

SMART SHOPPING TROLLEY USING LINE FOLLOWER ROBOT

Submitted in partial fulfilment of the requirements for the award of

Bachelor of Engineering Degree in
Electrical and Electronics Engineering

By

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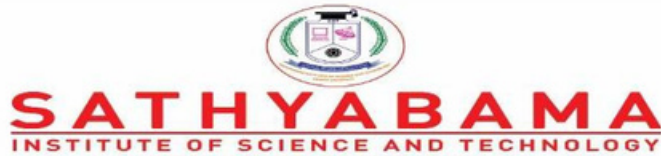
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BONAFIDE CERTIFICATE

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ABSTRACT

In metro cities we can see you a huge rush at shopping malls on holidays and weekends. This becomes even more when there are huge offers and discounts. Now a days people purchase a variety of items and put them in the trolley. After total purchasing one should approach counter for billing purpose. By using barcode reader the cashier prepares the bill which is a time consuming process .This results in long queues at the billing counters. This project presents an idea to develop a system in shopping malls to overcome the above problem. To achieve this all products in the mall should be equipped with RFID tags and all trolleys should be equipped with a RFID reader and LCD screen. When one puts any product in the trolley its code will be detected automatically, the item name and cost will be displayed on the LCD, thereby the cost gets added to the total bill. If we wish to remove the product from the trolley, you can take away the product and the amount of that specific product gets deducted from total amount and the same information passes to the central billing unit via zig bee module. Hence the billing can be done in the trolley itself thereby saving a lot of time to the customers.

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LIST OF ABBREVIATIONS

RFID	Radio Frequency Identification
UPC	Universal Product Code
LCD	Liquid Crystal Display
EEPROM	Electrically Erasable Programmable Read Only Memory
EPC	Electronic Product Code
LED	Light Emitting Diode
SPI	Serial Peripheral Interface
GUI	Graphical User Interface
GPIO	General purpose Input/Output
USB	Universal Serial Bus
IFF	Identification Friend or Foe
SDK	Small Development Kit
HDPE	High Density Polyethylene
LDPE	Low Density Polyethylene
IR	Infrared sensor
GSM	Global System for Mobile Communication

CHAPTER 1

INTRODUCTION

1.1 Background

Individuals have constantly created innovation to bolster their requirements as from the start of humankind. The fundamental reason for development in innovation is ought for more independency and this leads to improving tasks and making regular one simpler and speedier. One significant task that individuals invest maximum measure of energy is in shopping. Shopping center is a spot where individuals get their every day necessities running from sustenance items, garments, electrical machines and so forth. Some of the time clients have issues with respect to the unspecific data about the item marked down and misuse of superfluous time at the counters. In this innovative world, each grocery store and supermarkets utilize shopping trolleys with a specific end goal to help clients to choose and store the items which they expect to buy. Customers usually purchase the products required and place them in their carts and thereafter wait at the counters for payments of bills. The payment of bills at the counters is really troublesome and time consuming process which thereby increasing a heavy crowd at the counters.

As indicated by a study directed by US Department agency , on a normal, people spend through 1.4 hours consistently on shopping. A considerable number of clients will tend to leave a line if the line is too long. The present Shopping environment can be essentially be characterized into two classifications

- (1) Shopping in-individual.
- (2) Shopping in absentia.

Shopping in absentia is upheld from various perspectives including web shopping, online shopping, and so forth which will not require the buyer to be manually held at the Counters. Purchasing in-individual includes an individual call at location of purchasing and choosing items in view of different variables including need, comfort, brand, and so on. The proposed keen Shopping basket framework plans to help shopping in-individual that will minimize the time spent in shopping. Persistent change is required in the customary time spent at the counters to enhance the nature of shopping background to the clients. To beat these issues expressed above and to enhance the current framework, we have composed a Shopping basket. This can be done possible by basically connecting RFID labels to the items and reader with a LCD in the purchasing cart. From this framework client can posses data related to cost of each thing which are inside cart and furthermore absolute cost of the thing about the item. This framework will save time of clients and labor required in shopping center with respect to cost of the item .

Figure 1.1 illustrates the Shopping Environment in the modern World and and waste of unnecessary time at the billing counters.



Figure 1.1 Current Shopping Environment

1.2 Purpose of the project

The fundamental motivation behind this system is to show the proposition of a design and arrangement of an inventive framework for obtaining of items in markets. This cart explores rising versatile innovations and programmed recognizable proof advancements, (for example, RFID) as an approach to enhance the nature of administrations given by retailers and to expand the customer esteem consequently permitting to save time and cash. With this cart an excellent opportunity will be developed which assists the customers by showing the catalog of products and their respective costs. This approach thereby helps the inventory management unit with an instinctive upgrade on each purchase of product. This smart cart has the capability to make shopping more relaxable, comfortable and systematic for the customers as well as making easier for the store management .

1.3 Problem Statement

In realistic, markets are these days utilized by a considerable amount of individuals in order for securing most of items. Item procurement speaks to an unpredictable procedure that involves time spent in passageways, item area and checkout lines. Consumers commonly encounter some problems and difficulty during purchasing. These problems comprise worrying about the money which they have brought would be insufficient for all the items purchased and also dissipating a lot of time at the cashier[1]. And also it is becoming a increasing problem for the merchants to make their shoppers consigned and to anticipate their demands because of the effect of contention and also because of lack of of equipment that isolate application designs. At some instances clients have issues with respect to the inadequate data about the item of discounts and thereby misuse of superfluous time at the counters. We can end this issue by supplanting the omnipresent Universal Product Code (UPC) standardized identification by keen names known as radio frequency identification (RFID) tag. To overcome the above problems, we implement the extensive notion of RFID based keen shopping cart in the field of retail stock.

1.4 Objective

The main objective involved in this plan is to implement a smart shopping cart with the help of RFID technology for improvising purchasing. The plan is to employ the RFID related surveillance implementation practice in the purchasing cart. In this plan RFID card is utilised as protection entry for acquiring of commodities in the Shopping malls. If the commodity has been placed in the shopping cart the price of the product appears and accordingly the total amount will be shown and if we wish to remove the product from the trolley, you can take away the product and the amount of that specific product gets deducted from total amount .In this , the technology used is for obtaining the products thereby which boosts security performance and speed while purchasing in shopping complexes. The technological objective for our presented problem in shopping complexes is the practice of RFID technology for the instinctive recognition of commodity in the interior of the purchasing cart thereby annihilating shopper intervening in the task of commodity purchase and for payment. The principle point of proposed framework is to give an innovation which is minimal effort oriented , effectively adaptable, and efficiently feasible for helping shopping in individual. With the help of this a lot of time will be saved at the billing counters .

Figure 1.2 shows the typical smart shopping cart which has LCD display attached to it.



Figure 1.2 Smart Shopping Cart

1.5 Future scope and limitations

In spite of the fact that the RFID can't totally supplant the standardized identification innovation because of higher cost precision and speed is high in RFID implementation. The retailers, makers and purchaser products organizations like CVS, Tesco, Prada, Benetton, Wal-Shop and Procter and Bet are presently actualizing the innovation and investigating the effect of the innovation on their business. Others can likewise implement RFID. The basis of accomplishment lies in understanding the innovation and different components to minimize the potential issues. It is time for the Industry ought to begin using the new innovation, for example, RFID in different applications, for example, fabricating, and storing purposes. In this project the items in the cart is restricted to less than 50 as the customers don't prefer excess luggage at once. Tags used here can be attached to the products only in the longitudinal fashion without any folds. Tags given for the reader are of length 8cm and of width 2cm and they need to be attached to the products in a visible fashion for the reader then only the reader can detect tags with out any fail. Tags used in this project are water sensitive and metal sensitive and have the capacity of reading only one side. So the trolley is now restricted to use water sensitive packaged and metal sensitive packaged products. But the problem can be rectified with the waterproof tags and metal resistant tags which are under research at present. And the multiple object RFID reader used here has the constraint of skipping the tags at sometimes. Reader which can detect less than 50tags/sec is employed according to the requirement and meanwhile cost will also be under control for implementation of system.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

RFID is an up coming innovation which has as of late pulled in light of a legitimate concern for the exploration group in view of the uncommon advantages it offers over the other existing recognizable proof and information detecting advancements. RFID is a specific term utilized for systems which use radio wave to naturally distinguish things. RFID is a technology that permit exchange of information amongst labels and reader without the need of viewable pathway over a separation up to a couple of 10 meters relying upon the sort of label engaged. For this framework the information is being swapped by radio waves and distinct tags can be scrutinized or collected normally . This part is designed to survey the current technology writing and probe the problems in the existing RFID organisation starting from the transformation to yet in its recognition phase. From past the growth of this revolution from 1900's, aside to this expressed reliable perspectives, thus innovation likewise supports a few affairs or points. A planned motivation behind part for look at the writing identified with the above mentioned technology additionally develops scholarly analysis with giving an deal into a segment of the outstanding and noteworthy cases hindering the growth of this alteration. It ought to confront these cases with a specific end goal to give a more prominent perceivability and an enhanced item speed of the RFID innovation.

From past 1900's, the evolution of this innovation aside the expressed affirmative viewpoints, the innovation additionally carries a few problems. And the anticipated rationale for part is to have a look at the writing related to Radio frequency Identification further develops scholastic research, and giving a knowledge into a portion of the exceptional and urgent issues blocking the development of the RFID innovation. There is a emergency need to address these issues with a specific end goal to give a more prominent perceivability and an enhanced item speed of the RFID innovation. The main utilization of radio waves to transmit signals goes back to Worldwar II when transponder (labels) were put on plane and used to recognize drawing a nearer plane . Interrogators dispatched a signal to the system on the plane and the signal delivered previously could be deployed to identify amicable and hostile flying machine.

The historical backdrop of RFID innovation advancement is shown in Tabel 2.1

Tabel 2.1 History of RFID Development

Decade	Event
1940- 1950	1. RFID was used in major Second World War advancement exertion. RFID designed in 1948.
1950-1960	2. Premature investigations of innovation began.
1960-1970	3. Improvement of hypothesis, initiation

	of field trials started.
1970-1980	4. Blast of Development. Experiments has accelerated.Advance executions has begun.
1980-1990	5. Business uses of standard established.
1990-2000	6. Its usage increased and turns into a piece of ordinary life.

Differentiation between Prevailing and Suggested System

Tabel 2.2 shows the differences between existing system and suggested system

Tabel 2.2 Comparison between prevailing system and suggested system

Prevailing System	Suggested System
1. Hand operated Invoices.	1. Instinctive Invoices
2. Uses Barcode for Billing	2. Uses RFID tags for Billing
3. Human staff is needed for Billing Purpose.	3. No human staff is needed for Billing Purpose.
4. Difficult to track the product.	4. Simple to find or trace commodity.
5. Getting product information is difficult and time consuming.	5. Collecting commodity data is easy and additional time not required.
6. It does not expose an involuntary way of implying to the shopper the way in which aggregate bill is impacted as commodities keep on adding and removing from the cart.	6. LCD will show the improvised bill at each instance the shopper increase or reduce commodity from the cart.
7. Only one single product identification at a time.	7. Allows Multiple product identification at a time.

2.2 Automatic Identification Systems

There are several technologies available for Instinctive Recognition systems. In words of implementation, price necessity and the method associated single or a blend of results are selected for Instinctive Recognition effectiveness.

Barcode Systems

This implementation contains a double code comprising of exhibit of bars and spaces organised in parallel design as depicted in figure below. The sequence is of broad with limited bars and spaces which are depicted numerically and alpha numerically. This is done by optical laser scanning. In spite of same in their material implementation there are much more contrast among the code designs.

In Figure 2.1 a typical barcode which is printed on products is shown as follows.



Figure 2.1 A typical Barcode system

Optical Signal Identification

This was started in the past 1960's. For this specially designed fonts were developed which styled the signs so that they are studied easily in the usual mode by the people and instinctively through the equipment. The main utilization associated with this technology is huge solidity of data and the feasibility of interpreting data graphically during emergencies. This technology was applied in the banks for the registration of checks, productive and administrative fields. In spite of many advantages also this technology vanished globally due to huge costs along with complexity when compared to other identification systems.

Biometric Procedure

Biometrics is the science of computing and having magnitude methods involving human beings. It makes use of approaches to differentiate living beings by error free and unique physical characteristics. In implementation they include thumb marking, palm marking methods, vocalized recognition and opticdisk recognition.

Smart Card

Smart card is an automated information application probably with extra calculating magnitude which is blended into a plastic card as shown in the figure. These cards are furnished by energy and timer beat from the machine through the touching exterior . Information shift between the machine and the card takes place through a two guiding sequential connector. One of the primary benefits associated with the smartcard is that the information saved in it can be defended in opposition to not suitable approach and exploitation. The disadvantage mainly involved with the contact based smartcard is the susceptibility to corrosion ,dirt . Also the reader machines that are used often are also expensive to sustain because their accountability to fade.

In Figure 2.2 a typical smart card is shown as follows.



Figure 2.2 A typical Smart card

RFID systems

In RFID systems information is stored on an automatic information transfer equipment. This is more or less similar to Smartcard. Although the electrical discharge to the information transfer device and the statistics swap are attained with no use of touch like in smartcards but by using magnetic or electromagnetic scopes. A model of RFID system is presented in the figure beneath .Because of the numerous benefits of this when compared to alternate recognition systems these are going to get enacted all around.

Figure 2.3 shows the typical RFID system.



Figure 2.3 A typical RFID system

Comparison between Barcode and RFID

Tabel 2.3 shows the comparison between Barcode(existing) and RFID(proposed) technologies.

Tabel 2.3 Comparison between Barcode and RFID

Barcode (Prevailing Technology)	RFID (Suggested Technology)
1. An individual is needed to study the barcode upon the commodity.	1. Involuntary perusal of RFID tag from the commodity.
2. Barcode must be perceptible on the exterior of the commodity .	2. RFID is placed in the interior of the commodity.
3. Line of vision is necessary to study a Barcode.	3. No line of vision is entailed for this.
4. The legibility of ciphers can be damaged by flith, humidity and decay and during wrapping.	4. This is not influenced by the similar conditions.
5. The accessibility range is up to few inches.	5. The accessibility range is up to few meters.
6. Barcode does not have read and write capability.	6. RFID tag having read and write capability.
7. The damaged tags won't work properly.	7. The damaged tags will work flawlessly.
8. The content updating can't be done .	8. The content updating can be done.

2.3 Analysis of RFID from printed reviews

In 2009, the College of Arkansas Data Innovation Research Establishment done a study which reveals the advantages of tagging products with RFID tags for routine operations and also for business value at any prime retail store. The outcomes exhibited that general stock exactness enhanced by extra of 27 percent, under stocks reduced to 21 percent, and overloads reduced to 6 percent. It likewise also contrasted to what extent it brought with total things utilizing RFID versus a scanner tag reader. With RFID, inspecting 10,000 objects has taken two hours; while a conventional reader has taken 53 hours . Almost 15 billion sets of footwear and 10 billion design attire things get transfer from makers consistently. Therefore prices of leading physical stock of this things, overseeing unavailable stocks, also anticipating robbery keep on rising. Clothing retailers are quickly receiving commodity level observance to empower exact perceivability of every piece of clothing. Unending stocks are moving at rate of 60-70 percent progressively. Forte attire merchants those outline, origin, along with offer items supporting their personal particular labels are acknowledging critical outcomes, for example, a 14 percent deals raise and a 90 percent minimising in the moment involved to lead week after week stock.

A creative item with societal acknowledgment is the one which escorts solace, ease and yield in regular existence. A novel item has been created to help a man in ordinary shopping as far as lessened time spent while buying an item at the best cost accessible[3]. Open familiarity with this technology was uplifted as of late when merchant monster Wal-Bazaar wanted their sponsors to employ this innovation. In 2005 January Wal-Shop's CIO expressed about utilizing this innovation come about as a part of 26 percent decrease in deficit stocks in the shops with this technology utilization, and shortage of things which will be renewed thrice speedier than the things which are not RFID marked . Bill McBeath in April 2013 uttered merchants to make it devise in shops so that it will be simple for buyers to purchase at anyplace, get at anyplace, and to give back at anyplace. An ease wise shopping that helps the client to look and select items and illustrate the client on any extraordinary offers accessible on the products as they walk through out in the Purchasing malls[4]. A framework that can examine fixed items in the purchasing space deploying the technology[5]. A framework was build to help a man in regular shopping regarding lessened time spent while buying[6]. A shopping basket was build with an Item Distinguishing Gadget that consists of a microcontroller, a LCD, a RFID reader , EEPROM, and ZigBee module. Acquiring item data will be done through a RFID reader on shopping basket, in the interim item data will be put away into EEPROM connected to it and this information will be send to central billing unit through ZigBee module. The central billing unit gets the cart data and EEPROM information and computes the aggregate sum of buying for those specific cart[7].RFID has enhanced deficit stock precision in stores drastically, by 20% 30%.JC Penney enhanced deficit stock exactness from 75% to 99% in classes utilizing the innovation. The execution of a system involving RFID allows the customer a new experience for Shopping. At the point when getting into the store, purchaser leads towards a shopping basket that has a mechanical framework on the steering bar that consists of a hand tap display , a customer programmed card and an item reader.

2.4 Analysis in RFID

In a paper, Alexander has revealed how accessible ID and RFID strengthen effectiveness in building systems, changing the gain of an organisation and significantly building quality of consumer supervision. This advancement reviewed strengthening safety against robbery, lowering loss and smooth running of aligning strategy. Marking at the device proportion are unique favourable circumstances in products getting, inventory and payment in realistic cash becomes faster and further effective thereby additional benefits are made, for instance, customer administration.

A significant point can be solved by this innovation is that items which are out of supply , products not seeked at moment as of misty when and where amount of were in deficit supply with case of update .Thus by employing of this advancement in 21 different associations in diverse businesses, it was presumed that there will be four basic benefits of transformation by adapting this technology : decrease in the amount of work , less intervals of time spent , less supervision and low degree of failures. In a review, Roh says that he trusts that there are three elements which effect when associations opt to accomplish this technology ; the foremost is interest from consumers , suppliers , the second is the benefits expected from the RFID into usage, price grants by low robbery, short requisite for effort and hardware prices, and a directpath in the inventory chain and the final component is that modern firms types . It covers how the development of RFID tags creation is advancing repeatedly ,becoming much lower in size , the enhanced instruction restriction and decrement in prices.

2.5 RFID Usage Challenges

Effective RFID usage system requires some serious energy and effort. An undeniable framework execution in a vast assembling organization can cost \$10 to \$25 million. This advancement handles different implementation tests. The real problems involve alteration in growth, global embedding , management controls and price.A framework will be set in all the trolleys and this consists of a RFID reader. Each item in the shopping center should be provided with RFID labels. The moment the consumer places the objects in the cart , the corresponding cipher is identified and also the cost of the respective commodities are saved in the storage unit. Likewise by go on placing the items , the prices are computed and gets added to whole amount. Like this way the computing takes place in the cart itself. Commodity particulars are exhibited on the LCD. In the same way the commodity label and the price will be reported through earphones.Near the payment centre the whole invoice info is switched to Personal Computer via secret Radio frequency units[9].It also additionally talked about the improvement of showcasing implementations .

Tabel 2.4 shows the comparison of various automatic identification systems in terms of different parameters.

Tabel 2.4 Comparison of Auto-ID systems

Parameters	Barcode	OCR	Biometric	Smart Card	RFID
Typical. Data Capacity	1~100	1~100		16~64k	16~64k
Data density	Low	Low	High	Very high	Very high
Readability by people	Limited	Simple	Difficult	Impossible	Impossible
Reading speed	Low	Low	Very low	Low	Fast
Reading distance	0~50cm	< 1 cm	0~2m*	Contact	0~30m
Cost of readers	Very low	Medium	Very high	Low	Medium
Unauthorized copying / modification	slight	slight	Impossible **	Difficult	Difficult
Influence Factors					
Dirt / damp	Very high	Very high	--	Possible	No influence
Covering	Totally fail	Totally fail	Possible	--	Very low
Direction and position	Low	Low	--	Unidirectional	Very low

2.6 The Advancement of RFID

RFID is a developing innovation that has been around since mid 1900's and was utilized as a part of World War II. A preliminary analysis had inspected work based on innovation which expressed that Obviously, significant innovative work must be done before the field of valuable applications. At that point, the electromagnetic hypothesis identified with RFID had already been read in 1960's. Apart from them, it notifies about the Newly initiated radio frequency identification devices occurred in that time. At this point, the RFID growth had begun twisting. 1960's had been the begin of the revolution in business exercises. A perceptible change of service around there had happened in 1970's. By 1980's, innovation had come to fruitful. The organizations which started utilizing this innovation was seen as a part of 1990's. The stride of improvements is too clear in the 21st century enhancing the fitting of RFID labels to that of different products.

2.7 Innovation improvement

At first look, it creates the impression that the innovation is retaining its significance with no trouble because it might be a basic innovation, but however in fact it will have its cons. This is an innovation that ranges crosswise over assorted zones like CMOS outline, information administration, encryption, radio spread, sensor configuration and combination, system designing.

RFID innovation makes utilization of segments like labels and readers (ordinarily associated with a host PC or system). The RFID labels are assembled utilizing silicon chips and radio waves. In light of being classified as dynamic or detached, RFID labels are controlled by a storage cell or will initiate up by the radio signals radiated through a specific reader separately . The data accumulated by a RFID investigative specialist from a RFID tag is put away utilizing a database framework . A capacitor situated in the circuit of the Radio tag is charged by the energy discharged from the reader and therefore is utilized to transmit the tag information to the reader . Choice amid dynamic along with detached labels deployed is a urgent segment of a compositional plan procedure. Engineering outline of the RFID system is entirely fundamental with regards to improvement of a RFID framework. Regardless of the sorts of segments utilized as a part of a RFID framework, the RFID framework execution is assessed in view of the way effectively tracing items . Even the RFID tags which can withstand high temperature and are resistant to liquids and metals are also being developed. It is pivotal to create system that can scale in size . It was reasoned that with RFID flawlessly rising as the new inventory network standard, the open door is gigantic in this business sector. It demonstrated that If a trading is going to triumph of labels , all should initially see in such a way that the innovation assisted their matters and should choose equipment and software in such a way to their trading which would be flexible for future development. Even the expiry date of the products can also be included with the products information like quantity, price etc.

2.8 Misuse of range

For RFID applications, the accessible range of frequencies is entirely restricted. In addition, it is dealt with or rather assigned by various national and in addition territorial administrative powers. Furnished with this constrained transmission capacity and the differences of working periods , the respective conventions between the readers along with labels need to use the accessible range effectively . With time, as more RFID frameworks are actualized, the accessible data transmission gets to be over-used and impacts amongst readers and between labels get increased, bringing about performance to a low grade. In order to consign that type of affairs , investigation is continuous in the regions of label hostile to crash conventions . Concurrent communication in RFID frameworks head to crashes as the readers along with labels work on the common remote passage . In this manner, impact assertion for RFID labels is a noteworthy issue for quick identification. The crash issue happens in signal transmission from reader to labels or viceversa which hardly induces identification. Subsequently it turns into a key issue to build up a excellency against impact convention in order to minimize crashes in this zone .

The crash issues might be outlined into label impact issues and the reader impact issues . In genuine useful RFID frameworks, the previous happen more frequently than the later. The label impact issues are further sub-separated into dynamic label crashes and more confused distant label impacts. Since, the low-utilised detached labels can't distinguish impacts or make sense of neighboring labels, it is of incredible criticality to build up a label against crash convention enhancing the ID capacity of RFID frameworks.

2.9 Applications and client appropriation

A remarkable section of the literature promotes the advantage and price reduction that the firms procure through executing RFID, from perceptibility through supply chains and quicker scrutinizing of inward commodity.

Figure 2.4 depicts to a pictorial view of the RFID technology which is received all over the planet which has been taken from the data examining review in particular Clothing RFID, (IDTechEx, 2009-2019) .

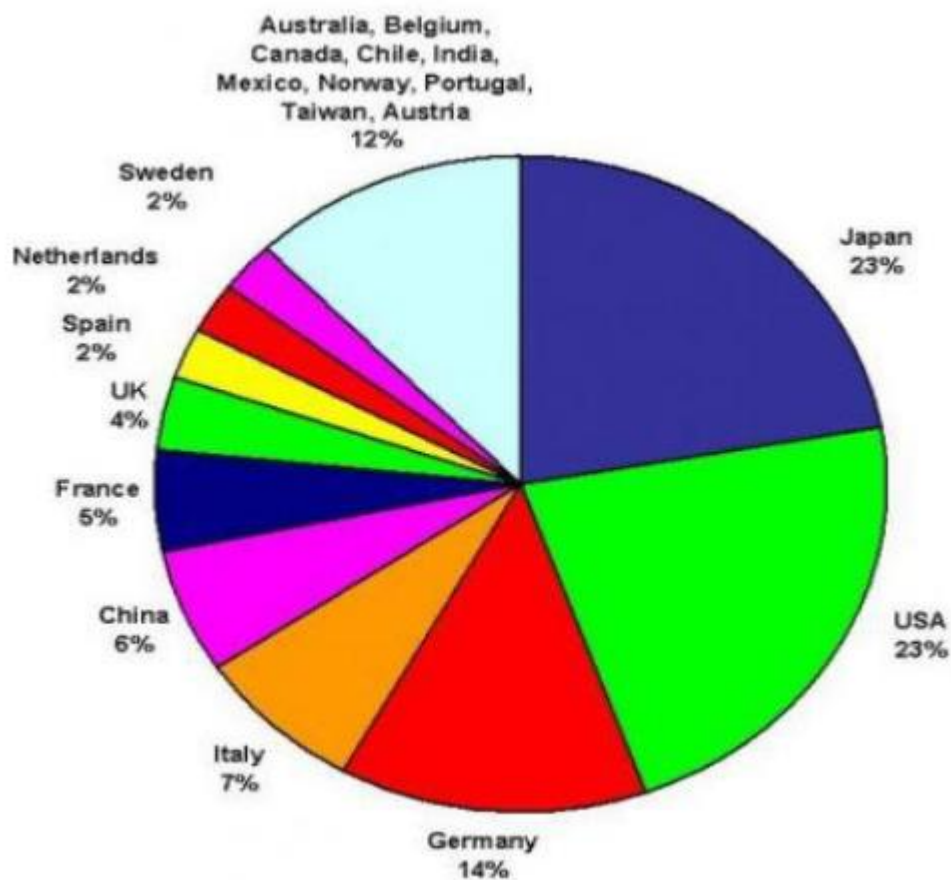


Figure 2.4 Adoption of RFID Technology across the world

It elucidates different organisations in whole directing the planet and are presently using this technology as depicted in percentages. It furtherly mentions that the advantages are intense and colossal from enhancing client administration and productivity – including diminishing stock outs - to lessening falsifying, robbery and scattering and robotizing sorting procedures and stock takes. As per the most recent 2009-2019 RFID TechEx statistical surveying review , An expansive number of real brands are working together to make the procedure consistent, from tiny assembling to large deal in the store and even later use for overseeing client returns and other activity like the checkout. The selection in this business sector must be done on by customer request. Purpose for this is clear as including in any effective RFID application need to remember the client's perspective. It also portrays the possible enterprises for RFID and comprising amid divided price and seclusion. Further an practical analysis on the client conception about technology is explained . Scope for many more features like reading products name and cost and storing data for further purchasing can be included in future days. Suggestions can also be given to the customers based on their shopping history.

2.10 Research gaps

The innovative improvement parts of technology indicated atop despite the fact which would demonstrate that the innovation has progressed significantly yet at the same time it needs to vitally concentrate on resuscitating the structural configuration of a RFID technology that can scale in size as per the evolving needs. Broad measure of work has been done in the current writing on RFID anticollision conventions to enhance the execution of RFID frameworks, yet not very many observational examinations have been made in the same connection with a specific end goal to evaluate the advantages of the Cipher Isolation . Despite the fact , a large amount of considerable quantity of work has been done by identifying with the performance of RFID frameworks .There will be some compelling issue to address this vital execution concern of frameworks. In the writing, regardless of much research being done on the information administration viewpoint in RFID frameworks, the concern of fault indications or taking care of vulnerability in RFID information is not tended to from the perspective to include this present reality instabilities connected with the RFID information but these may assist help keeping in mind the end goal to reach all the more semantically ultimate goals for more prominent purposes. Also, from the primary passage of this writing , it is entirely clear that bulk and rapidity of information will transcend the limit of prevailing innovation base. Thus, there is no need to offer a design that is not fit for overseeing advanced RFID information but rather additionally can oblige

the arrangements of existing RFID issues thinking about genuine vulnerabilities. Also, in that is a enthralling urge to convey this concern in to the brilliance and to strive for gathering of the development at a more broad magnitude. Further it concentrates on the innovation being developed all over the world for a various arrangement of uses. Likewise on the identical hand , it shows the interest of customers which might comprise the buyer of the innovation for its advancement along with ample extensive utilization. Likewise usage expenses also need to be considered along with frameworks, it requires an interest to spare that danger before genuine performance of the composed framework.

2.11 Value Execution concern

As we probably aware right now in investigation with standardized identification marks, RFID labels are still a great deal of highcost . The unit cost for standardized tags is just couple of pennies and it can even be printed specifically to the item bundles or boxes. The RFID labels will cost 60~80 pennies now. For dynamic RFID labels, the expense could achieve couple of thousand USD dollars.

There is a major value between these two arrangements now. Despite the fact that RFID has advantages when compared to the scanner tag , label expense is the real scenario when comes toward the business selection. In the mean time, the framework implantation cost incorporates the equipment and programming are a major costs for the organizations. As far as business applications, the basic attentiveness toward the implementation are the label cost as well as its exhibitions it can reach. For example the RFID labels utilized as a part of social interest are those which can diminish the destructive mistakes by human operation. The disappointment costs because of these sorts of mistakes could cost a huge number of USD Dollars .Through the RFID implementation , the danger for these mistakes can be lessened by accurately checking the data stream .

CHAPTER 3 METHODOLOGY

3.1 System Overview

The proposed system in this thesis will be implemented into two parts . First part is the initialization of the Raspberry Pi for the set up of RFID Reader and Zigbee . Second part is the tag detection of products by RFID Reader which are placed in the cart and sending of product information from cart to Central billing unit through Zigbee. The overview working of this system is - This proposed system works as on customer getting into the mall she/he first takes a trolley. Every cart is connected with a RFID reader ,a microcontroller and LCD screen. When the customer starts dropping products into the trolley, tags will be read by the reader and the reader sends the information to the microcontroller.The microcontroller compares the information with the data

already stored in it. If the data matches then the cost of that product will be displayed on the LCD screen for user . If the user wish to remove any product from the cart then they can take away that product from trolley and cost of that particular product will be subtracted from the total amount instantaneously and after shopping the products data with total amount gets transmitted to the central billing system through zigbee. The RFID Reader will be placed in the mid position on the base/bottom inside the trolley. The cart is designed in such away that the outerpart of the trolley will be covered with RF(Radiofrequency) shielding in order to make sure that the RFID reader will not read any products associated with tags outside the cart.

Figure 3.1 shows the block diagram of proposed system in which reader is connected to Raspberry Pi which in turns gets connected to LCD and Zigbee which then sends billing information to Central Billing unit

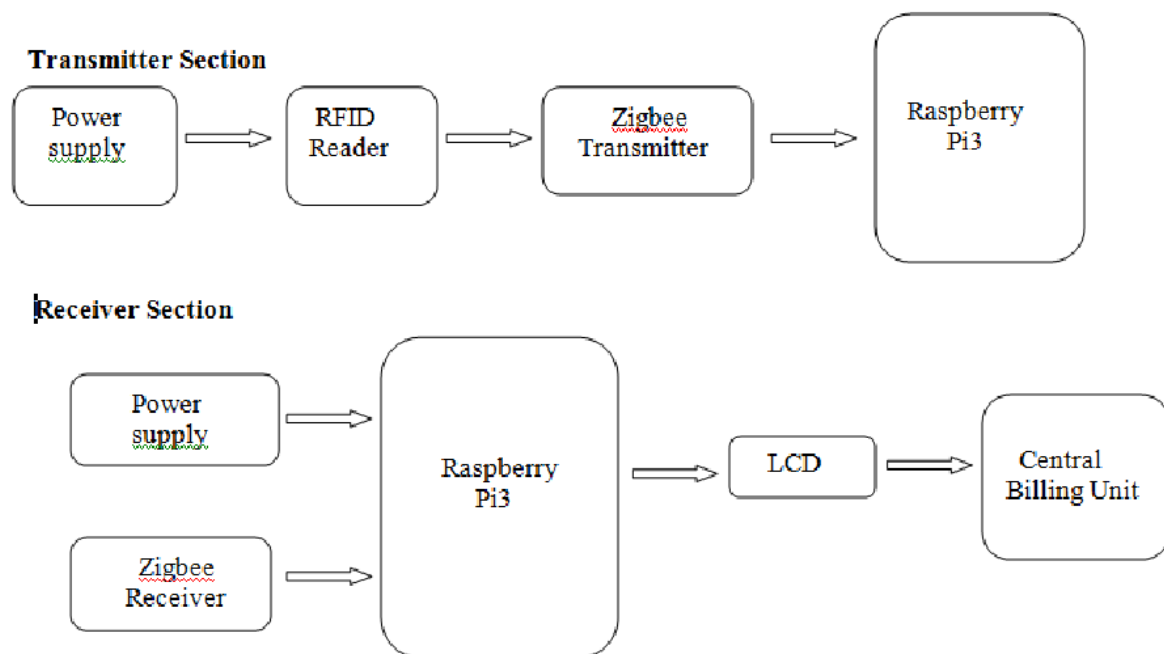
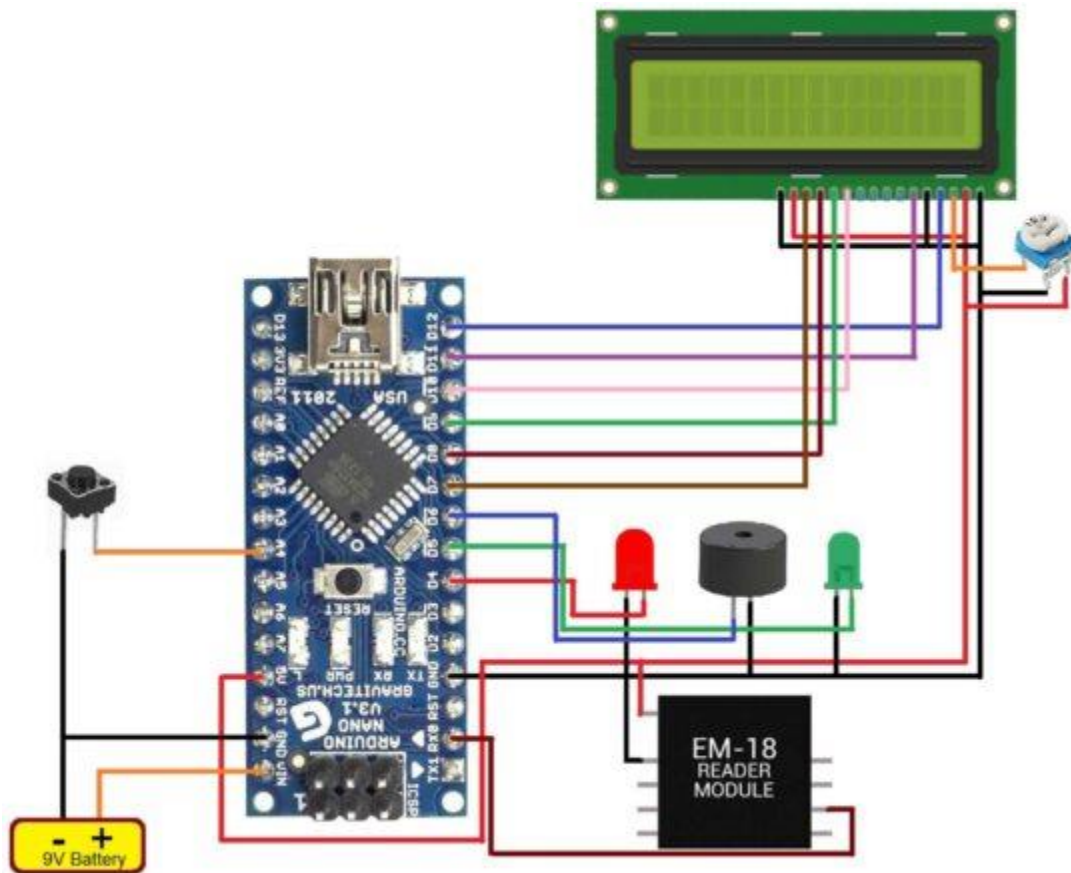


Figure 3.1 Block Diagram

At the transmitter section the reader detect the tags and sends the data to Raspberry Pi which then compares it with the data stored in it and displays on the LCD Screen attached to it. The zigbee transmitter sends the information displayed on LCD. Zigbee receiver present at the Central Billing unit finally prints the data sent by the Zigbee transmitter.

3.2 Schematic Design



3.3 Flowchart depicting the working of proposed model

In Figure 3.3 the flow chart of the proposed system is shown. It states that after initialising the system the reader will scan for RFID tags. If RFID tag is found reader reads the tag and sends the information to microcontroller which then compares it with data stored in memory. If the tag matches with the data stored it will display data on the LCD. If items keep on adding it goes on adding to the total amount. If item from trolley is removed then it deducts cost of that specific item from total amount. Then after adding of items is done total amount is send to Central billing unit .

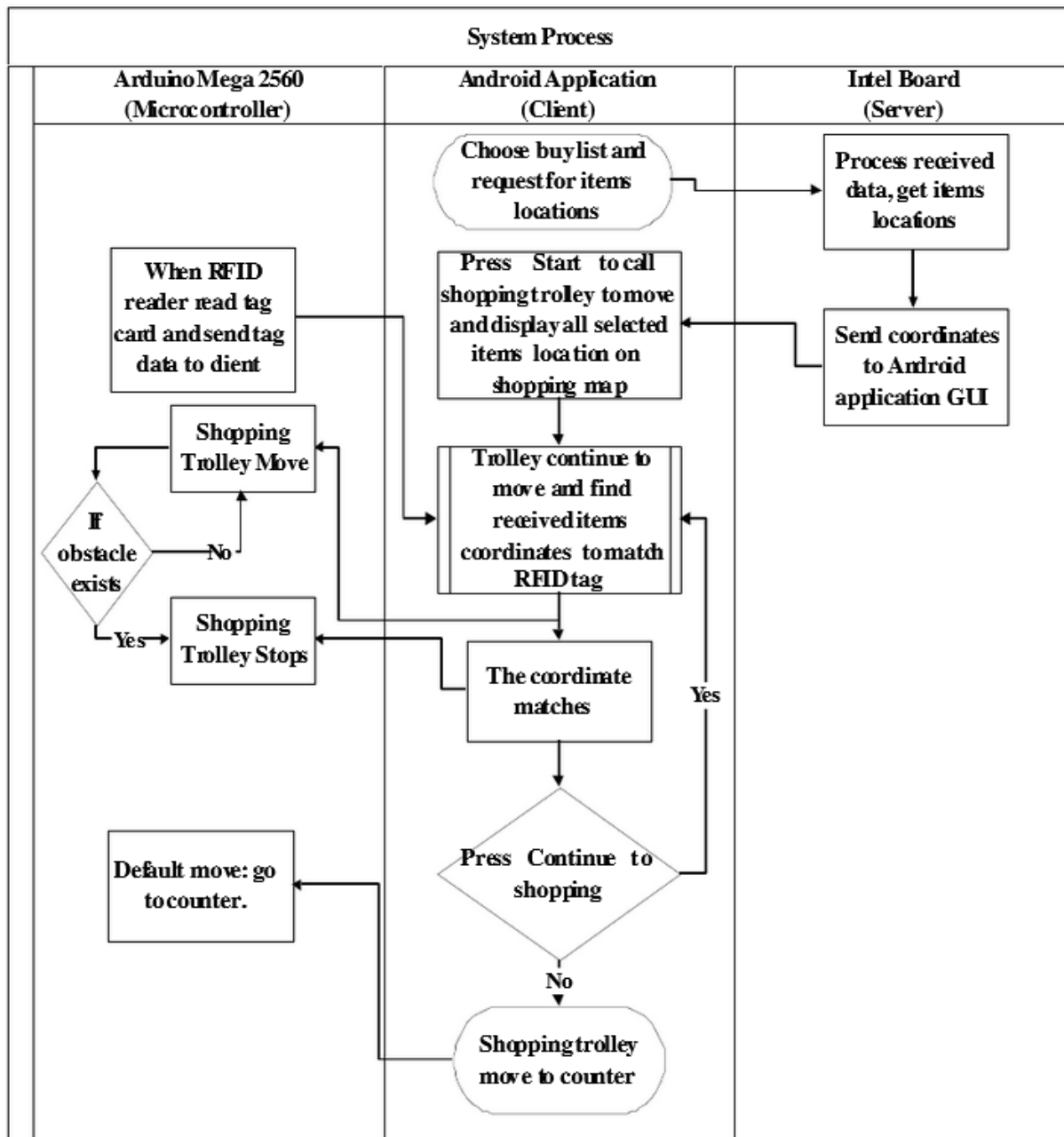
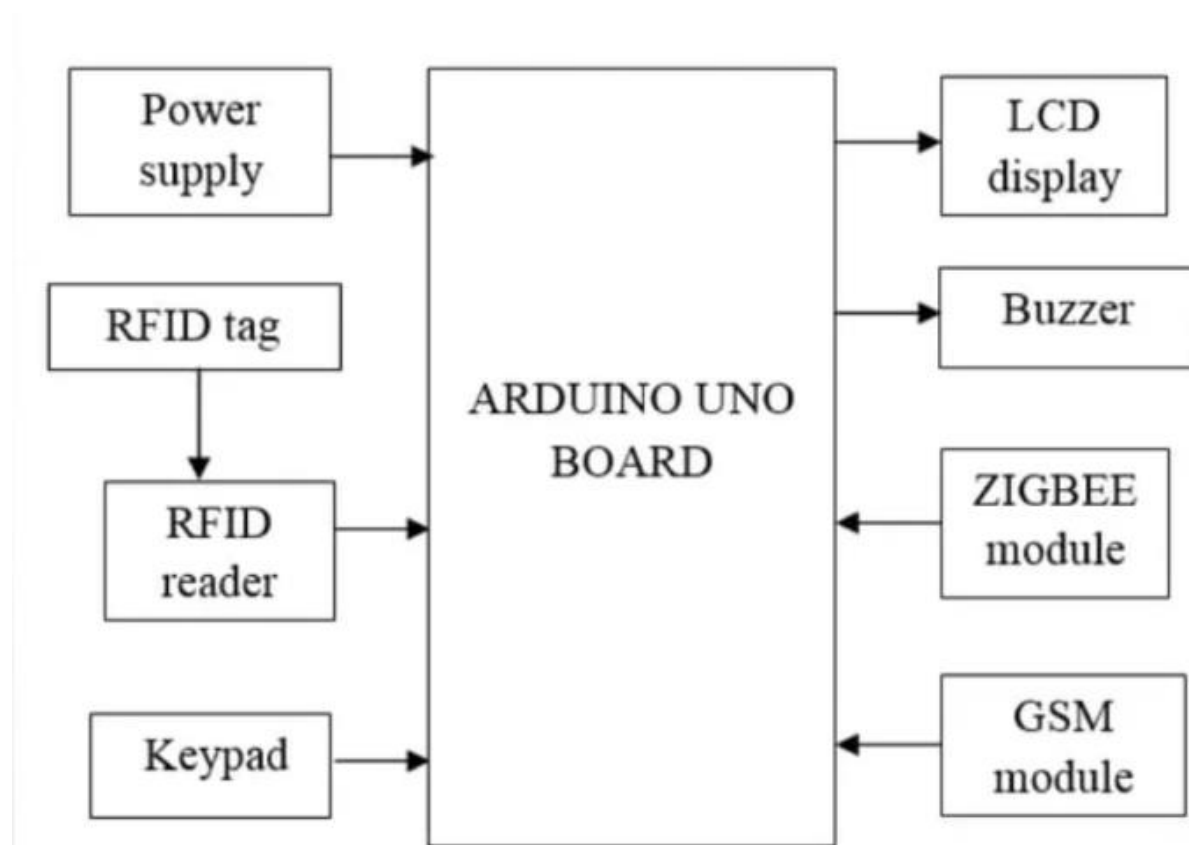


Figure 3.3 The flow chart of the proposed system

3.4 Hardware Specifications

An RFID tag (of frequency 125khz) is attached to every product in the mall and the reader (EM-18) is attached to the trolley. At the time of purchase, the tag attached to the product is scanned by the reader. Each tag has a unique EPC. Based on the EPC received by the Arduino, the information of the product is displayed on the LCD along with the updated cost. This information is also sent to central PC with the help of HC-12 transmitter at the trolley and HC-12 receiver at the PC. If the customer wants to remove the added product, the product should be scanned again. Then the cost of the corresponding product will be deducted from the bill. The push button is

provided at the trolley to indicate the end of the shopping. On pressing of push button, the final bill is displayed on the LCD and the payment through precharged card can be done. Recharged cards are unique RFID tags provided for each customer. These cards contain the information such as the customer identification number and the balance available in the card. By scanning precharged cards, payment is done at the trolley itself. Finally, LCD shows the balance available in their card. This whole information is available on the serial monitor of central PC TRANSMITTER.



3.5 ARDUINO UNO

Arduino is an open-source REF stands for Analog Reference. It is sometimes, used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins. electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments.

Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be

stand-alone or they can communicate with software on running on a computer (e.g. Flash, Processing, MaxMSP). Arduino received an Honory Mention in the Digital Communities section of the 2006 Ars Electronica Prix. Credits .

Arduino Nano overview:

Arduino Nano is a surface mount breadboard embedded version with integrated USB. It is a smallest, complete, and breadboard friendly. It has everything that Diecimila/Duemilanove has (electrically) with more analog input pins and onboard +5V AREF jumper. Physically, it is missing power jack. The Nano is automatically sense and switch to the higher potential source of power, there is no need for the power select jumper. Nano's got the breadboard-ability of the Boarduino and the Mini+USB with smaller footprint than either, so users have more breadboard space. It's got a pin layout that works well with the Mini or the Basic Stamp (TX, RX, ATN,HC-12 Receiver module USB to TTL Converter PC GND on one top, power and ground on the other). This new version 3.0 comes with ATMEGA328 which offer more programming and data memory space. It is two layers. That make it easier to hack and more affordable. You end up paying less with Nano than Mini and USB combined!

Specifications:

Microcontroller	Atmel ATmega328
Operating Voltage (logic level)	5 V
Input Voltage (recommended)	7-12 V
Input Voltage (limits)	6-20 V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	8
DC Current per I/O Pin	40 mA
Flash Memory	32 KB (of which 2KB used by bootloader)
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz
Dimensions	0.70" x 1.70"

Features:

- Automatic reset during program download
- Power OK blue LED
- Green (TX), red (RX) and orange (L) LED
- Auto sensing/switching power input
- Small mini-B USB for programming and serial monitor
- ICSP header for direct program download
- Standard 0.1" spacing DIP (breadboard friendly)
- Manual reset switch.

Power:

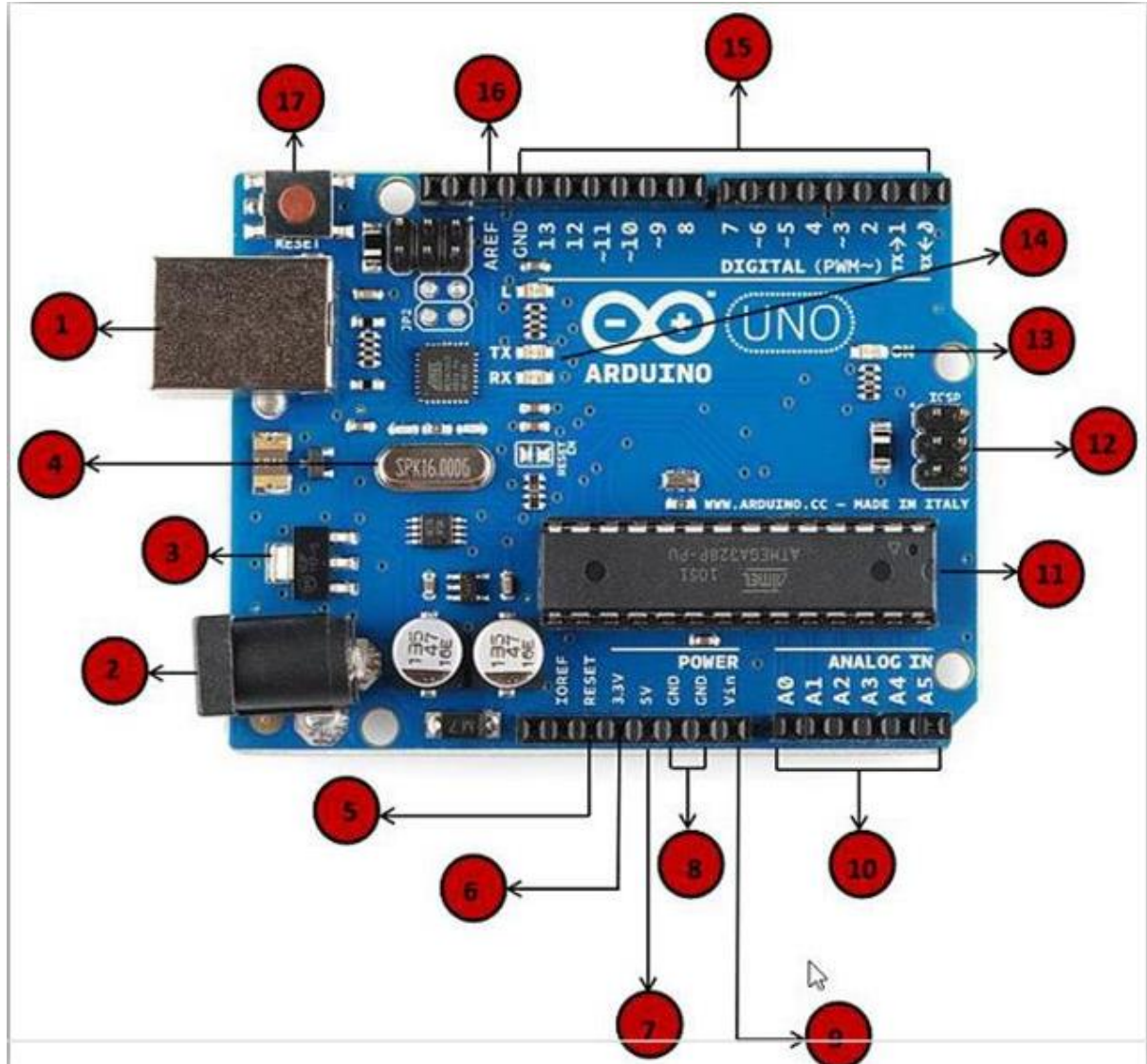
The Arduino Nano can be powered via the mini-B USB connection, 6-20V unregulated external power supply (pin 30), or 5V regulated external power supply (pin 27). The power source is automatically selected to the highest voltage source.

The key features are –

- Arduino boards are able to read analog or digital input signals from different sensors and turn it into an output such as activating a motor, turning LED on/off, connect to the cloud and many other actions.
- You can control your board functions by sending a set of instructions to the microcontroller on the board via Arduino IDE (referred to as uploading software).
- Unlike most previous programmable circuit boards, Arduino does not need an extra piece of hardware (called a programmer) in order to load a new code onto the board. You can simply use a USB cable.
- Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program.
- Finally, Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package.

BOARD DESCRIPTION:

3.5.1 Arduino board description



	Power USB Arduino board can be powered by using the USB cable from your computer. All you need to do is connect the USB cable to the USB connection (1).
	Power (Barrel Jack) Arduino boards can be powered directly from the AC mains power supply by connecting it to the Barrel Jack (2).
	Voltage Regulator The function of the voltage regulator is to control the voltage given to the Arduino board and stabilize the DC voltages used by the processor and other elements.
	Crystal Oscillator The crystal oscillator helps Arduino in dealing with time issues. How does Arduino calculate time? The answer is, by using the crystal oscillator. The number printed on top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or 16 MHz.
	Arduino Reset You can reset your Arduino board, i.e., start your program from the beginning. You can reset the UNO board in two ways. First, by using the reset button (17) on the board. Second, you can connect an external reset button to the Arduino pin labelled RESET (5).
	Pins (3.3, 5, GND, Vin) • 3.3V (6) – Supply 3.3 output volt • 5V (7) – Supply 5 output volt • Most of the components used with Arduino board works fine with 3.3 volt and 5 volt. • GND (8)(Ground) – There are several GND pins on the Arduino, any of which can be used to ground your circuit. • Vin (9) – This pin also can be used to power the Arduino board from an external power source, like AC mains power supply.
	Analog pins The Arduino UNO board has six analog input pins A0 through A5. These pins can read the signal from an analog sensor like the humidity sensor or temperature sensor and convert it into a digital value that can be read by the microprocessor.

	Main microcontroller Each Arduino board has its own microcontroller (11). You can assume it as the brain of your board. The main IC (integrated circuit) on the Arduino is slightly different from board to board. The microcontrollers are usually of the ATMEL Company. You must know what IC your board has before loading up a new program from the Arduino IDE. This information is available on the top of the IC. For more details about the IC construction and functions, you can refer to the data sheet.
	ICSP pin Mostly, ICSP (12) is an AVR, a tiny programming header for the Arduino consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often referred to as an SPI (Serial Peripheral Interface), which could be considered as an "expansion" of the output. Actually, you are slaving the output device to the master of the SPI bus.
	Power LED indicator This LED should light up when you plug your Arduino into a power source to indicate that your board is powered up correctly. If this light does not turn on, then there is something wrong with the connection.
	TX and RX LEDs On your board, you will find two labels: TX (transmit) and RX (receive). They appear in two places on the Arduino UNO board. First, at the digital pins 0 and 1, to indicate the pins responsible for serial communication. Second, the TX and RX led (13). The TX led flashes with different speed while sending the serial data. The speed of flashing depends on the baud rate used by the board. RX flashes during the receiving process.
	Digital I/O The Arduino UNO board has 14 digital I/O pins (15) (of which 6 provide PWM (Pulse Width Modulation) output. These pins can be configured to work as input digital pins to read logic values (0 or 1) or as digital output pins to drive different modules like LEDs, relays, etc. The pins labeled “~” can be used to generate PWM.
	AREF AREF stands for Analog Reference. It is sometimes, used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

3.6 RFID Reader

The RFID Reader selected for this project is uhf rfid of model YR9010. It's dimensions are as 120x85x20mm. It works in the frequency range of 902 Mhz-928 Mhz or either in the range of 865Mhz-868Mhz. It works with the voltage of 3.5V-5V and the output power will be in the scope of 0dbm-26dbm. It is a multiconnector and can communicate with the many interfaces like USB 2.0,RS232,Wiegand 26 and Wiegand 34. It can read up to 50 tags/sec depending on antenna, tag and application. It's reading capability varies from 10cm-3m depending on tag, antenna and implementation. It has a communication baud rate of 115200bps(default) and operating current will be 180mA at 3.5V (26dBm output,25°C) and as 110mA at 3.5V (18 dBm output,25°C).It can be used as Desktop reader and also as a entry guard machine.

Figure 3.11 shows the RFID Reader and its peripherals which is used in our proposed system.



Tabel 3.1 Description of Reader pins

PIN	Definition	Explain
1	+9V	External 9 V power supply. (Note: can't connect the external power supply and USB at the same time.)
2	GND	With + 9 v external power supply common grounding.
3	RS-232 TXD	RS-232 data output.
4	RS-232 RXD	RS-232 data input. .
5	GND	With RS-232 connector common grounding.
6	GPIO3	GPIO3 or <u>WiegandData 0.</u>
7	GPIO4	GPIO4 or <u>WiegandData 1.</u>
8	GND	with <u>Wiegand Data</u> common grounding.

3.6.1 Reader Set Up

The RFID reader is first tested using the SDK (software development kit) provided by YR9010 reader itself which helps in testing and debugging. The SDK is compiled in C# language. Its firmware version is 1.9. The RFID reader besides RS232 also supports connecting through RS 485 and wireless connection through ethernet using TCP/IP protocol. This project is taking UHF RFID reader as the read range required is less than one meter depending on cart dimensions . The SDK has option to select the COM port for RS232 connection and to set the baud rate for the reader. The default baud rate of the reader is 115200. Through this SDK we can select GPIO, set RF output power and frequency. The Fig 3.8 is a picture of the SDK and how to use it. For this experiment COM port 1 has been connected to the reader and the baud rate through which computer is connected is 115200, which is written in the code. The RF output power can be set from 10-26 dbm. This reader is connected with USB to the RaspberryPi Board.

3.6.2 Tag testing

The testing of tag is done in the SDK in the Tag inventory in real mode, there are two modes for the testing, one is the caching pattern and another is the real time mode. For the cache pattern namely, firstly, put into reader the cache after reading the tag number of EPC ;finally ,to upload multiple EPC data together when needed. The real time mode immediately uploads after reading the tag number of EPC, and recognises next tag after the data uploaded finished. Real-time model has quick response of advantage, the user can get the label data in the first time with no delay. And can get real-time tag at different times and different locations of RSSI (tag signal strength indicate), frequency parameters (read tag carrier frequency). The Fig 3.13 shows that five tags have been read Serial Monitor: this monitor shows the incoming and outgoing signals (hexadecimal codes) for each task being performed. The codes appear in two color blue and red. Blue is for the bytes that are going to the reader from the computer i.e the command the user is giving and red is the response packet from the reader in reply to the command.

3.6.3 Working and testing

The main steps involved in testing of the system is:

- Sending data to the reader
- Receiving data from the reader
- Sending data to the reader: As the reader can understand only hexadecimal values, an array of data is initialized to turn the antenna ON and send data i.e.; `request[7] = {0xA0,0X04,0X01,0X89,0X01,0XD1,0X00};` . Similarly, different arrays of each tag were initialized and stored.
- Receiving data from the reader: As the reader receives the signal, it responds by sending an array of data, the one which is stored in the buffer. For this project only the unique ID of the tag is being stored in the program, which were read during the reader configuration and tag testing process.

3.7.1 LCD (LIQUID CRYSTAL DISPLAY):

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels. It is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other.

The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other.

Types of LCDs include:

- Twisted Nematic (TN)- which are inexpensive while having high response times. However, TN displays have low contrast ratios, viewing angles and color contrasts.
- In Panel Switching displays (IPS Panels)- which boast much better contrast ratios, viewing angles and colour contrast when compared to TN LCDs.
- Vertical Alignment Panels (VA Panels)- which are seen as a medium quality between TN and IPS displays.
- Advanced Fringe Field Switching (AFFS)- which is a top performer compared IPS displays in colour reproduction range. Many microcontroller devices use 'smart LCD' displays to output visual information. LCD displays designed around LCD NT-C1611 module, are inexpensive, easy to use, and it is even possible to produce a readout using the 5X7 dots plus cursor of the display. They have a standard ASCII set of characters and mathematical symbols. For an 8-bit data bus, the display requires a +5V supply plus 10 I/O lines (RS RW D7 D6 D5 D4 D3 D2 D1 D0). For a 4-bit data bus it only requires the supply lines plus 6 extra lines(RS RW D7 D6 D5 D4). When the LCD display is not enabled, data lines are tri-state and they do not interfere with the operation of the microcontroller.

FEATURES:

- (1) Interface with either 4-bit or 8-bit microprocessor.
- (2) Display data RAM
- (3) 80x 8 bits(80 characters).
- (4) Character generator ROM
- (5). 160 different 5 7 dot-matrix character patterns.
- (6). Character generator RAM
- (7) 8 different user programmed 5 7 dot-matrix patterns.
- (8)Display data RAM and character generator RAM may be Accessed by the microprocessor.
- (9) Numerous instructions
- (10) Clear Display, Cursor Home, Display ON/OFF, Cursor ON/OFF, Blink Character, Cursor Shift, Display Shift.
- (11). Built-in reset circuit is triggered at power ON.
- (12). Built-in oscillator.

3.7.2 Key Variables

Tabel 3.2 details the key variables of LCD with their respective descriptions.

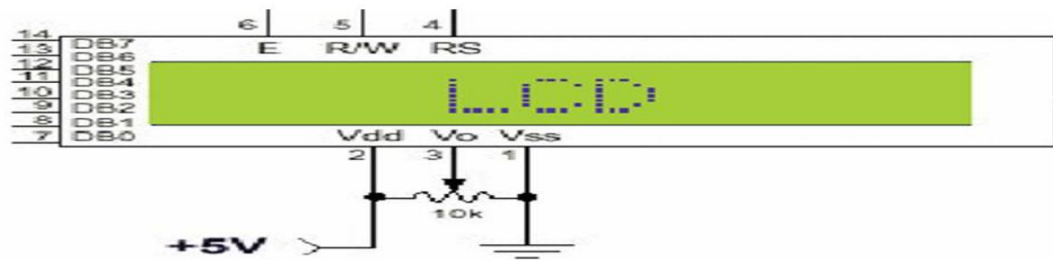
Tabel 3.2 Key variables of LCD

LCD Type	TFT
LCD Interface	SPI
Touch Screen Type	Resistive
Touch Screen Controller	XPT2046
Colors	65536
Backlight	LED
Resolution	320*480 (Fixel)
Aspect Ratio	8:5
Power Consumption	TBD
Backlight Current	TBD
Operating Temp. (°C)	TBD

3.7.3 Pins Description

Tabel 3.3 shows the description of various pins with their respective pin numbers and symbols.

Tabel 3.3 Description of LCD pins



PIN NO.	SYMBOL	DESCRIPTION
1, 17	3.3V	Power positive (3.3V power input)
2, 4	5V	Power positive (5V power input)
3, 5, 7, 8, 10, 12, 13, 15, 16	NC	NC
6, 9, 14, 20, 25	GND	Ground
11	TP_IRQ	Touch Panel interrupt, low level while the Touch Panel detects touching
18	LCD_RS	Instruction/Data Register selection
19	LCD_SI / TP_SI	SPI data input of LCD/Touch Panel
21	TP_SO	SPI data output of Touch Panel
22	RST	Reset
23	LCD_SCK / TP_SCK	SPI clock of LCD/Touch Panel
24	LCD_CS	LCD chip selection, low active
26	TP_CS	Touch Panel chip selection, low active

3.8 RFX240 Zigbee Module

RFX240 is minimised to a greater extent to supply all suitability of transfer of power intensification for IEEE 802.11b/g/n implementation in the 2.4GHz frequency range . It produces a gain of 30db and a range of +26dbm of linear output power with low EVM of less than 3percent for 802.11n MCS7 HT40 signals. It has argument control for CMOS, input impedance matching for on chip along with mixed RF decoupling for the electricity supply. It is constructed in a optimised 3.0x3.0mm 16L-QFN package. It requires less outward elements to significantly make easier the RF Front end implementation. In this project we have connected one zigbee to the USB port of Raspberry Pi and other Zigbee to the USB port of PC which acts as Central billing unit.

Figure 3.17 shows the RFX240 Zigbee Module which is used in our proposed system.

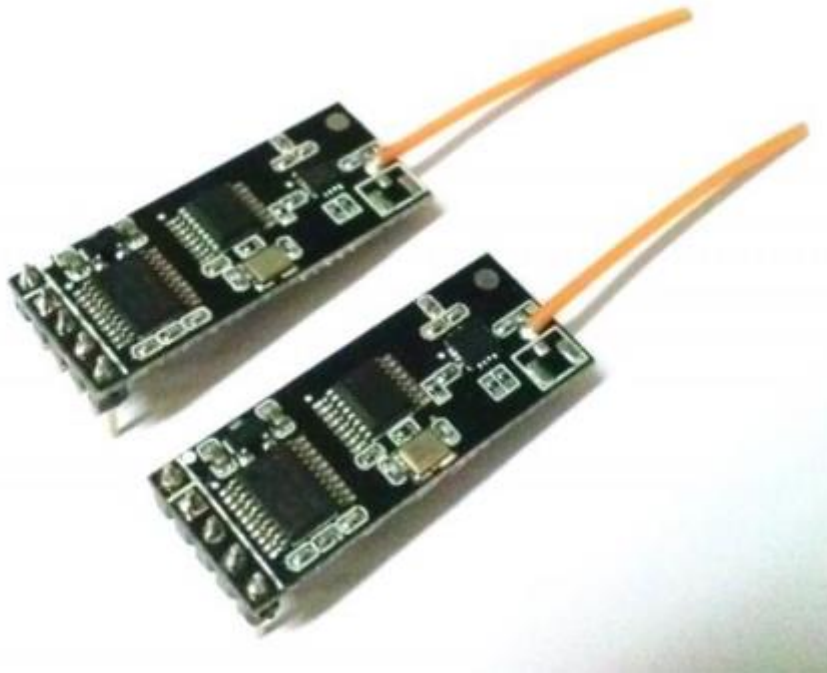


Figure 3.17 RFX240 Zigbee Module

3.8.1 Applications

- Excessive power WLAN AP/Routers
- Exterior WLAN Hotspot
- Set-Top Box/Home Gateway
- Wi-Fi Extenders
- Wi-Fi Electronic devices
- Enterprise/SOHO Wi-Fi Networks

3.8.2 Features

- Very Less DC power Consumption
- DC Decoupled RFports
- 50 ohm input/output matching
- Very less External Elements required
- Consistent with low voltage(1.2V) CMOS control logic levels or levels upto VDD
- High gain of 30db
- ESD Protection circuitry on all ports
- Mixed power indicator for transfer of power monitoring and control
- Great transfer signal proportionality meeting standards for OFDM/CCK Modulation.
- Inward RF decoupling on all VDD bias pins

3.8.3 Device Pin-Out

Figure 3.18 shows the internal connection of Zigbee module with their respective Pins

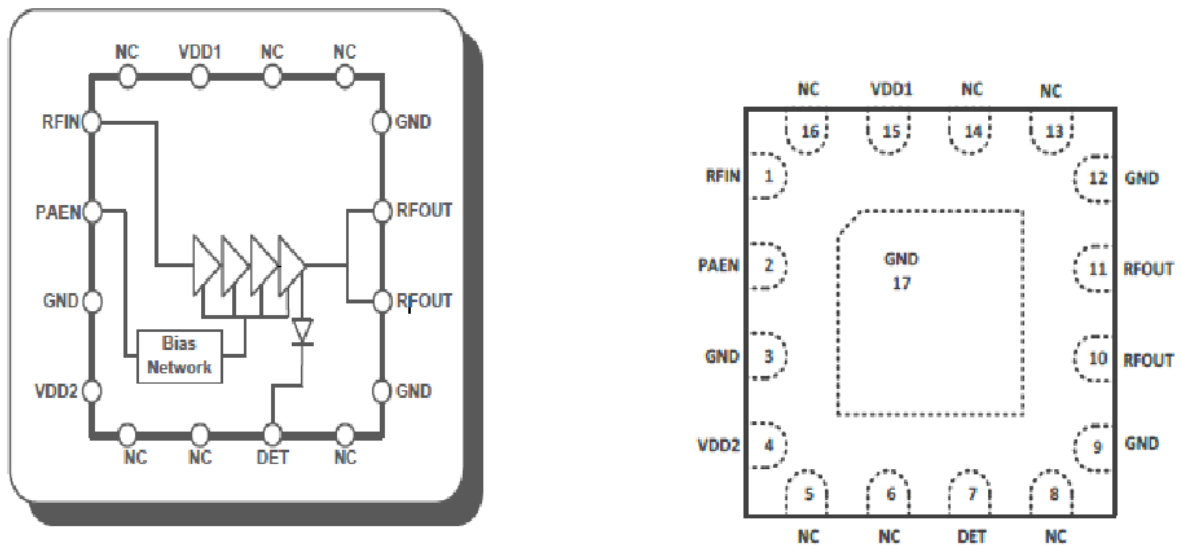


Figure 3.18 Pin out diagram of Zigbee

3.8.4 Device Pin-out Description

Tabel 3.4 shows the description of various pins with their respective pin names and pin numbers.

Tabel 3.4 Description of Device pins

Pin Number	Pin Name	Description
1	RFIN	RF Input Signal to the PA – DC Internally Shorted to GND
2	PAEN	CMOS Logic Control to Enable the PA
3, 9, 12, 17	GND	Ground – Must be Connected to Ground in the Application Circuit
4, 15	VDD1, VDD2	DC Supply Voltage
7	DET	PA Power Detector Voltage Output
5, 6, 8, 13, 14, 16	NC	Not Connected Internally
10, 11	RFOUT	RF Output Signal from the PA

- VDD : 3.3V or 5V power supply positive
- GND : power negative
- TXD : serial output module connected to microcontroller or USB to serial TXD
- RXD : serial input module connected to microcontroller or USB to serial RXD
- CMD : enter upgrade mode or AT mode pin ,active low

3.8.5 Transfer Characteristics

VDD = 5.0V, PAEN = HI, TA = +25°C, unless otherwise specified, as measured on the RFX240 (evaluation board, de-embedded to the device.)

Tabel 3.5 shows the properties which detail the gain and loss of different input and output parameters along with their respective types, units, minimum and maximum values and their working conditions.

Tabel 3.5 Transfer Properties of Zigbee Module

Parameters	Min	Typ	Max	Units	Conditions
Operating Frequency Band	2.4		2.5	GHz	All RF Pins Terminated by 50 Ohms
Output P1dB		+32		dBm	CW
Linear Output Power (802.11n)		+25.5		dBm	802.11n MCS7 HT20 <30dB DEVM
Linear Output Power (802.11b)		+26		dBm	1Mbps CCK Mask Compliance
Small-Signal Gain		30		dB	CW
Second Harmonic		-70		dBc	P _{OUT} = +29dBm, CW
Third Harmonic		-70		dBc	P _{OUT} = +29dBm, CW
Input Return Loss		-15		dB	At RFIN Pin
Output Return Loss		-5		dB	At RFOUT Pins
TX Quiescent Current		210		mA	No RF Input Signal
TX Linear Current		420		mA	P _{OUT} = +26dBm, 11n MCS7 HT20
Power Detector Voltage Output		0.2-0.9		V	5dBm to +27dBm, 10KΩ Load
Load VSWR for Stability (CW, Fix Pin for P _{OUT} = +29dBm with 50Ω Load)	4:1	6:1		N/A	All non-harmonically related spurs less than -43 dBm/MHz
Load VSWR for Ruggedness (CW, Fix Pin for P _{OUT} = +29dBm with 50Ω Load)	8:1	10:1		N/A	No damage

3.9 RFID Passive Tags

Figure 3.19 shows the various types of passive tags



Figure 3.19 Passive Tags

Passive tags are also known as Battery less tags. Price per each tag may vary few cents to ten or twenty euros depending on frequency, formfactor, packaging etc. This tags have no inward power generators and are driven by the electromagnetic energy supplied from the RFID Reader. The lesser price per tag makes availing RFID systems beneficial and inexpensive for many industries.

Applications

- Admittance Management
- Data Tracing,
- Contest Scheduling,
- Supply chain management,
- Elegant designing

3.9.1 Working

Usually three main parts constitute an Passive RFID system. They are

- i) RFID Reader
- ii) RFID antenna and
- iii) RFID tags

When Compared to active tags the standard passive tags have only two components.

They are:

- i) Tag Antenna and
- ii) Microchip or Integrated circuit(IC)

This standard structure is usually mentioned as RFID inlay.

As the name itself refers passive, these tags normally holdup for a signal from reader.

The Reader discharges energy to the antenna whereby the antenna converts that energy into radiofrequency waves which are thereby sent to the readzone. After the tag getting read with in the readzone ,the antenna which is present in passive tag gets energy from the RF waves. The energy there from the tag antenna moves to chip and produces a signal back to the system.This is called as backscatter. The backscatter or alter in electromagnetic or RF wave is identified by the reader (through the antenna) which interprets the data. Passive tags do not operate at all frequencies. Along with the frequency range there are many factors like readrange, materials attached ,type of application with the which the working gets influenced. There are three important frequencies with which passive tags operate. They are

Low Frequency(LF)

125-134-KHz- This is generally used for animal tracking as this will not be affected by water or metal mostly with a less range of about 1-10 centimeters.

High Frequency (HF) & Near-Field Communication (NFC)

13.56MHz- This is used for information transmits, entry control implementations, DVD stalks, passport defense implementations which do not require a long range with a general range of 1 centimeter to 1 meter .

Ultra High Frequency (UHF)

865 – 960 MHz – Passive UHF tags can read from a average distance of 5-6 meters but larger UHF tags can read up to 30+meters range in ideal conditions.This frequency is used for contest tracing, IT asset tracking, file and laundry management as they need more than meter of read range. Usually speaking the higher the frequency ,the more the problems with an RFID system as they have nonfriendly RFID materials like water, metal etc

3.9.2 Electronic Product Code (EPC)

The electronic product code(EPC) which is saved in tag's chip memory is written to tag and has form of 96 bit-string of information. In that the first eight bits are used to recognise the type of protocol, the next 28 bits relates the arrangement which manages the data for the tag, the next 24 bits are an object class which determine type of product, the last 38 bits are a distinct serial number for specific tag. The last two categories are set by organisation which issue tag. This total electronic product code number can be used as way into global database to specially identify the item.

Figure 3.20 details the Electronic product code(EPC) and its arrangement of bits in tags chip memory written to tag.

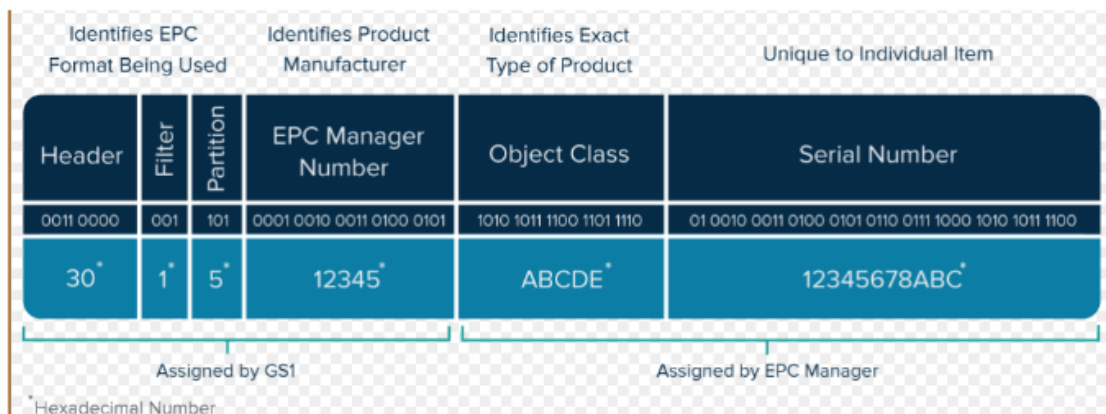


Figure 3.20 Electronic Product Code

Advantages of Passive Tags

- Optimised size
- Lesser Cost
- More Flexibility
- Longer range of read choice
- Life long capability lasting(as they don't have battery)

3.9.3 the most inexpensive RFID tags pricing as small as \$0.12 per tag in large quantity eventhough the price doesnot have influence on the performance. If at any circumstances tagging a certain product becomes a problem for particular applications because of deteioration ,embeddable tags will be fitted in mini fissures and covered in adhesive so that tag will not be damaged.

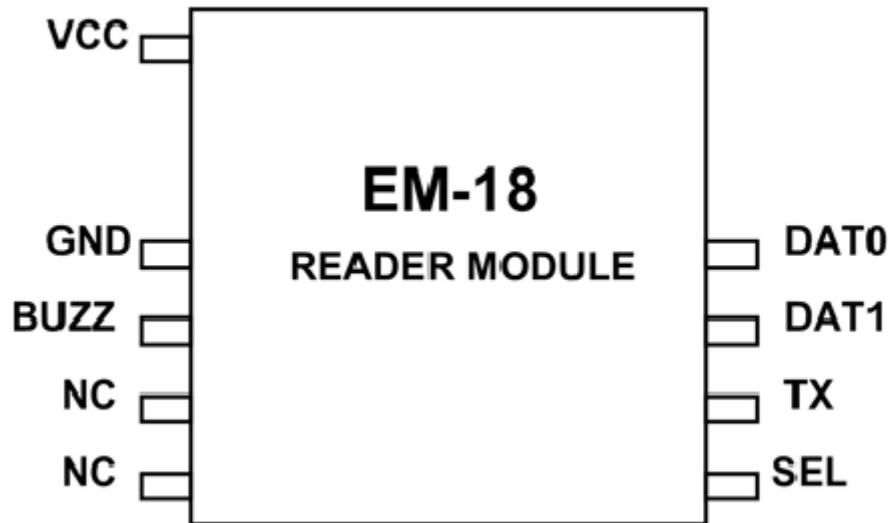
Figure 3.21 shows a pack of passive RFID Inlays.



3.10 EM-18 RFID READER

EM-18 RFID reader is one of the commonly used RFID readers to read 125KHz tags. It features low cost, low power consumption, small form factor and easy to use. It provides both UART and Wiegand26 output formats. It can be directly interfaced with microcontrollers using UART and with PC using an RS232 converter.





**EM-18 PIN
CONFIGURATION**

3.11 PUSH BOTTON

A push button is a simple type of switch that controls an action in a machine or some type of process. Most of the time, the buttons are plastic or metal. The shape of the push button may conform to fingers or hands for easy use, or they may simply be flat. It all depends on the individual design. The push button can be normally open or normally closed.



WORKING:

Push button switches have three parts. The actuator, stationary contacts, and the grooves. The actuator will go all the way through the switch and into a thin cylinder at the bottom. Inside is a movable contact and spring. When someone presses the button, it touches with the stationary contacts, causing the action to take place. In some cases, the user needs to keep holding the button, or to press it repeatedly, for an action to take place. With other push buttons, a latch connects and keeps the switch on until the user presses the button again.

APPLICATIONS:

Push button switches are popular in a variety of different applications, including calculators, push button phones, and many home appliances. You can find them in the home, the office, and in industrial applications today. They can turn machines on and off, or cause the devices to perform specific actions, as is the case with calculators. In some cases, specifically for commercial and industrial usage, the buttons can connect through mechanical linkage, which means that pushing one button can actually cause another button to release. In many cases, the buttons will have specific coloration to help denote their actions. This ensures that the chance of someone pushing the button by mistake is lower. Red will usually indicate stopping, while green generally indicates starting a machine. Emergency stop buttons, which tend to be large push buttons, are generally red, and they typically have larger heads for easier use.

3.12 software Used

SOFTWARE TOOLS

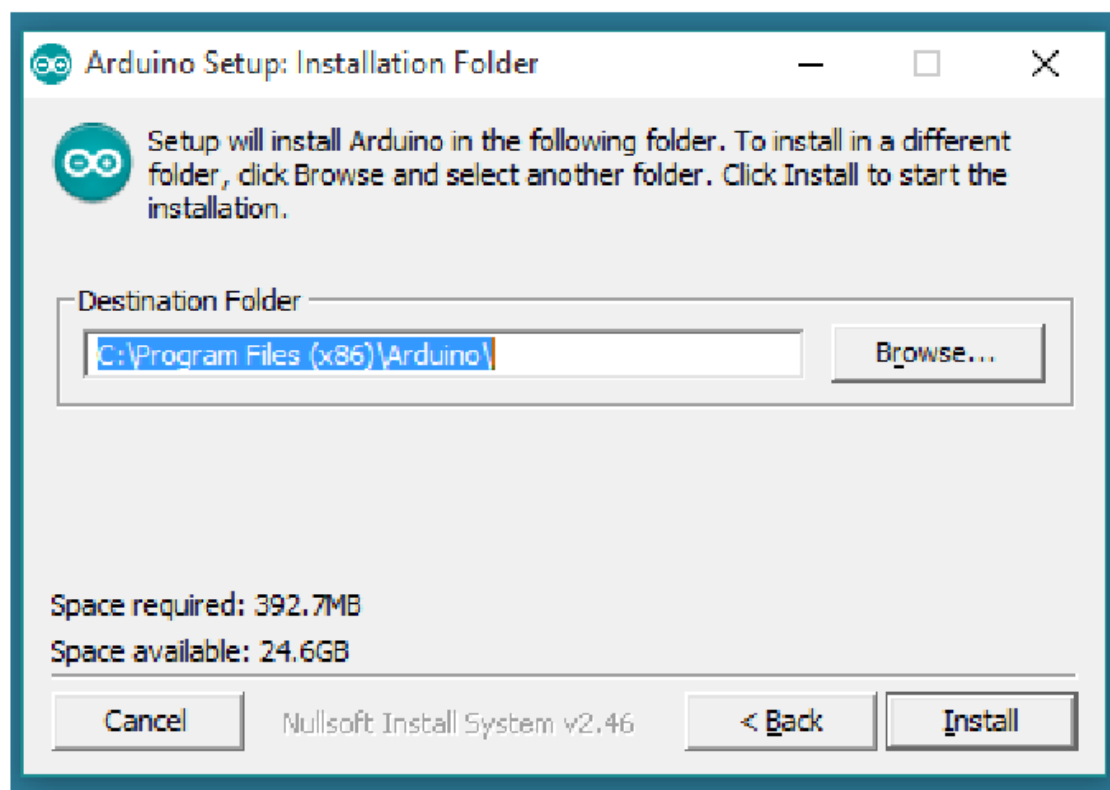
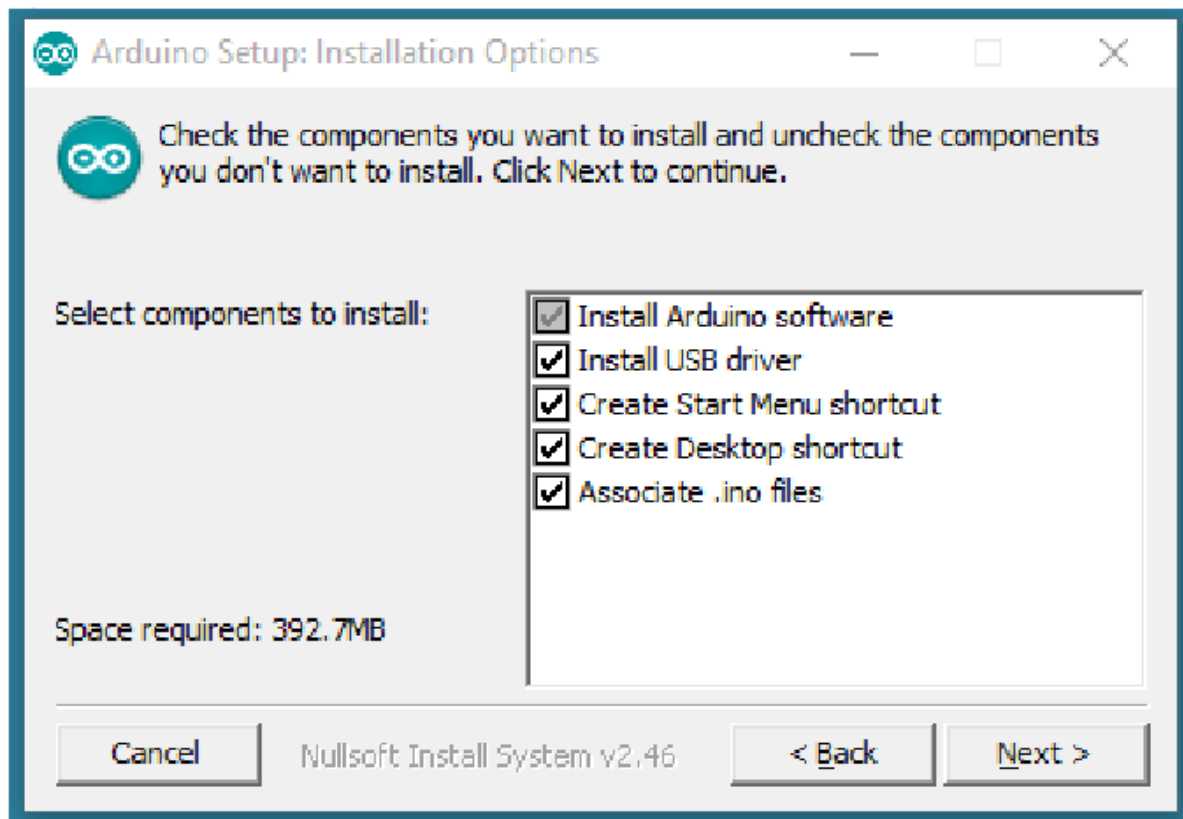
ARDUINO

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software. This software can be used with any Arduino board

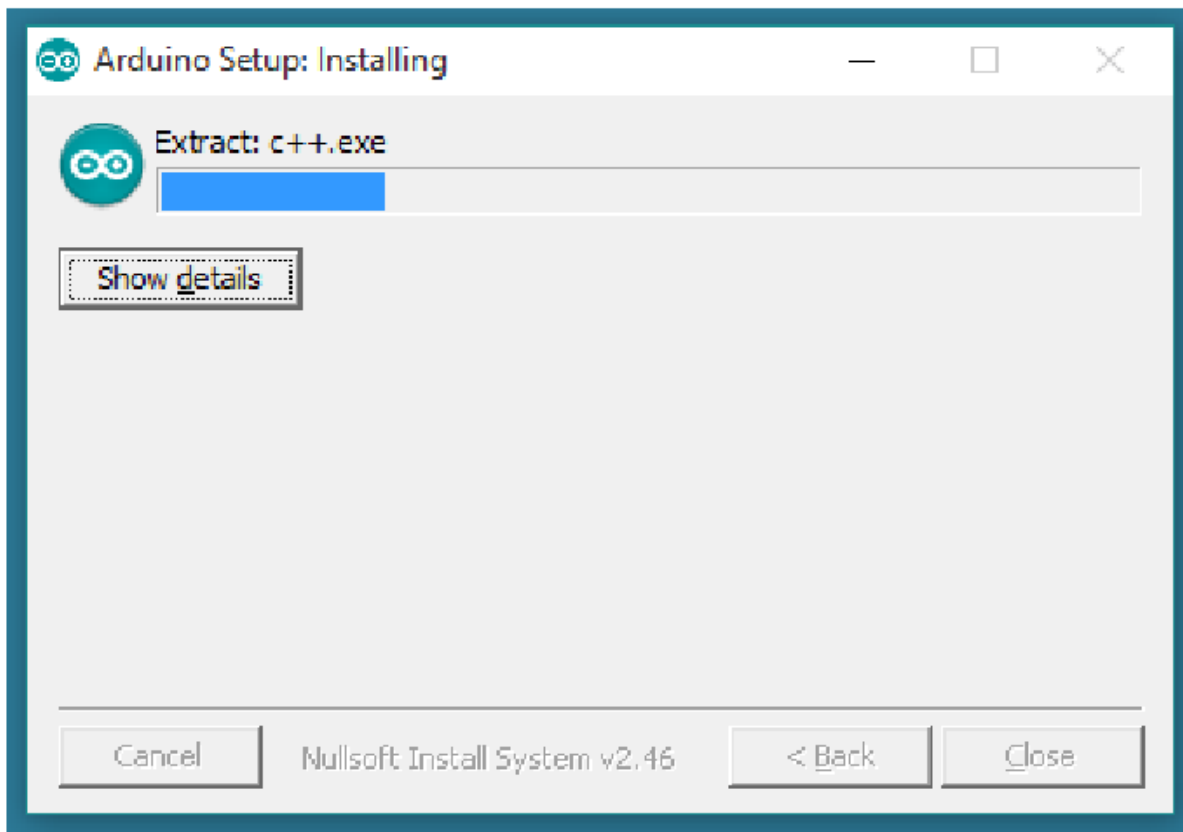
INSTALLATION

In this project Arduino 4.0 is installed. We can choose between the Installer (.exe) and the Zip packages. If you use the first one that installs directly everything you need to use the Arduino Software (IDE), including the drivers. With the Zip package you need to install the drivers manually. The Zip file is also useful if you want to create a portable installation.

When the download finishes, proceed with the installation and please allow the driver installation process when you get a warning from the operating system.



Choose the installation directory (suggested to keep the default one)



The process will extract and install all the required files to execute properly the Arduino Software (IDE)

SoftwareSerial Library

The Arduino hardware has built-in support for serial communication on pins 0 and 1 (which also goes to the computer via the USB connection). The native serial support happens via a piece of hardware (built into the chip) called a UART. This hardware allows the Atmega chip to receive serial communication even while working on other tasks, as long as there room in the 64 byte serial buffer.

The SoftwareSerial library has been developed to allow serial communication on other digital pins of the Arduino, using software to replicate the functionality (hence the name "SoftwareSerial"). It is possible to have multiple software serial ports with speeds up to 115200 bps. A parameter enables inverted signaling for devices which require that protocol.

To use this library,we have to write
`#include <SoftwareSerial.h>`

INSTALLATION:

This can be installed in arduino ide using library manager(contains all libraries)

Limitations

The library has the following known limitations:

- If using multiple software serial ports, only one can receive data at a time.
- Not all pins on the Mega and Mega 2560 support change interrupts, so only the following can be used for RX: 10, 11, 12, 13, 14, 15, 50, 51, 52, 53, A8 (62), A9 (63), A10 (64), A11 (65), A12 (66), A13 (67), A14 (68), A15 (69).
- Not all pins on the Leonardo and Micro support change interrupts, so only the following can be used for RX: 8, 9, 10, 11, 14 (MISO), 15 (SCK), 16 (MOSI).
- On Arduino or Genuino 101 the current maximum RX speed is 57600bps
- On Arduino or Genuino 101 RX doesn't work on Pin 13

LiquidCrystal I2C library:

The library allows to control I2C displays with functions extremely similar to LiquidCrystal library. This library allows an Arduino board to control LiquidCrystal displays (LCDs) based on the Hitachi HD44780 (or a compatible) chipset, which is found on most text-based LCDs. The library works with in either 4- or 8-bit mode (i.e. using 4 or 8 data lines in addition to the rs, enable, and, optionally, the rw control lines).

To use this library ,we have to write

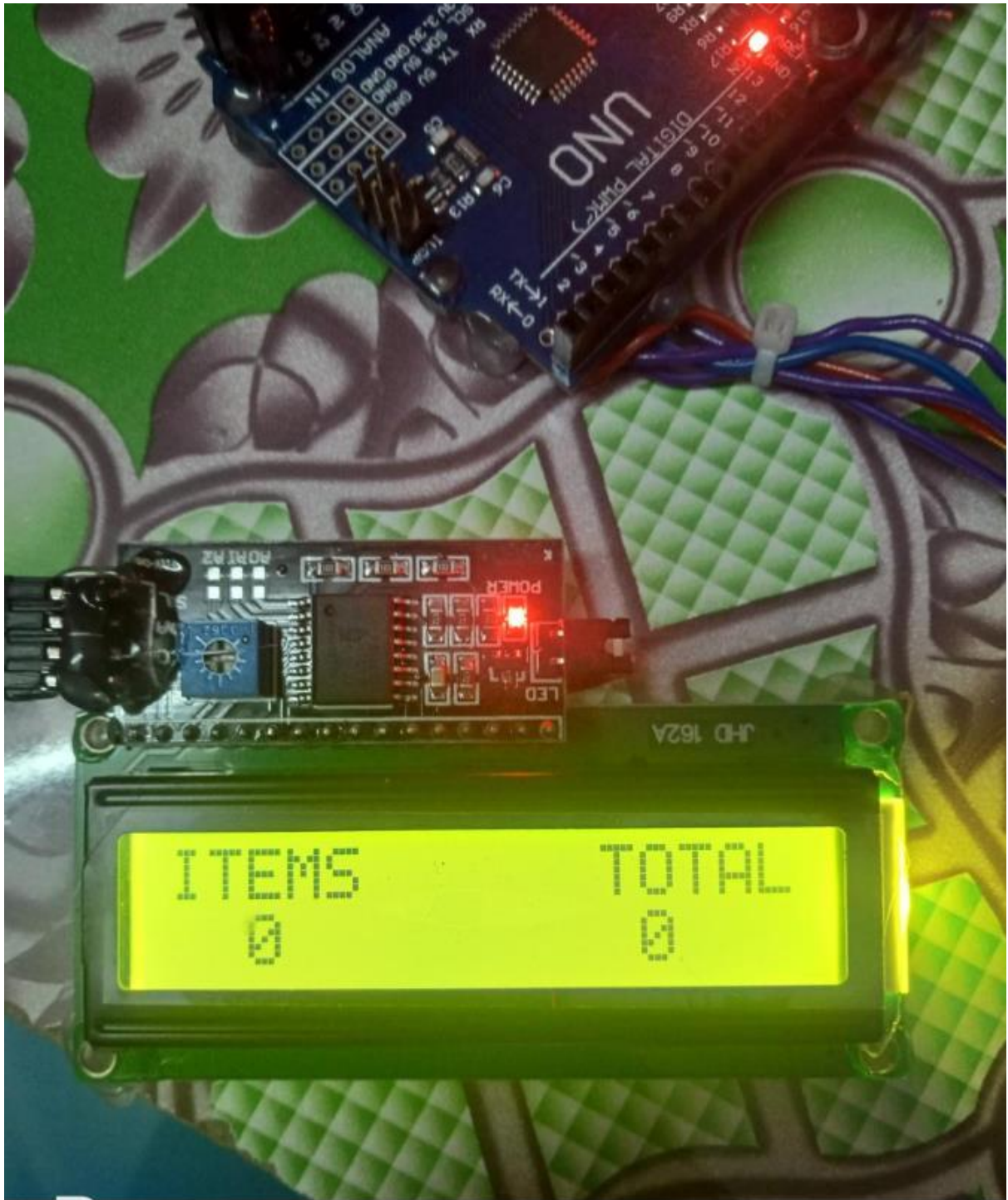
```
#include <LiquidCrystal.h>
```

INSTALLATION:

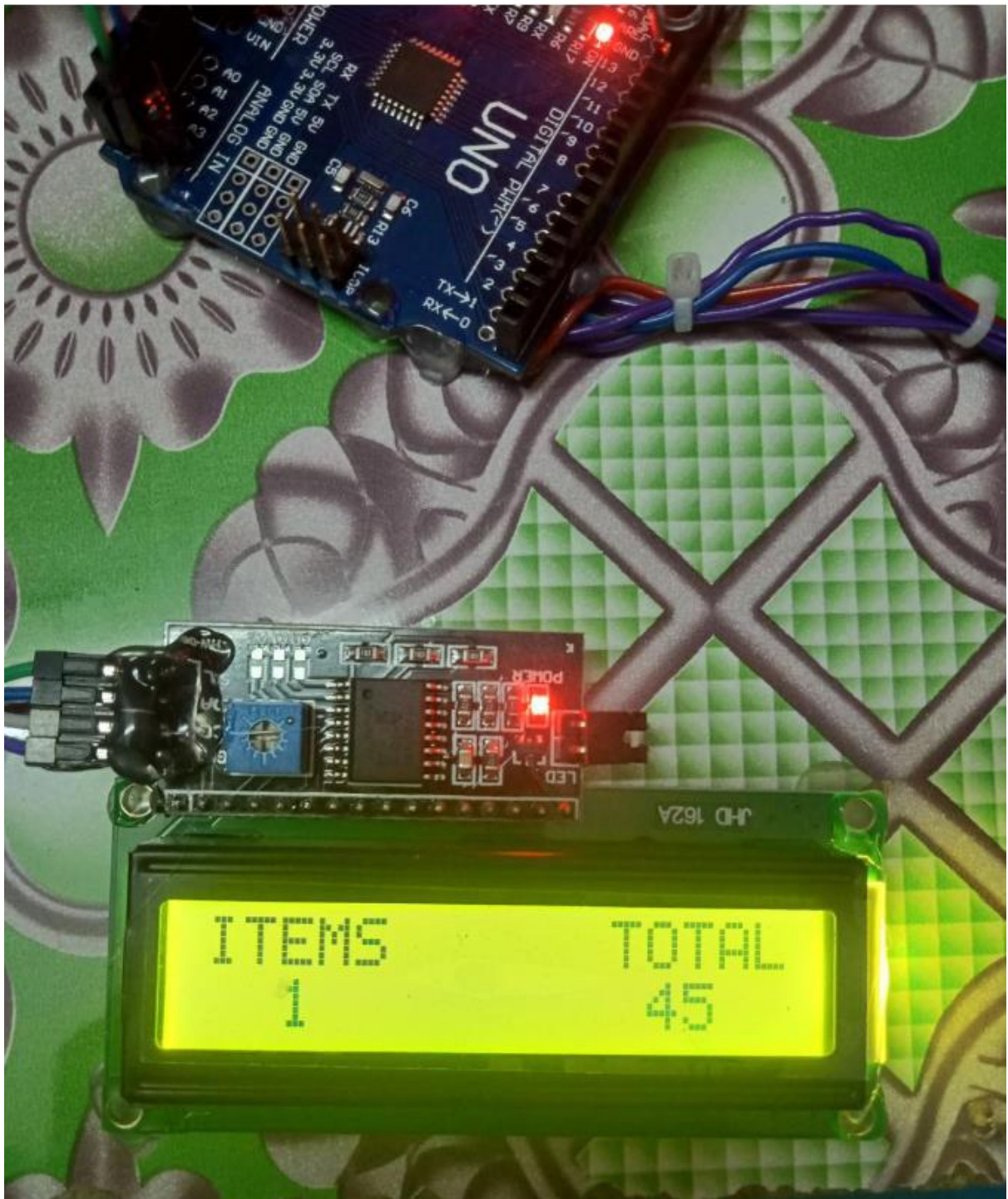
This can be installed in arduino ide using library manager (contains all libraries).

RESULTS :





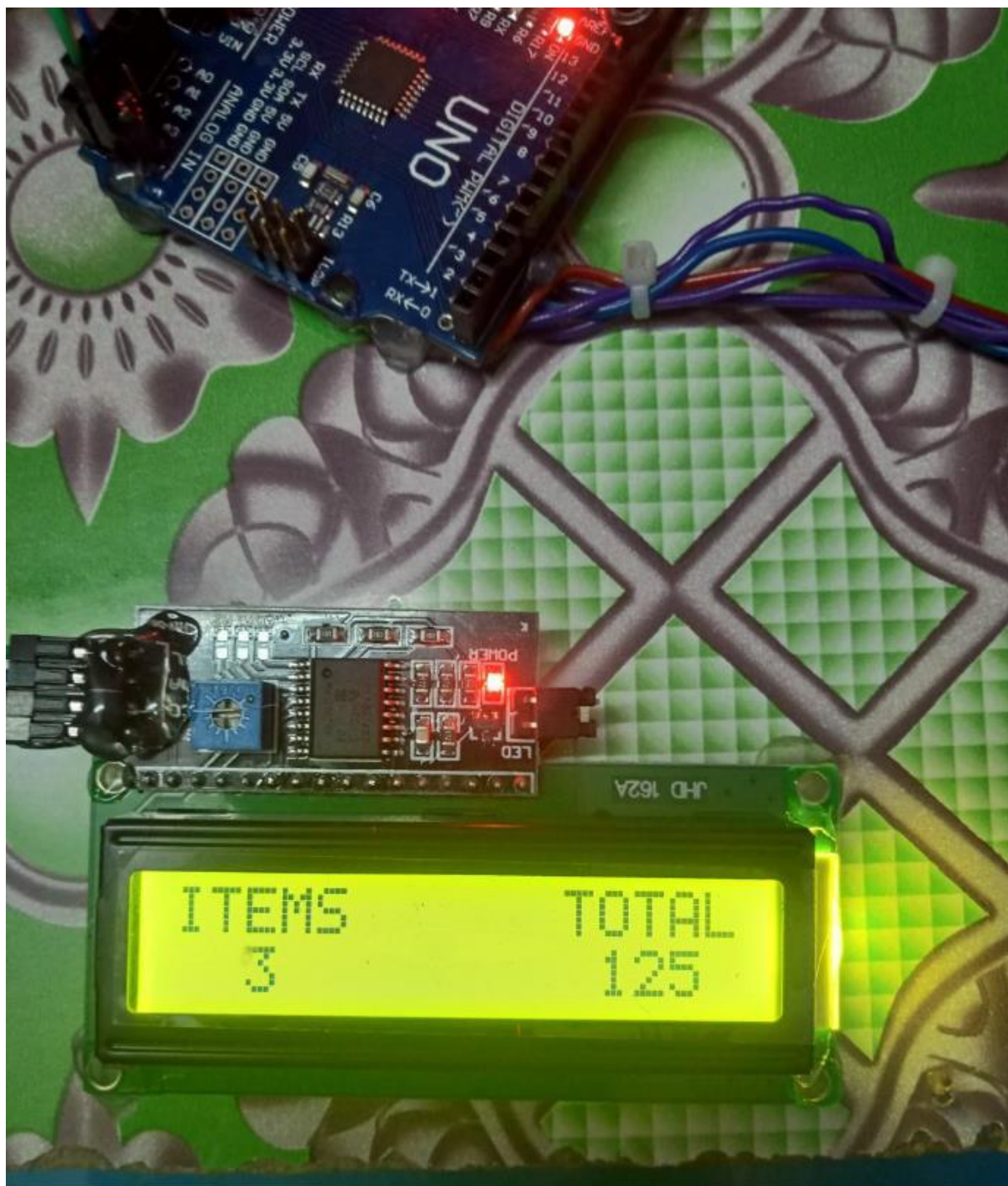














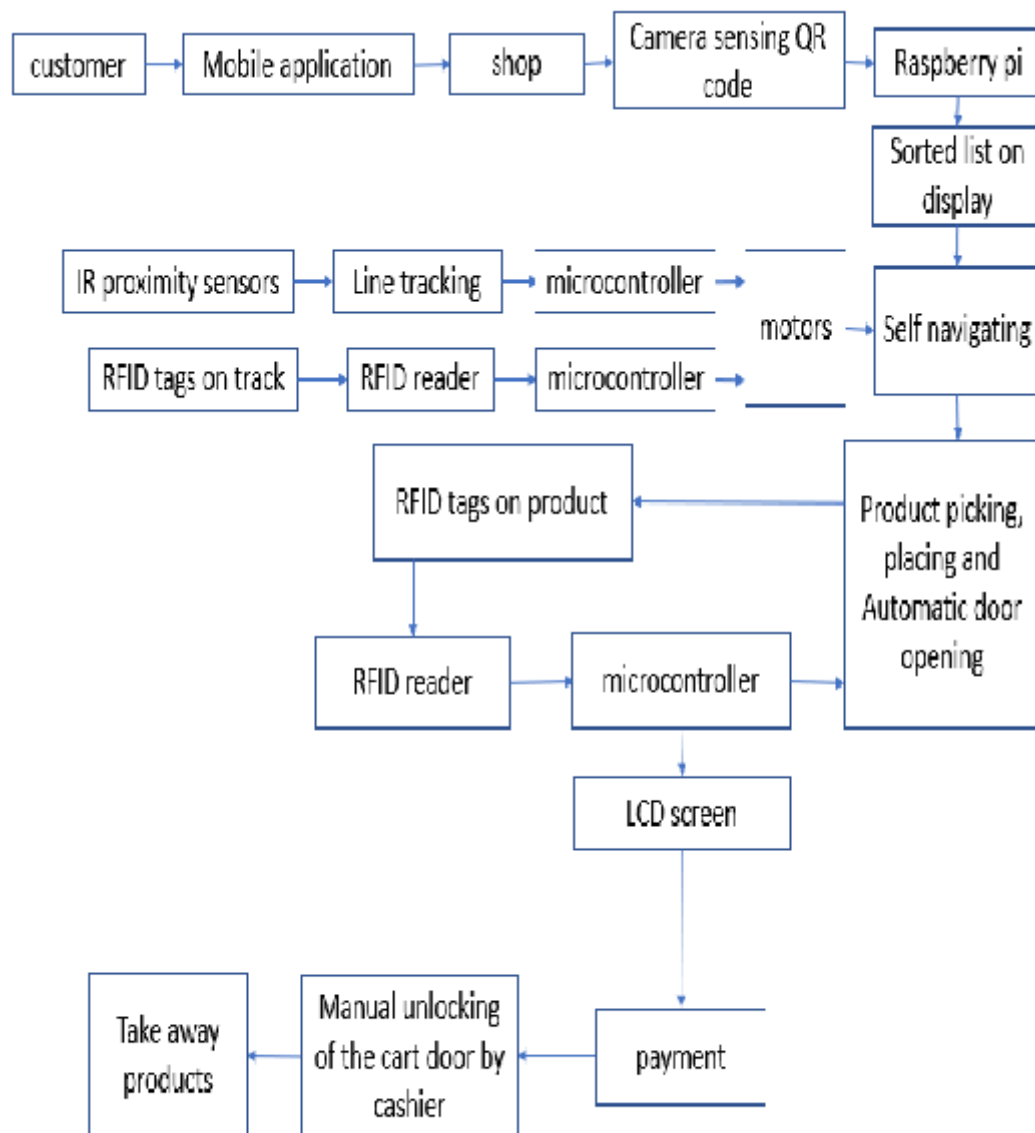




CHAPTER 4

PROJECT DESCRIPTION

4.1 BLOCK DIAGRAM



4.2 PROJECT CONCEPT EXPLANATION

Every customer will be having a smart phone in which they install the mobile application from the playstore or appstore. The mobile application namely “Easy and Access “, in which the user can select and create a list of products they need to buy according to their needs and amount of cash they have. The application also shows the items whether it is available in the market or not. The application will generate a QR code at the end while clicking the proceed option given in the application. While the customer enters the shop, they can link the QR code which they have in their Smartphone, with the cart from the shop. The cart will be having a camera to scan the generated QR code. The camera is linked with the cart screen with the help of raspberry pi, so that the customer can see their list sorted in the screen. The cart will move automatically while clicking the proceed or go option in the cart screen. The cart which self navigates using the line follower technology, where it senses the black lines using two IR proximity sensors. While encountering with the RFID tags placed on the black lines or the track drawn on the floor of the shop, the tags will be read by the RFID reader. The motor of the cart will be controlled using two microcontrollers where one of them is linked with the line follower technology and the other with the RFID technology. The reader will compare the information from the tag with the pre-programmed information in the microcontroller and if it is true the cart stops in the aisle. The tags are placed according to the nearby shelf. The customer picks up the product from the shelf and the RFID tags attached with the product will be read by the RFID reader thus the door will be automatically opened, and the LCD screen will be displaying the product amount and the total amount at the same time. The microcontroller is used to interface both the LCD screen and the door to open automatically when the tag is sensed. The cart will move to the next location and so on.

4.3 EXISTING MODEL

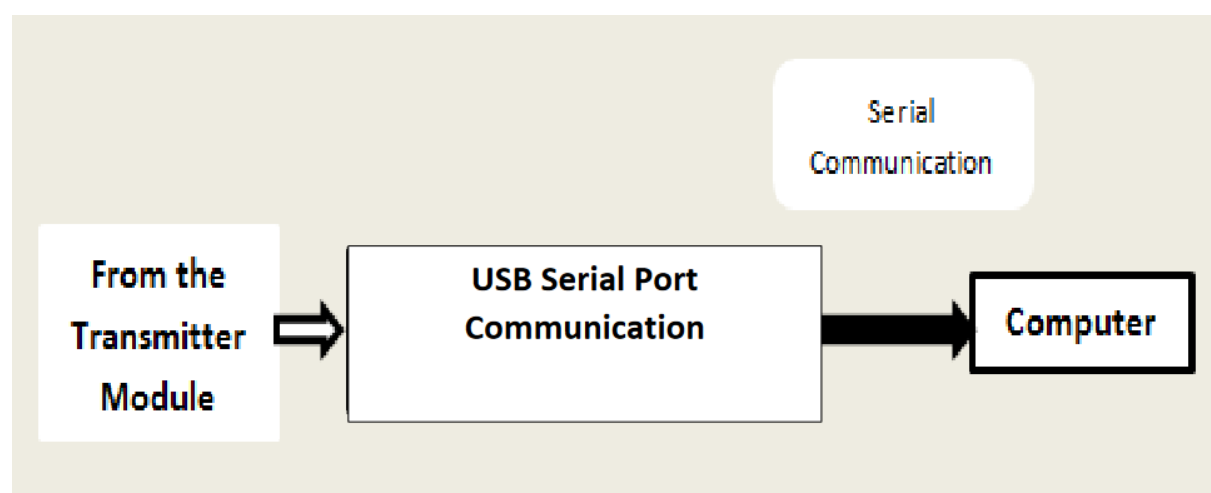
There are many existing and novel solutions for the stated problems. The currently available solution in shopping malls is the Barcode method in which there are barcode labels on every product which is browsed through barcode readers. All barcode readers contain decoder circuit which analyses the barcode's image data provided by the sensor and sending the barcode's 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 scans the product through the barcode scanner and offer the bill
But this becomes a slow method and lots of products is to be scanned,
therefore creating the billing method slow and this results long queues.
Although advances have been made in this area, developing and maintaining
such applications is still a critical challenge and expensive. Thus, the barcode
scanning method is seen in most of the shops and grocery centres.

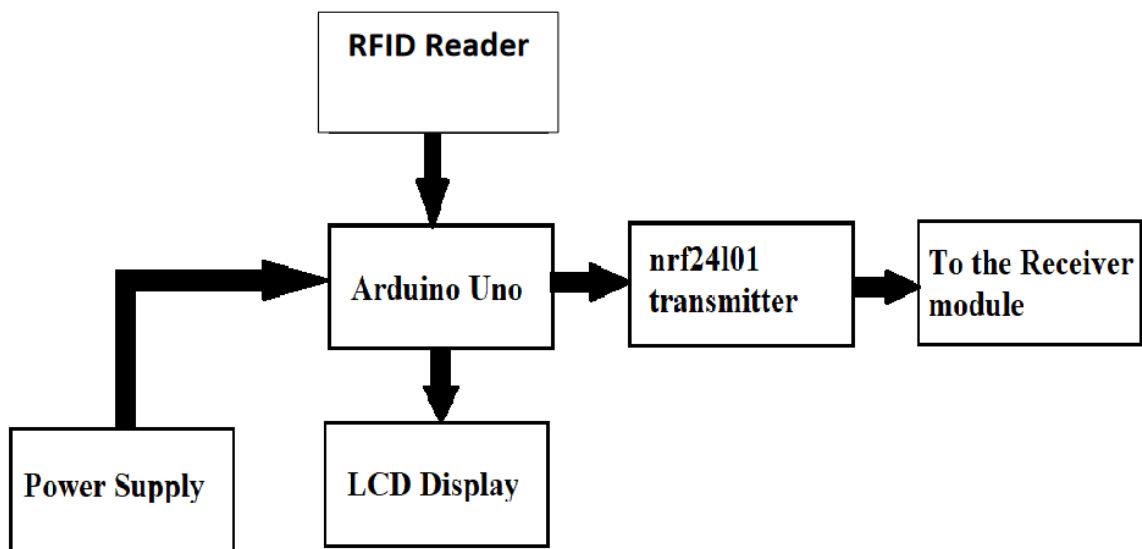
CHAPTER 5

PROPOSED SYSTEM

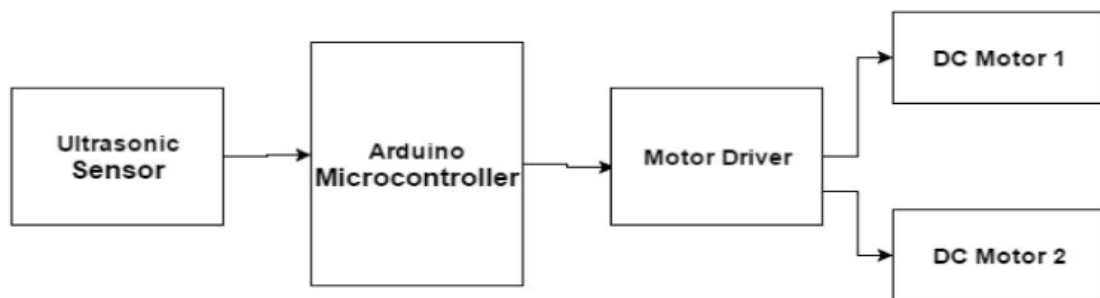
5.1 PROJECT DESIGN



Block Diagram of Receiver Side



Block Diagram of Trolley



Block Diagram for Human Follower Trolley

5.2 COMPONENTS

HARDWARE REQUIREMENTS:

- 1) PCB Breadboard.
- 2) LED Bulb.
- 3) Buzzer.
- 4) Jumper Wires.
- 5) EM-18 Module.
- 6) RFID Tag.
- 7) Potmeter.

- 8) Arduino Nano.
- 9) LCD display(16x2).
- 10) Battery.
- 11)Arduino UNO.
- 12)l298 Motor Drive.
- 13)IR sensor.
- 14)Ultrasonic sensor.
- 15)Servo motor.
- 16)Gear Motor.
- 17)car Wheel.
- 18)Battery.
- 19)Battery stand.

SOFTWARE REQUIREMENT:

- 1)Arduino IDE.
- 2) Programming language-c

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

6.1 SUMMARY

Taking into account the changing trend in retail shopping. We come to a conclusion that the Intelligent Shopping Basket is most certainly a definite necessity for the Retail marketing industry for fast billing. It can follow a human whenever he moves in a straight line. The project aims to develop an automatic human guided shopping trolley with a smart shopping system. This shopping trolley can lead a user to the items' locations in supermarket and he or she is able to know the items' locations through a shopping map. It will follow user. Accuracy - advance IR systems improve accuracy by improving. With the aid of automatic line following and human leading functions portable robot,

supermarket owners need only to purchase the portable robot and can easily install it under shopping trolleys. Users can then enjoy shopping without pushing the shopping trolley themselves.

6.2 FUTURE SCOPE

- An interactive LCD, which can show location of the items a customer wants to buy, also other details of the scanned product, can be thought of appending along too.
- In case a person wants to buy multiple items, currently there is no provision for it, but a keypad can be thought of for the customer to manually add the prices.
- The RFID system which can scan multiple tags at a time with 100% accuracy is still under development. Once it is available, this technology can attain new heights with least time consumption and higher security.
- Instead of the user pushing the buttons to control the trolley, we can add a webcam and make the trolley follow the specific person around.



REFERENCES:

- 1) <https://ieeexplore.ieee.org/document/9609710>
- 2) <https://www.youtube.com/watch?v=IEgciDvqLxU>
- 3) <https://www.youtube.com/watch?v=4PQgjjOqJa4&t=148s>
- 4) <https://how2electronics.com/smart-shopping-cart-with-automatic-billing-system-using-rfid-arduino/>
- 5) <https://www.youtube.com/watch?v=f6njy zp4YDw>