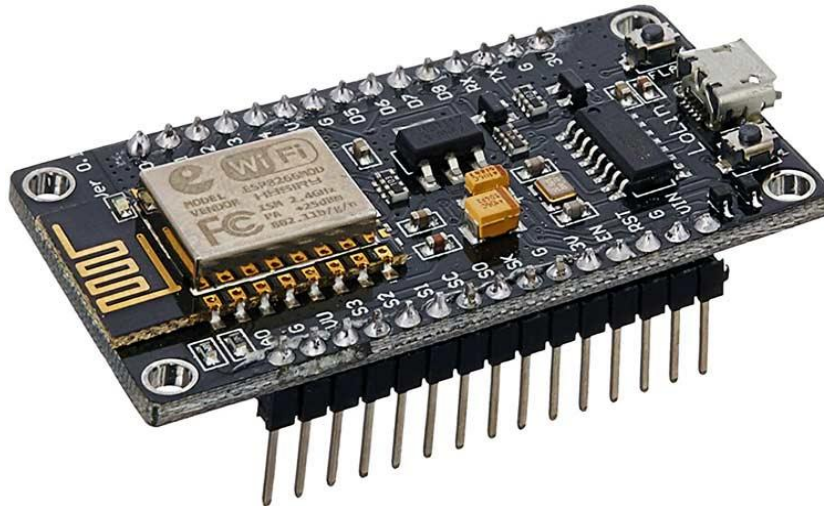


Fig: 4.3: NodeMCU ESP8266

Table 4.1: Pin Configurations

Pin Category	Description
Power	Micro-USB: NodeMCU can be powered through the USB port 3.3V: Regulated 3.3V can be supplied to this pin to power the board GND: Ground pins Vin: External Power Supply
Control Pins	The pin and the button resets the microcontroller

Analog Pin	Used to measure analog voltage in the range of 0-3.3V
GPIO Pins	NodeMCU has 16 general purpose input-output pins on its board
SPI Pins	NodeMCU has four pins available for SPI communication.
UART Pins	NodeMCU has two UART interfaces, UART0 (RXD0 & TXD0) and UART1 (RXD1 & TXD1). UART1 is used to upload the firmware/program.
I2C Pins	NodeMCU has I2C functionality support but due to the internal functionality of these pins, you have to find which pin is I2C.

Table : 4.1 describes about the Pin Configurations of Nodemcu

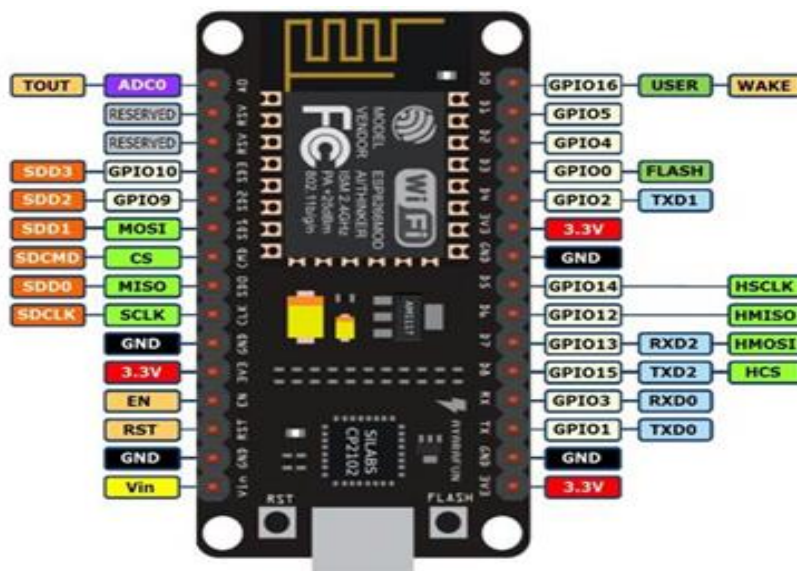


Fig: 4.4: NodeMCU ESP8266 PIN EXPLANATION

4.4.1 NodeMCU ESP8266 Pinout

NodeMCU is an open-source Lua-based firmware and development board designed specifically for Internet of Things (IoT) applications. It contains firmware that runs on Espressif Systems' ESP8266 Wi-Fi SoC and hardware built on the ESP-12 board.

4.4.2 NodeMCU ESP8266 Specifications & Features

- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1
- UARTs: 1
- SPIs: 1
- I2Cs: 1
- Flash Memory: 4 MB
- SRAM: 64 KB
- Clock Speed: 80 MHz
- USB-TTL based on CP2102 is included onboard, Enabling Plug n Play
- PCB Antenna
- Small Sized module to fit smartly inside your IoT projects

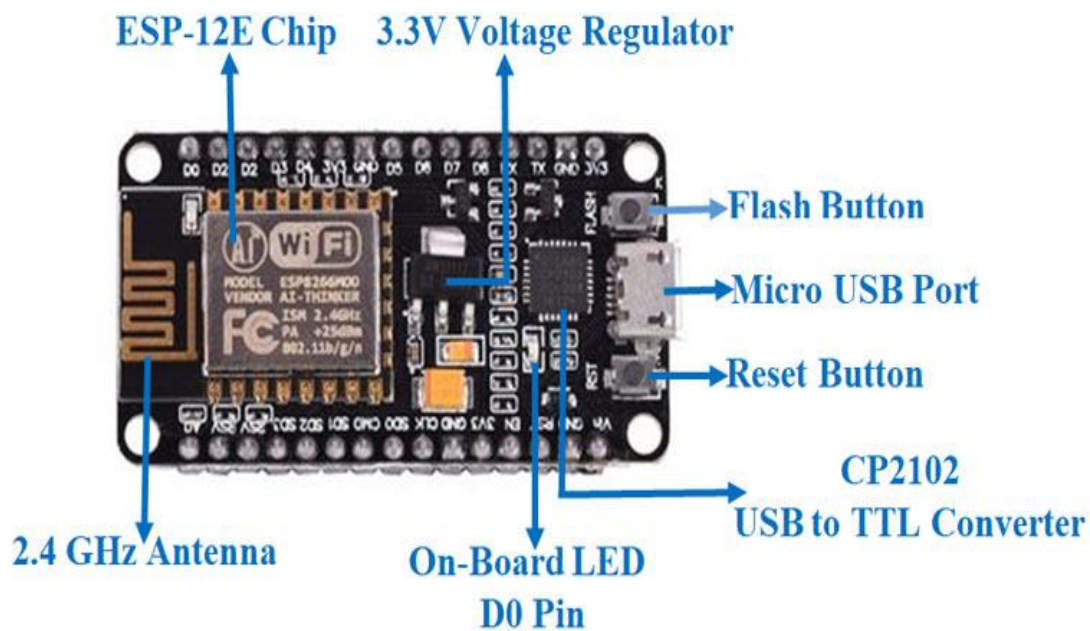
4.4.3 Brief About NodeMCU ESP8266

The ESP-12E module on the NodeMCU ESP8266 production board contains an ESP8266 chip with a Tensilica Xtensa 32-bit LX106 RISC microprocessor. This microprocessor runs on an adjustable clock frequency of 80MHz to 160MHz and supports RTOS. To store data and applications, the NodeMCU has 128 KB of RAM and 4MB of Flash memory. It is suitable for IoT ventures due to its high computing speed, built-in Wi-Fi / Bluetooth, and Deep Sleep Operating features.

Since the embedded device is committed to a particular purpose, design engineers may customise it to reduce the product's size and expense while also improving its reliability and efficiency. Embedded devices are often mass-produced to take advantage of economies of scale.

Embedded systems can vary in size from small handheld devices like digital watches and MP3 players to massive stationary structures like traffic lights, factory controls, and nuclear power plant control systems. With a single microcontroller chip, complexity is low; with multiple modules, peripherals, and networks installed within a massive chassis or enclosure, complexity is very high.

The NodeMCU is operated by a Micro USB jack and a VIN pin (External Supply Pin). It has interfaces for UART, SPI, and I2C.



the NodeMCU board and blink the built-in LED. Click the 'upload' button on the top bar until the sample code has been loaded into your IDE. When the upload is complete, the board's built-in LED can begin to blink.

4.4.6 Applications of NodeMCU

- IoT computer prototyping
- Low-power battery-powered systems
- Network ventures
- Projects that necessitate several I/O interfaces with Wi-Fi and Bluetooth capabilities

4.5 IR (Infrared) Sensor

An infrared sensor is an electronic system that emits infrared light in order to detect certain features of its environment. An infrared sensor can sense motion as well as quantify the heat of an object. The term "passive IR camera" refers to a sensor that only detects infrared radiation rather than emitting it. Almost all objects emit some kind of thermal radiation in the infrared spectrum. There are radiations that are harmless to the naked eye but can be measured by an infrared camera. The emitter is a simple infrared LED (Light Emitting Diode), and the detector is a simple infrared photodiode that detects infrared light of the same wavelength as the IR LED. As infrared light strikes the photodiode, the resistances and output voltages change in relation to the intensity of the IR light.

4.5.1 IR Sensor Circuit Diagram and Working Principle

In an electronic system, an infrared sensor circuit is one of the most common and widely used sensor modules. This sensor is similar to a human's visionary senses, and it can be used to locate barriers, which is one of the most popular real-time applications. The following components make up this circuit:

- A pair of IR transmitter and receiver LM358 IC 2 resistors in the kilo ohm range
- Resistors that can be adjusted.
- Light emitting diode (Light Emitting Diode).

The transmitter part of this project contains an IR sensor that emits continuous IR rays that are received by an IR receiver module. The receiver's IR output terminal changes depending on how much it receives IR rays. This output should be fed to a comparator circuit so this difference cannot be evaluated separately. As a comparator circuit, an LM 339 operational amplifier (op-amp) is used. When the IR receiver does not transmit a signal, the inverting response of the comparator IC has a higher potential than the comparator IC's non-inverting input (LM339). As a result, the comparator's output drops, but the LED does not light up. As the potential detects a signal from the IR receiver module.

4.5.2 IR Sensor circuit

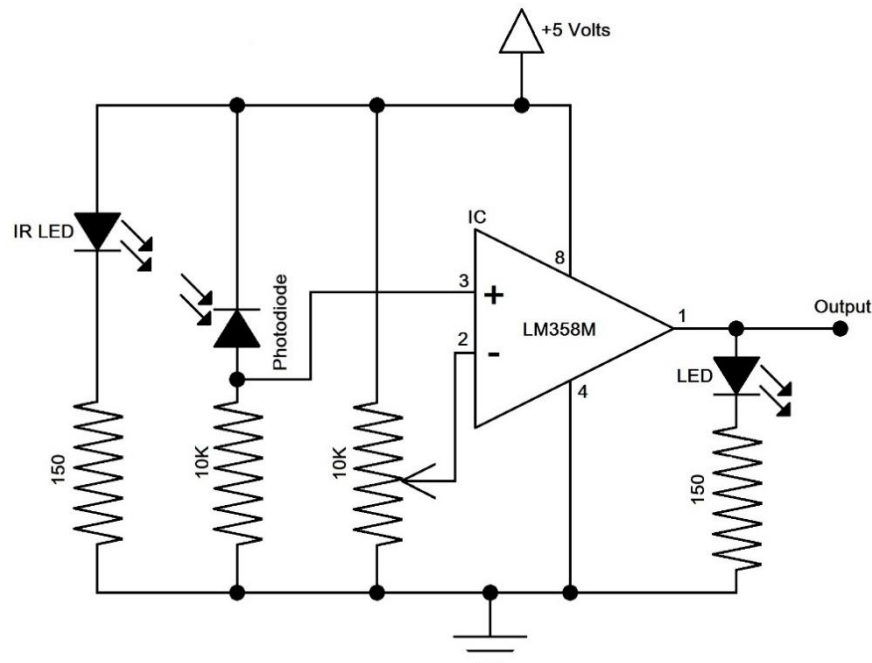


Fig: 4.6: IR Sensor Circuit diagram

To ensure that a minimum of 10 mA current passes through IR LED Devices such as Photodiode and standard LEDs, resistors R1 (100), R2 (10k), and R3 (330) are used. The output terminals are adjusted with the resistor VR2 (preset=5k). The circuit diagram's sensitivity is regulated by the resistor VR1 (preset=10k). Find out all from infrared sensors.

4.5.3 Applications on Types of IR Sensors

Based on the use, IR sensors are categorised into various categories. The speed sensor is used to keep the speeds of various motors in sync. The temperature sensor is used to monitor the temperature in industrial settings. PIR sensors are used for automatic door opening, while Ultrasonic sensors are used to measure time.

4.5.3.1 Radiation Thermometers

Radiation thermometers use infrared sensors to measure temperature, which is dependent on the object's temperature and material, and these thermometers have some of the following features.

- Faster reaction
- Measurement without direct interaction with the object
- Pattern measurements are easy.

4.5.3.2 Flame Monitors

These sensors are used to sense the light released by the flames and to keep track of how they're burning. Flames emit light that ranges from ultraviolet to infrared. Four of the most widely used detectors in flame sensors are PbS, PbSe, two-color detectors, and pyroelectric detectors.

4.5.3.3 Moisture Analyzers

Moisture analyzers use wavelengths in the infrared field that are absorbed by moisture. Objects are exposed to light of the following wavelengths (1.1 μ m, 1.4 μ m, 1.9 μ m, and 2.7 μ m) as well as reference wavelengths. The moisture content of the surfaces is determined by the light emitted by them, and is detected by an analyzer to determine moisture content (ratio of reflected light at these wavelengths to the reflected light at reference wavelength). PbS photoconductive detectors are used in moisture analyzer circuits in GaAs PIN photodiodes.

4.5.3.4 IR Imaging Devices

The infrared imaging unit is one of the most popular uses of infrared waves, owing

to its invisibility. Thermal imagers, night vision cameras, and other devices use it.



Fig:4.7: IR Imaging Devices

As an alternative, IR radiation is emitted by water, minerals, soil, vegetation, the atmosphere, and human skin. Thermal infrared detectors quantify these radiations in the infrared spectrum and map the object/spatial area's temperature distributions on an image. Sb (indium antimonite), Gd Hg (mercury-doped germanium), and Hg Cd Te (mercury-cadmium-telluride) sensors are often used in thermal imagers.

Liquid helium or liquid nitrogen was used to cool an electrical detector to very low temperatures. Then, by cooling the detectors, the radiant energy (photons) captured by the detectors comes from the terrain, not from the ambient temperature of objects within the scanner itself, as is the case for infrared imaging electronic devices.

This concludes our discussion of the IR sensor circuit, including its use and applications. Many sensor-based electronics ventures use these sensors.

4.6 ARDUINO UNO AND ITS PROGRAMMING

Arduino is a programming language that allows you to create machines that can feel and monitor more of the real world than your typical desktop computer. It's an open-source physical computing platform that includes a programming environment for writing applications for the board and a basic microcontroller board. Arduino may be used to create interactive objects that accept input from various switches or sensors and power lighting, motors, and other physical outputs. Arduino projects may be self-contained or interact through apps installed on your server. The boards can be hand-assembled or bought pre-assembled, with the open-source IDE available for free download.

The Arduino programming language is based on the Processing multimedia programming environment and is an emulation of Wiring, a related physical computing platform.

4.6.1 Overview

The Arduino microcontroller is a simple-to-use but powerful single-board machine that has gained popularity in both the hobby and commercial markets. Since the Arduino is open-source, the hardware is inexpensive and the programming software is free. This tutorial is intended for ME 2011 students, as well as students everywhere who are encountering the Arduino for the first time. Prowl the web for experienced Arduino users; there are plenty of tools.

The Arduino Uno board (Spark fun DEV-09950, \$29.95) is covered in this guide, which is a good option for students and educators. You will use the Arduino board to write programmes and interface circuits for reading switches and other sensors, as well as controlling motors.



Fig: 4.8: ARDUINO IDE

The Duemilanove board has an Atmel ATmega328 microcontroller with 2 KB of RAM, 32 KB of flash memory for storing programmes, and 1 KB of EEPROM for storing parameters that runs at 5 volts. The clock speed is 16 MHz, which corresponds to 300,000 lines of C source code being executed per second. There are 14 optical I/O pins and 6 analogue input pins on the circuit. When running a programme when not connected to the host computer, there is a USB connector for communicating to the host computer and a DC power jack for attaching an external 6-20 V power source, such as a 9 V battery. Headers are supported for connecting 22 g solid wire or header connectors to the I/O pins.

Arduino is a condensed variant of C/C++ programming language. Programming the Arduino would be familiar if you know C. There's no need to worry if you don't know C because only a few commands are needed to execute useful functions.

The ability to build a control programme on the host PC, download it to the Arduino, and have it run automatically is a key feature of the Arduino. If you disconnect the USB cable from the PC, the software will continue to run from the top any time you press the reset button. Remove the battery and store the Arduino board for six months in a cabinet. The last programme you saved will run until you reconnect the battery. This entails connecting the board to the host computer.

The Arduino Uno is an ATmega328-based microcontroller module. There are 14 optical input/output pins (six of which can be used as PWM outputs), six analogue inputs, a 16 MHz ceramic resonator, a USB link, a power port, an ICSP header, and a reset button on the board. It comes with everything you'll need to get started with the microcontroller; simply plug it into a device with a USB cable or power it with an AC-to-DC converter or battery.

The Uno is unique in that it does not use the FTDI USB-to-serial driver chip used on previous boards. Instead, it has a USB-to-serial adapter programmed on the Atmega16U2 (Atmega8U2 up to version R2).

4.6.2 Arduino Software (IDE)

The Arduino Software (IDE) includes a text editor for writing code, a message field, a text console, a toolbar with buttons for basic functions, and a set of menus. It communicates with the Arduino and Genuino hardware by connecting to them and uploading programmes.

4.6.3 Writing Sketches

Sketches are programmes created with the Arduino Software (IDE). These sketches were created in a text editor and saved with the .ino file extension. Cutting/pasting, as well as searching/replacing text, are all available in the editor. The message region shows errors and provides input when saving and exporting. The Arduino Software (IDE) outputs text to the terminal, which includes full error messages and other information. The designed board and serial port are shown in the window's

bottom righthand corner. You can check and import programmes, make, open, and save drawings, and open the serial monitor using the toolbar buttons.

NB: Previous versions of the Arduino Software (IDE) used the.pde extension to save drawings. These files can be opened with version 1.0, but you'll be asked to save the sketch with the.ino extension when you save it.

Arduino is a condensed variant of C/C++ programming language. Programming the Arduino would be familiar if you know C. There's no need to worry if you don't know C because only a few commands are needed to execute useful functions.

The ability to build a control programme on the host PC, download it to the Arduino, and have it run automatically is a key feature of the Arduino. If you disconnect the USB cable from the PC, the software will continue to run from the top any time you press the reset button. Remove the battery and store the Arduino board for six months in a cabinet. The last programme you saved will run until you reconnect the battery. This entails connecting the board to the host computer.

Arduino is a programming language that allows you to create machines that can feel and monitor more of the real world than your typical desktop computer. It's an open-source physical computing platform that includes a programming environment for writing applications for the board and a basic microcontroller board. Arduino may be used to create interactive objects that accept input from various switches or sensors and power lighting, motors, and other physical outputs. Arduino projects may be self-contained or interact through apps installed on your server. The boards can be hand-assembled or bought pre-assembled, with the open-source IDE available for free download.

Link the board to the motherboard using the USB cable until the Arduino IDE is loaded on the device. Now open the Arduino IDE and go to Tools>Boards>NodeMCU1.0 (ESP-12E Module) to select the correct board, and Tools>Port to select the correct port. Load the sample code from Files>Examples>Basics>Blink to get it started with the NodeMCU board and blink the built-in LED.

Additional commands are found within the five menus: File, Edit, Sketch, Tools, Help. The menus are context sensitive, which means only those items relevant to the work currently being carried out are available.

4.6.4 Sketchbook

The Arduino Software (IDE) is based on the idea of a sketchbook, which is a typical location for storing your programmes (or sketches). The Open button on the toolbar or the File > Sketchbook menu can be used to open the sketches in your sketchbook. The Arduino app can build a directory for your sketchbook the first time you run it. Through the Preferences dialogue, you can see or adjust the position of the sketchbook.

Files are saved with a.ino extension starting with version 1.0. The.pde extension was included in previous versions. In version 1.0 and older, you can still open.pde files; however, the programme will immediately rename the extension to.ino.

4.6.5 Tabs, Multiple Files, and Compilation

Allows you to manage sketches with more than one file (each of which appears in its own tab). These can be normal Arduino code files (no visible extension), C files (.c extension), C++ files (.cpp), or header files (.h).

4.6.6 Uploading

You must pick the right items from the Tools > Board and Tools > Port menus before uploading your drawing. The boards are listed in the following sections. The serial port on a Mac is possibly /dev/tty.usbmodem241 (for an Uno, Mega2560, or Leonardo) or /dev/tty.usbserial-1B1 (for a Duemilanove or earlier USB board) or /dev/tty.USA19QW1b1P1.1 (for a Duemilanove or earlier USB board) (for a serial board connected with a Keyspan USB-to-Serial adapter). It's most likely COM1 or COM2 (for a serial board) or COM4, COM5, COM7, or higher (for a USB board) on Windows; to find out, search for USB serial device in the Windows Device Manager's ports section. It should be /dev/ttyACMx, /dev/ttyUSBx, or something similar on Linux. Click the upload button in the toolbar or pick the Upload object from the Sketch menu until you've chosen the right serial port and board. Current Arduino boards can automatically reset and start uploading. You'll need to click the reset button on the board just before beginning the upload on older boards (pre-Diecimila) that don't have

auto-reset. When the sketch is submitted, the RX and TX LEDs on most boards can blink. When the upload is complete, the Arduino Software (IDE) will show a message or an error.

When you upload a drawing, you're using the Arduino bootloader, which is a little programme loaded into your board's microcontroller. It enables you to upload code without the need for any extra hardware. When the board resets, the bootloader is active for a few seconds before starting whatever sketch was most recently uploaded to the microcontroller. When the bootloader begins, the on-board (pin 13) LED will blink (i.e. when the board resets).

4.6.7 Libraries

Libraries provide extra features to drawings, such as the ability to interact with hardware or manipulate files. Pick a library from the Sketch > Import Library menu to include it in a sketch. This will compile the library for your sketch and add one or more `#include` comments to the top of the sketch. Libraries take up more room on the board than the drawing since they are submitted with it. Remove the `#include` statements from the top of your code if a sketch no longer needs a library.

In the reference section, there is a directory of repositories. The Arduino app comes with a few libraries. Others are available for free from a number of places, like the Library Manager. You can load a library from a zip file and use it in an open sketch starting with version 1.0.5 of the IDE. To build a third-party catalogue, follow these directions.

4.6.8 Third-Party Hardware

Support for third-party hardware may be linked to the sketchbook directory's hardware directory. Board definitions (which appear in the board menu), key repositories, bootloaders, and programmer definitions are some of the platforms that can be installed. Create the hardware directory first, then unzip the third-party platform into its own subdirectory. (If you use "arduino" as the sub-directory name, the built-in Arduino framework would be overridden.) Simply delete the program's directory to disable it.

4.6.9 Serial Monitor

This shows serial data sent via USB or serial connector from an Arduino or Genuino board. Insert text and press enter or click the "send" button to send data to the monitor. From the drop-down display, choose the baud rate that corresponds to the rate transferred to Serial. start with your drawing. When you interact with the serial monitor on Windows, Mac, or Linux, the board will reset (and rerun your sketch). Please notice that the Serial Monitor does not handle control characters; if your sketch requires full serial communication management with control characters, you can add an external terminal programme to the COM port allocated to your Arduino board. You can also talk with the board from Processing, Flash, MaxMSP, etc.

4.6.10 Language Support

The Arduino Software (IDE) has been translated into 30+ languages since version 1.0.1. The IDE starts up in the language that your operating system has chosen by design. (Note that on Windows and perhaps Linux, the locale environment, which governs currency and date formats, determines this, not the language in which the operating system is displayed.)

If you choose to adjust the language manually, open the Preferences window in the Arduino Software (IDE). A dropdown menu of officially supported languages appears next to the Editor Language. Choose your favourite language from the menu, and then restart the programme to use it. The Arduino Software (IDE) will switch to English if your operating system language is not allowed.

Select Interface Default from the Editor Language drop-down to restore the programme to its default setting of choosing the language depending on your operating system. When you restart the Arduino Software, this setting will take place (IDE). Similarly, you must restart the Arduino Software (IDE) after updating the operating system's settings to upgrade it to the current default language.

4.7 UBIDOTS EXPLORER

Welcome to the hardware documentation for the Ubidots REST API. You'll learn how to transmit and receive data from your hardware devices using the HTTP, MQTT, and TCP/UDP networking protocols that we provide.

The aim of this segment is to explain what happens behind the scenes when interacting with Ubidots so that you can reproduce it in your firmware. As a result, we avoid using examples that use libraries. Check out our compatible devices and API clients pages if you want to use one of our libraries (Python, C, and more).

4.7.1 Working

Every time a device updates a sensor value in a variable, a data-point or "dot" is created. Ubidots stores dots that come from your devices inside variables, and these stored dots have corresponding timestamps:

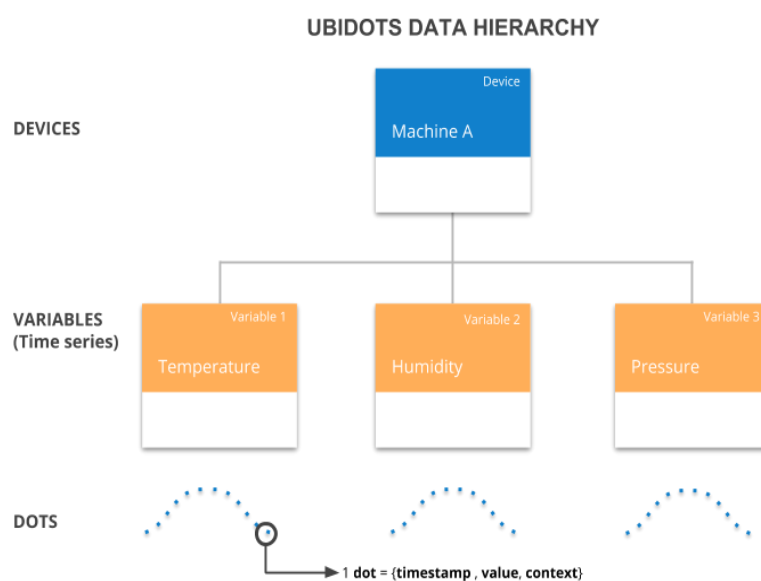


Fig: 4.9 : Working of Ubidots

Table 4.2 Ubidots Data Heirarchy

Each dot contains these items:

Item	Description	Mandatory
value	A numerical value. Ubidots accepts up to 16 floating-point length numbers.	YES
timestamp	Unix Epoch time, in milliseconds. If not specified, then our servers will assign one upon reception.	NO

Item	Description	Mandatory
context	An arbitrary collection of key-value pairs. Mostly used to store the latitude and longitude coordinates of GPS devices.	NO

4.7.2 Values

A numerical value. Ubidots accepts up to 16 floating-point length numbers.

```
{"value" : 34.87654974}
```

4.7.3 Timestamps

A timestamp is a way to measure time as a running number of seconds, as best explained here. The Unix Epoch, which began on January 1st, 1970 at UTC, is the starting point for this count. As a result, the unix time stamp is simply the difference in seconds between a given date and the Unix Epoch. Please bear in mind that you must set the timestamp in milliseconds when sending data to Ubidots, and that the timestamp will be in milliseconds when retrieving a dot's timestamp.

4.7.4 Context

Numerical values are not the only data type supported; you can also store *string* or *char* data types inside what we call context. The context is a key-value object that allows you to store not only numerical but also string values. An example use of the context could be:

```
"context" : {"status" : "on", "weather" : "sunny"}
```

For GPS/tracking programme use cases, a background is typically used to store the device's latitude and longitude coordinates. All Ubidots maps derive the coordinates of your unit using the lat and lng keys from a dot's context, so you only need to send a single dot with the coordinates values in the vector context to plot a map, rather than sending both latitude and longitude in two different variables. A standard background of coordinate values can be found below:

```
"context" : {"lat":-6.2, "lng":75.4, "weather" : "sunny"}
```

Please note that you can mix both string and numerical values in the context.

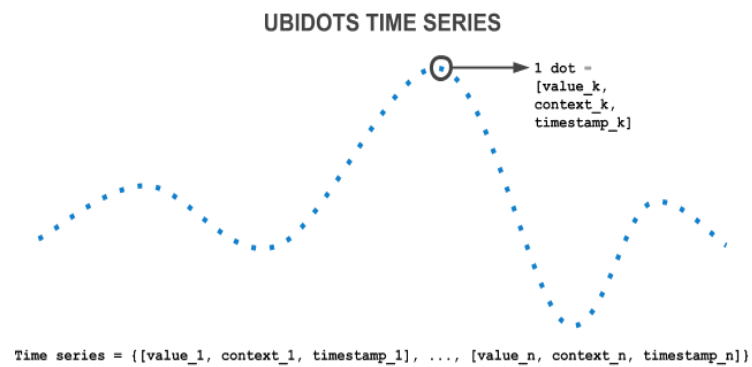


Fig 4.10 Time Series of ubidots

CHAPTER 5

SIMULATION RESULTS

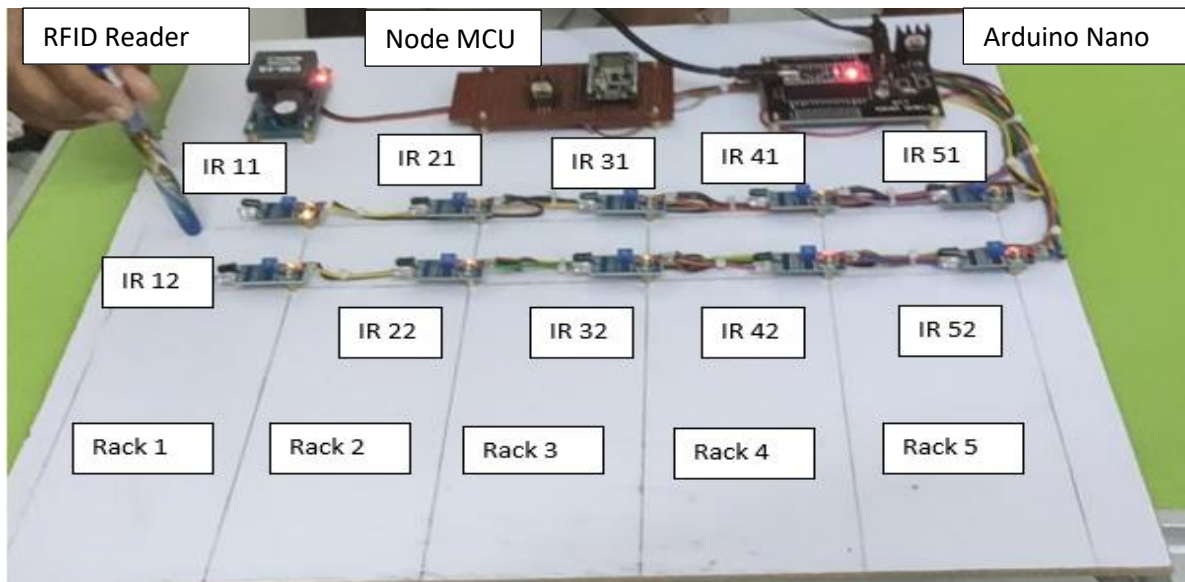


Fig: 5.1: Hardware Setup Model

Fig. 5.1 describes about the setup model of the hardware. It consists of totally 5 racks. In each rack, 2 IR module are fixed for reading the data. IR 11& IR 12 is fixed in first rack. Similarly, IR 21 & 22 , IR 31 & 32 , IR 41 & 42 , IR 51 & 52 are fixed in rack 2,3 4, 5 respectively. The setup consists of RFID Reader, Arduino Nano, Node MCU. RFID Reader is used for reading the RFID tag. Arduino Nano is used for updating the data for adding and removing the products. Node MCU is used for updating the data in cloud.

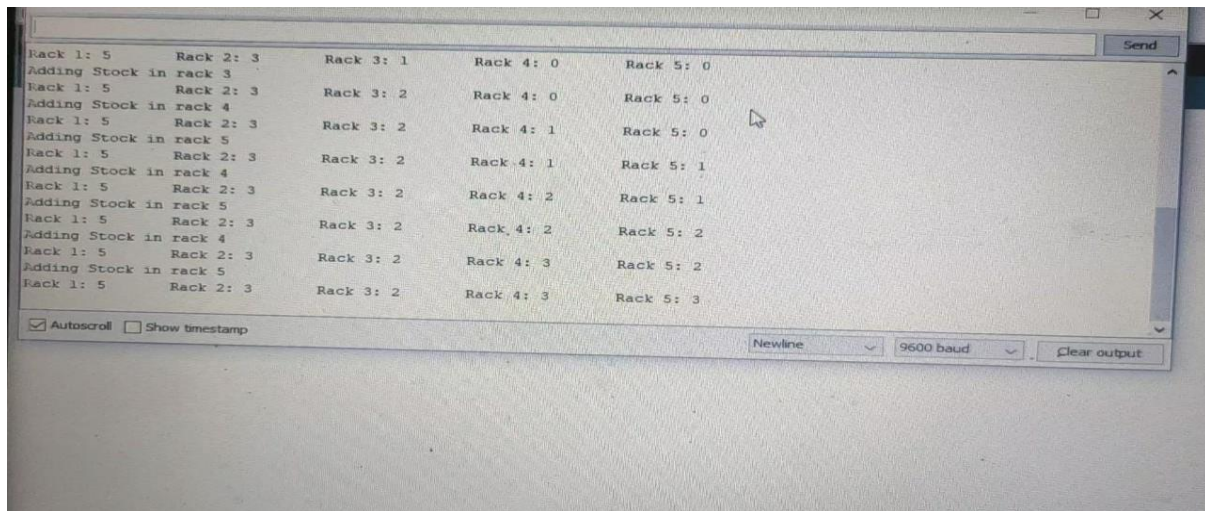


Fig: 5.2: Adding of Products in rack

Fig. 5.2 describes about adding of products in every rack. Let discuss the process in rack 1 and similar is followed in every rack. When the products moved from IR 11 to IR 12 ,then the products is added in rack.

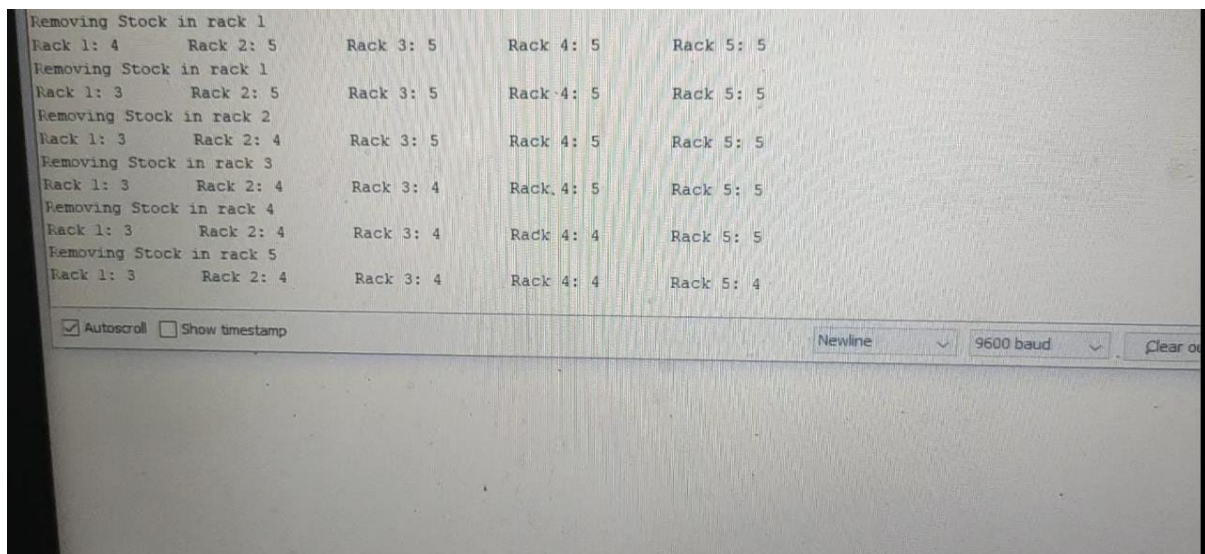


Fig: 5.3: Removing of Products in rack

Fig. 5.3 describes about removing of products in every rack. Let discuss the process in rack 1 and similar is followed in every rack. When the products moved from IR 12 to IR 11 ,then the products is removed in rack.

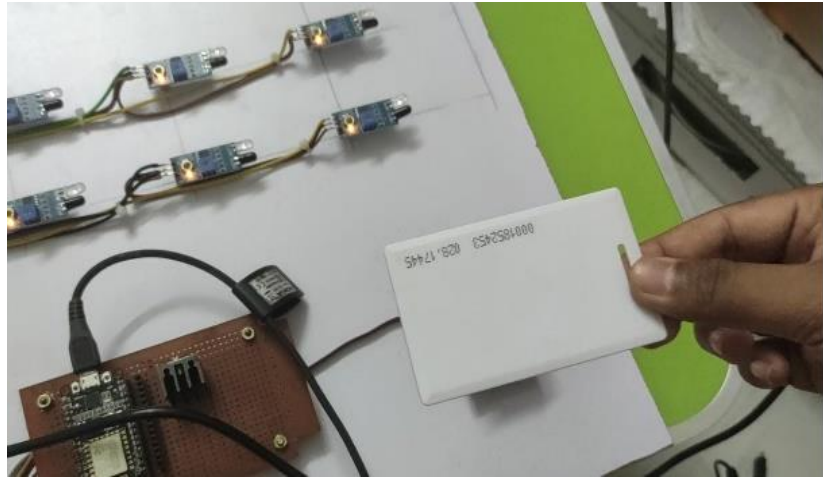


Fig: 5.4: RFID Tag for accessing customers

Fig. 5.4 describes about the Rfid Tag. It is given every customer for taking bill easily and quickly. The products which customer is taking is added in RFID tag and when they are coming to bill counter the tag is scanned and bill, total price is taken fastly.

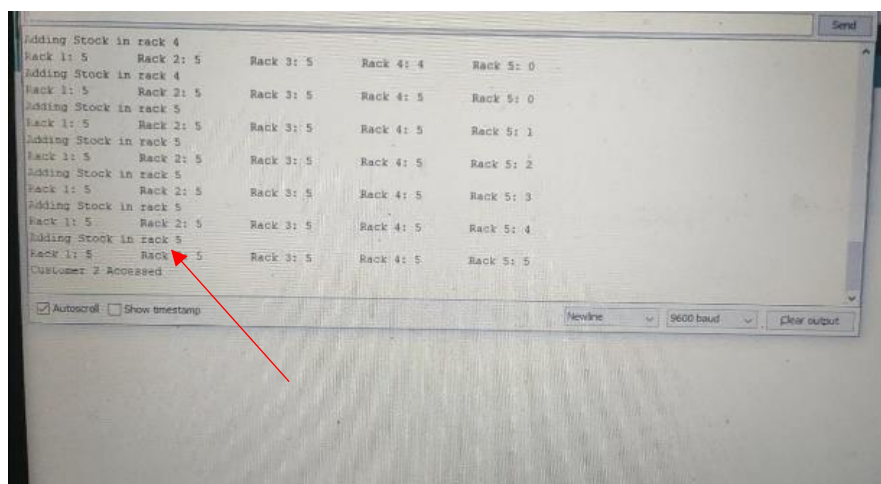


Fig: 5.5: Accessing the Customer Using Tag

Fig. 5.5 describes about the RFID tag. It is scanned and given to each customer for adding the products which they bought and it is accessed and it is viewed in the screen.



Fig: 5.6: Billing and Total amount

Fig. 5.6 describes about the scanning of RFID tag for billing and total amount. When all the needed products are took by the customer and it will be added in RFID tag also. At billing counter, the RFID tag is scanned the bill and total amount is displayed.

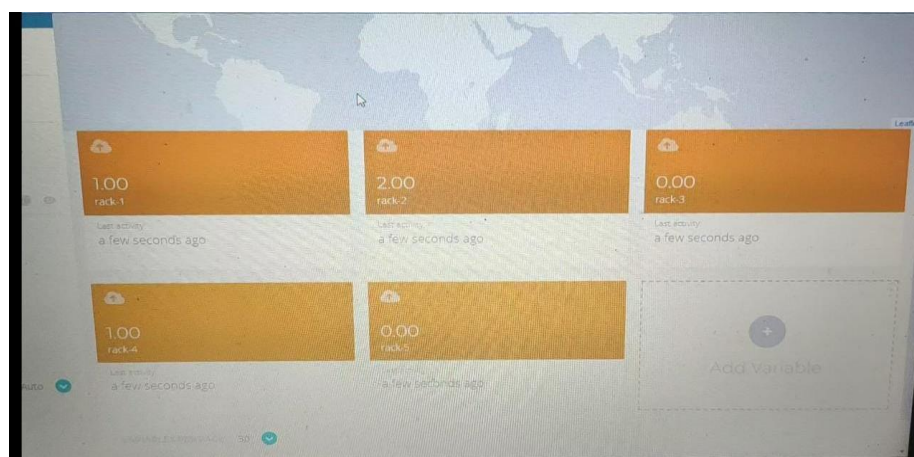


Fig: 5.7: Display of available quantity in shop on Cloud

Fig. 5.7 describes about the available amount of products on shop. When the Product is added in rack the number will be updated i.e., increased in cloud and when we are removing the stock in shop, it will be updated i.e., decreased in quantity on cloud.

5.1 Comparison of Existing and Proposed System

The existing system is based on Cart. Tag is given to all products. Product is scanned with reader which is fixed in cart. Bill is directly taken when we take the cart to bill counter.

The proposed system is based on maintaining stock in shop. IR module is fixed in each rack. Product quantity is maintained on cloud. Alert message is sent when quantity is less. Bill is taken with the help of RFID tag which contain all the product quantity took by the customer.

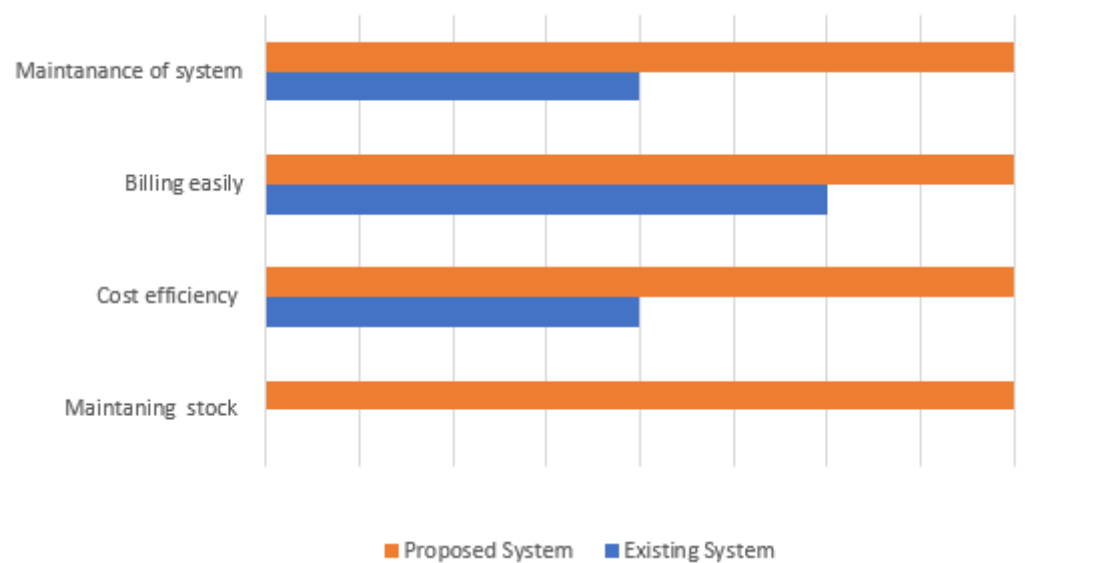


Fig:5.8: Comparison of Existing and Proposed System in Graph

Parameters used for drawing the graph:

- Maintaining stock
- Cost efficiency
- Billing easily
- Maintenance of system

Fig. 5.8 shows that the proposed system is better than existing system

5.2 OUTPUT

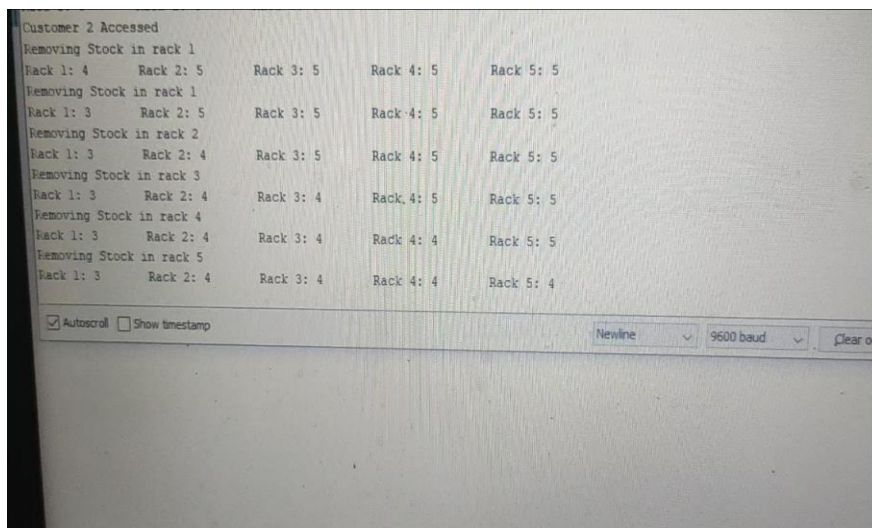


Fig: 5.9: Accessing of Customers

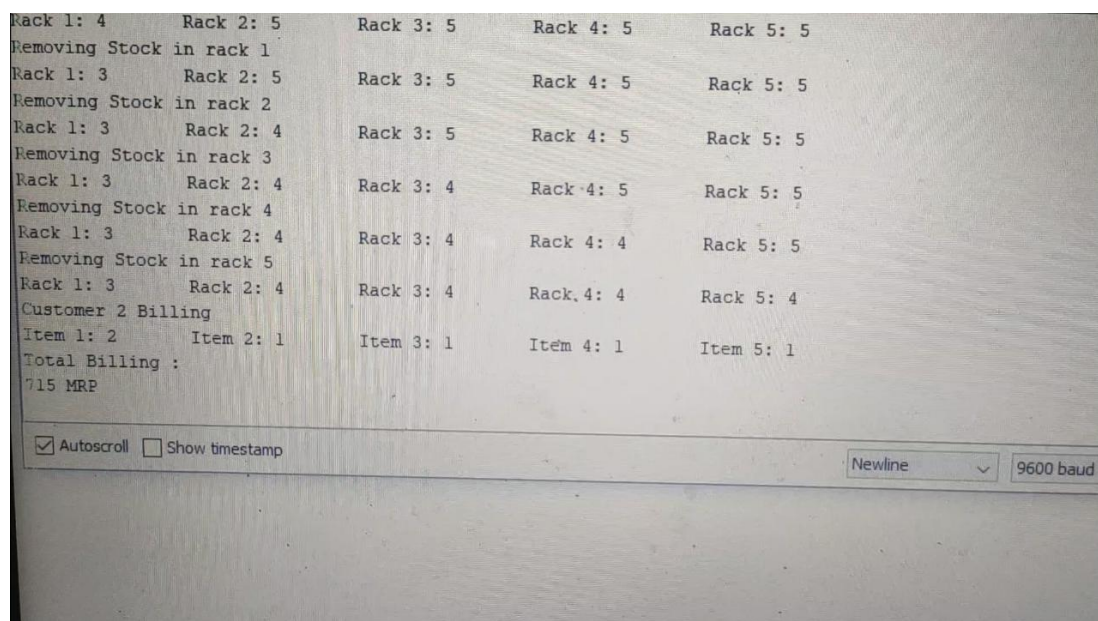
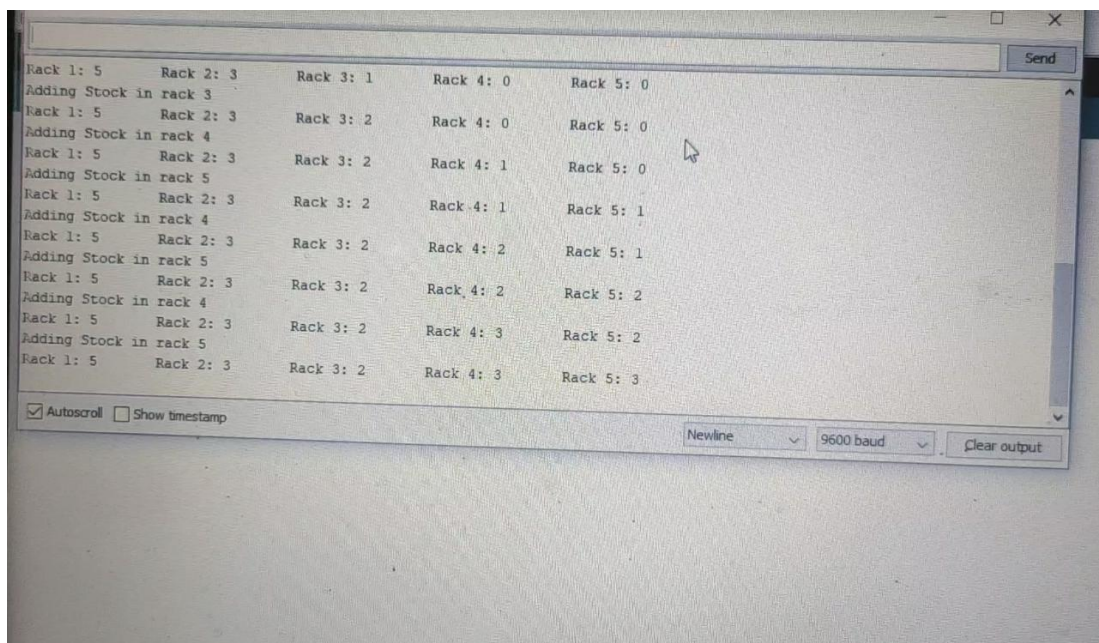
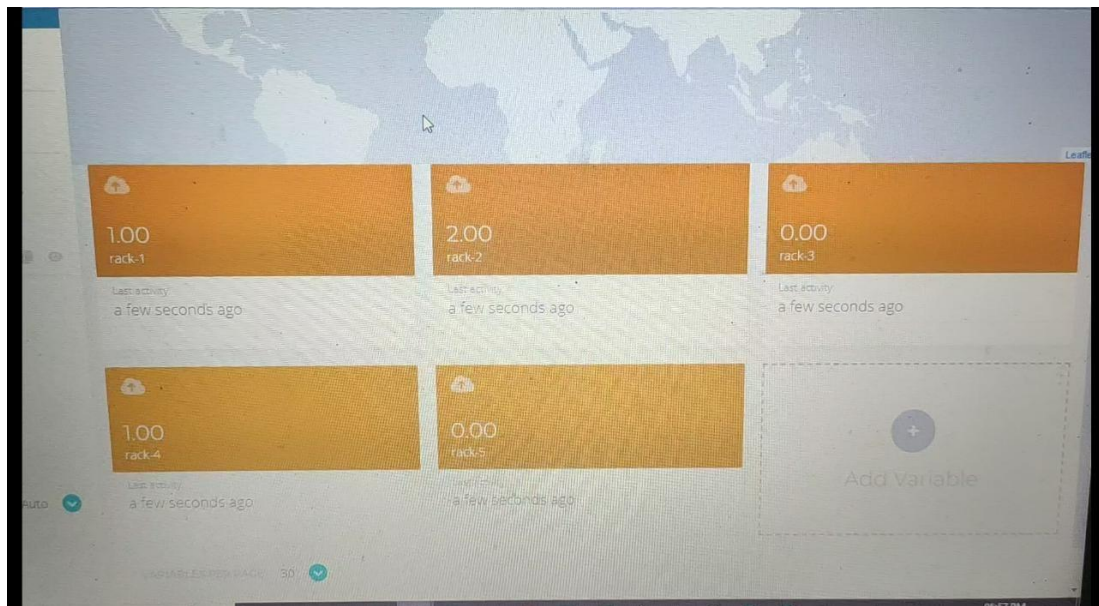


Fig: 5.10: Total Bill Amount of products



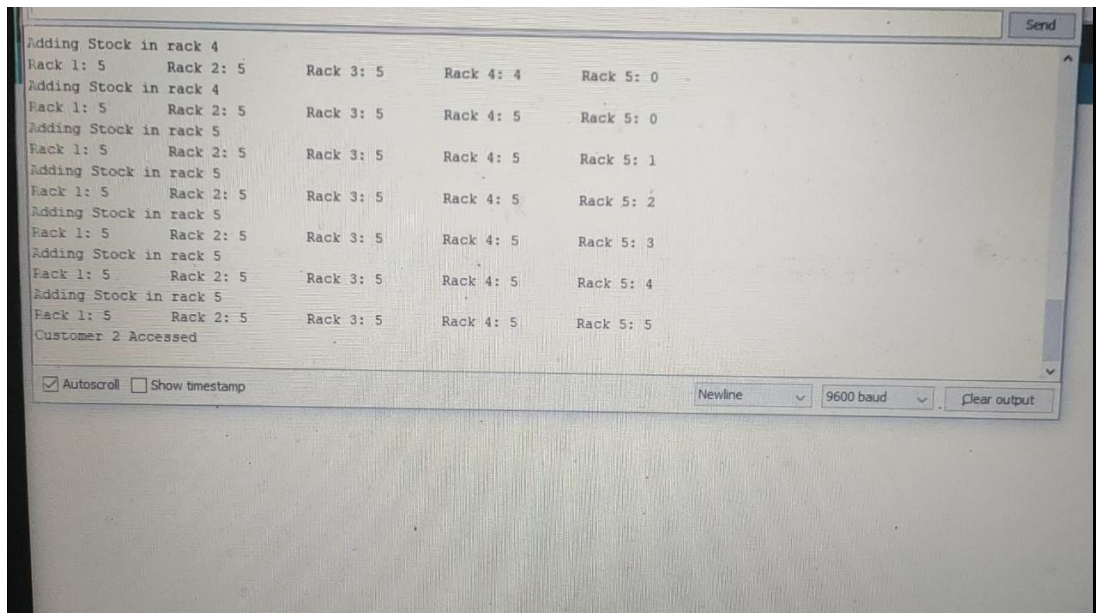


Fig: 5.13: Removing Stocks in rack

Fig 5.9, 5.10, 5.11, 5.12, 5.13 shows the output of the system. Adding and removing of products, Accessing the customer and the quantity available in shop output is showed.

CHAPTER 6

CONCLUSION

This proposed system is about maintain the proper amount of stocks and finding expiry date before expires. Existing System is based on cart and there is no way for maintaining the stock and about finding expiry date. The proposed method is about maintain the proper amount of stocks and finding expiry date and taking the bill faster by providing RFID tag to every person. This developed Warehouse inventory management system is very efficient, it can perform dynamic data Updation and Real Time search operations from the database with the help of cloud. Thus, the implementation of scanning System of this proposed methodology is not bounded to prototype or laboratory setup, but can also work efficiently in Real world application. The total implementation cost of the developed warehouse inventory management system is very low compared with the present existing models in the marketplace. With this system we can track the expiry of the product also. By tracking the expiry date, we can sell that products soon. We will receive alert message when the product is going to get over soon and when the product is expiry soon. With this system we can prevent the major loss because of shortage of products and losing the customer. We can prevent the products before getting expire.

FUTURE SCOPE:

This system can be used in Supermarket, Warehouse or places where large quantity of products is stored, replaced and moved on daily basis. With this system we can find the amount of products available in shop or warehouse easily. With this system we can prevent losing the customers due to lack of products.

REFERENCE

- [1]. Souvik Paul, Atrayee Chatterjee, Digbijay Guha, "STUDY OF SMART INVENTORY MANAGEMENT SYSTEM BASED ON THE INTERNET OF THINGS (IOT)".
- [2]. B. Sai Subrahmanya Tejesh , S.Neeraja , "Warehouse inventory management system using IoT and open-source framework". Alexandria Engineering Journal Volume 57, Issue 4, December 2018, Pages 3817-3823.
- [3]. Walaa Hamdy, Noha Mostafa, and Hesham Elawady, "Towards a Smart Warehouse Management System". Proceedings of the International Conference on Industrial Engineering and Operations Management Washington DC, USA, September 27-29, 2018
- [4]. Kunal Singh, "Smart Inventory Management Using Electronic Sensor Based Computational Intelligence". Recent Advances in Computational Intelligence pp 3-25 published online in 2019.
- [5]. Sifat Rezwan; Wasit Ahmed; Mahrin Alam Mahia; Mohammad Rezaul Islam," IoT Based Smart Inventory Management System for Kitchen Using Weight Sensors, LDR, LED, Arduino Mega and NodeMCU (ESP8266) Wi-Fi Module with Website and App. Published in 2018 Fourth International Conference on Advances in Computing, Communication & Automation (ICACCA). [5].
- [6]. G. SanthoshKumarK, P. Jayarekha, "SMART INVENTORY MANAGEMENT SYSTEM". Published 2017, Computer Science, International Education and Research Journal.
- [7]. B. Karunakara Rai, J. P. Harshitha, Radhika S. Kalagudi, B. S. Priyanka Chowdary, Palak Hora, B. Sahana, "A Cloud-Based Inventory Management System Using a Smart Trolley for Automated Billing and Theft Detection",Innovations in Electronics and Communication Engineering pp 491-500 published online in 2019.
- [8].K. Umamaheswari; M. Susneha; B.Sheeba Kala, "IoT based Smart Cold Storage System for Efficient Stock Management". Published in 2020 International Conference on Communication and Signal Processing (ICCSP).

[9]. Xiong Wei, Anupam Manori, Nandgopal Devnath, Nitin Pasi, and Vivek Kumar, "QR Code Based Smart Attendance System". Published in International Journal of Smart Business and Technology.

[10]. M MOHAMED SHIRAJ, ALMA SHAMEEM, "Barcode Enabled Inventory Management System for the Successful Pharmaceutical Business Organizations". Published in Implementation of Radio Frequency Identification (RFID) Technology in Retail Business: An Empirical Investigation in Eastern Province, Sri Lanka.