

FOOL PROOF TICKETING SYSTEM MANAGEMENT FOR RAILWAY

Submitted in partial fulfillment of the requirements

for the award of

Bachelor of Engineering degree in Computer Science and
Engineering by

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**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SCHOOL OF COMPUTING**

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

**Accredited with Grade "A" by NAAC
JEPPIAAR NAGAR, RAJIV GANDHI
SALAI, CHENNAI – 600 119**

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

BONAFIDE CERTIFICATE



This is to certify that this project report is the bonafidework of **SINGAREDDY HRUDAI TEJAWITH REDDY** (REG.NO.37110717)&**PATAKAMUDI SIDHARDHA** (REG.NO.37110550) whocarried out the project entitled “**FOOL PROOF TICKETING SYSTEM MANAGEMENT FOR RAILWAY**” under my supervision from August 2020 to March 2021.

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DECLARATION

I, **SINGAREDDY HRUDAI TEJASWITH REDDY AND PATAKAMUDI SIDHARDHA** hereby declare that the Project Report entitled **“Fool Proof Ticketing System management for Railway”** is done by me under the guidance of **Dr . A.MaryPosonia,M.E.,PH.D.**, Dept of CSE at Sathyabama Institute of science and technology is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in Computer Science and Engineering.

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ABSTRACT

Railway Transport remains some of the most vital modes of travel all over the world and especially in India. Therefore, all their operative techniques have to be simplified for deriving the best results. These technologies were engaged for providing one of the best services by the railway department and they provide RFID railway reservation technology. This makes it much easier for the customers means passengers and they help them without affecting any problems like ticketless travelling. The main concept of implementing such a system will make the reservation ticketing and the ticket process much easier. These types of tags are used for the verification process and they can be used to avoid the fool proof respectively. Here, lot of passengers are using railways and they need to be somewhat more enriched in securities. These RFID tags are much easier to scan and they are cheap and reusable too. These kind of technologies increases more revenues to the government and makes the ticketing process as much as easier as well. These RFID tag makes the exact location for the Passengers and they make such more secure and luggage as well as possible. Here the way of using the RFID is much more different from all the usage among the real time examples the RFID were scanned and they check using the program which was dumped into it. By scanning the RFID tag makes much more initial process and they are safer to use when compare to barcode and other scanning type of process like qrcode respectively.

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CHAPTER 1

INTRODUCTION

RFID is also known as the frequency identification device and which was in the form of tags these are the upcoming technologies. RFID projects and these technologies were used and they are much more efficient too. These types of rfid tags are used to identify the radio waves automatically and to store some kind of values into it. Generally, the rfid tag consists of the antenna which is inbuilt in the tag and which used as the reader the chip as well as possible respectively. The RFID may consists of two main parts like the reader part and the tag. The RFID tag and reader transfers the message through electromagnetic waves and they have prior modules. This RFID system uses the technology of embedded systems and they provide such an automated ticketing system in the railways. These type of RFID project has been implemented and they have utilised as well as possible.

Literature survey:

Transportation has become a part of the day to day life. Furthermore, it holds a principle called "ticket" in [2]Keith E. Mayes*, Konstantinos Markantonakis, Gerhard Hancke in transport ticketing securities and fraud controls as proposed. However, the technology is increasing it provides more advantages of electronic ticketing, which are both beneficial for the passengers and the government. As the authors suggested, to bring the enormous scope to the future in the evolution of the systems and where these are considered the fundamentals of the current society where it satisfies the basic requirements for mobility, it also minimizes the time. Moreover, those operations have turned the technology to close the loops in the system and catch the frauds and tighten the security information system and reusable.

As public transportation is quite affordable, many people make a journey on a daily basis, and there is a chance of fire accidents in the journey. In [3], C. Ananthakumar, D.Edison Selvaraj, proposed a structure where fire accidents are minimized, and loss of damage could be covered by applying the Firesensor in the RFID module with GSM, .where the total operation is controlled by the controller using IDE software. This module is proposed to make the work of manual easier by an integer program developed to formulate the subject problems to solve easier by where the system is already provided with the algorithm module provided.

Due to the growing population, the fraud activities have been increased in the tickets .issuing one ticket and the benefits have been used by the other members, in

[4]Sejal. S. Chhabile, Dr Ashwini Kumar Varma defined the pattern for identifying and recognizing the documents and their classification in this model. An ANN classifier is constructed to find the fraud within the tickets. In brief, the data set is collected with various variables as they are simple to method. The central perspective of this is to one should not surpass others ticket, so the details of the person all are collected and are interlinked to each other. The program is organized for the recognition and image processing in the system by the automated fraud detection system in the ticket

Propose the service of automatic train ticketing system by Irfan Abbas, Hamsa Iqbal[5].by providing the architecture of printing the tickets with both QR Scanner and

Validating it and can also be checked manually which in term decreases time and cost and would be running on automated wireless systems by the field communication process and web-based system. In the proposed work, the ATTS Generates tickets and validates the ticket by time and distance travelled and measured the cost. The BTS range is limited and helpful in quoting the cost of the ticket from the source to the destination, where the data synchronization through Bluetooth is also made accessible due to the IoT system, where the QR code is to be carried throughout the journey for the entry and exit into the stations.

The ticketing system based on the passenger's unique identification system proposed by [6]Mr. Celso Furtado, Mr Jeshley Rebello, has proposed their work in march 2017 by the RFID Ticketing System, which automatically detects the passengers fare(Ratio frequency identification) based on unique passenger Identity. It is a user-friendly system It automatically identifies the passenger and deducts the fare according to the distance travelled. It reduces human errors and efforts.RF card has a unique id for every tag. The RF card is allotted to every person with a fixed balance in it, as the person has to swipe the card while entering and leaving the metro train and deduced the balance according to the distance travelled. A Stepper motor shows the opening and closing of the door by swiping the card. The computer hosts a specific application that reads the data and stores the data in the hub.

The public transport, which was a step to change the world, but there was one thing which was a traditional thing which everyone ignored by Padigala Divija[7], Venkata Thirumala Sai Kiran, that is nothing by ticket, we can see till today we had to have a hold a small piece of paper, and some areas like urban side, the private-public transport can overload the passengers. After a ticket as fire so by this project, the passengers were too helpless we had introduced a system named RFID BASED UNIVERSAL/MULTI TRANSPORT TICKETING SYSTEM. The whole system contains only a few smart cards, links them to your account(banking), and accesses them. Okay, here are the few hardware things that you wanted to know RFID(Radiofrequency identification) and another one is GSM (Global System for Mobile Communication), and the last one is PIC(Peripheral Interface Controllers).

Due to cheaper train ticket costs, many people are inclined towards travelling by train. Issuing tickets manually to a large number of passages is a tiresome and time taking task. In [8], Godson Michael Proposed a model in which the commuters purchase the seasonal tickets for a particular number of days at their discreet. This system used AWS public cloud to make it robust and scalable. The proposed architecture includes capturing the RFID sensors data with a raspberry pi then sending the event data to AWS IoT. In the end, all the IoT events are processed and fed as input to the machine learning operations to predict an output. Whenever a commuter enters a train, the event is recorded, and the number of commuters in a



particular coach is incremented or decremented accordingly. The paper concluded that the proposed model is efficient in issuing the tickets and also detecting ticketless commuters.

Vijaysanthi. R et.al.[9]have proposed in their research that Raspberry-Pi can be used with a cloud platform to obtain fingerprint.Usage of Raspberry Pi with biometric authentication and cloud platform is safe to use. Generally, biometric authentication is utilized for confirmation of the distinctive using biological attributes. These are verified and stored in a database. When the data is matched, then the authentication is successful. In their research, a combination of fingerprint authentication and storage in a cloud platform is the modern usage of technology at that time. The various steps in this research include retrieving images from the optical sensor, converting and storing them in a database, using Django webserver authentication of fingerprints obtained, extracting the region of interest(ROI) from the images. This proposed research can be functional where system security is mandatory.

The whole project is a fusion of IoT and mechanical worlds. It's like just trying to touch the two index fingers, which are both two different worlds[10] by Amr S.El-Wakeel, Jin Li, Aboelmagd noureldin. This project makes our life more efficient and more simple life, and this project is going to concentrate on things which we do not have time to it. However, on one day it eats our time or money, and one of those things is the road condition, see we are all in our busy lives, where we cannot go somewhere else and complaint about it, so this project breaks the chain or block. By the uses of Micro-Electro-Mechanical Systems (MEMS) sensors which are accelerator meter, and gyroscope sensor, and global positing sensor(GPS), which can monitor the vehicles speed and changes in its direction of the condition within a fraction of seconds and by marking the Multiple road anomalies(potholes), and unsigned dangers like wild animals crossing area and accident-prone.

The primary issue is with precise, delicate trade because, without fail, the traveller does not have precise change and even conductor. Because of that, there would be a misfortune to the traveller on the off chance that they try not to get the specific change back. To correct this issue, they proposed the work[11]by K.Mahesh, Hari Hara Brahma. The RFID cards are secure tokens that have given security administrations to a wide scope of utilizations. The RFID card peruser is utilized to peruse the information from the card. The RFID card peruser peruses the people subtleties and less the specific sum with token age. Radio recurrence distinguishing proof (RFID) is an innovation that utilizes radio frequencies to naturally recognize and identify account numbers and subtleties needed along with gave security. It tends to be valuable for some transportation offices which need to improve the innovation, what's more, to fulfil the clients. RFID offers higher information stockpiling limits, higher distinguishing proof paces, and more noteworthy quickness and exactness of



information assortment. By this framework, we are moving into the credit-only exchanges.

These things are made out of web-empowered gadgets that utilization sensors, installed processors and correspondence equipment all together to send/get information from conditions[12] by Jawed Ali Toqeer Ali, Yazed Alsaawy. Plus, IoT permits the advancement of a few regions like home to keen home, medical care to brilliant medical care, urban communities to smart cities furthermore, some more. The vital thought behind the IoT environment is the variety of things that brings about a colossal number of gadgets in any case; it is essential that solitary approved clients can have the option to access and utilize the framework. Since the majority of correspondences between these gadgets are remote which make the framework more helpless against various assaults, for example, snooping, message altering and Mirai assault [4] and so on (2) Gadgets from various producers have restricted limit in the wording of preparing, battery, and memory that do not permit to carry out advance security arrangements. Moreover, no instrument can show the degree of trust for each zone when an outside substance has to know before correspondence.

Existing system:

- In existing system there is no proper maintenance ticketing system, in this system passengers won't have ticket travelled by some reasons like time maintenance.

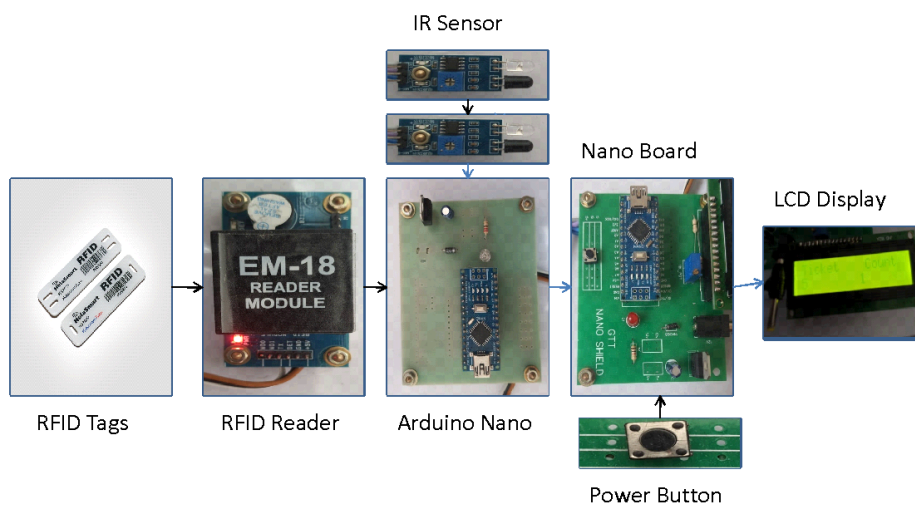
Proposed system:

- RFID has many positives and as well as negatives when come to real time applications these kind of RFID can takes place with lesser limitations respectively. By using RFID in real time process the more kind of getting easier data's from the passengers through database and these kind of RFID costs very low and they can be reusable. While the researching kind of peoples are much easier to identify the scanning and the scanner technology is much safer and makes much more easily when compare to others respectively. If the project is



implemented to railway and they can be much more embedded systems and they are very similar to the scanner technologies. This kind of Fast Ticketing process can be implemented with the help of the RFID scanner as well as the RFID tag into it. When compared to the other ticketing process these kind of fast and reliable technique is much easier to implement and expecting this project can be implemented in the railways as much as possible in 22nd country.

- **Block diagram:**



Hardware required:

- Arduino nano
- RFID Reader
- Tags



- IR sensor
- Buzzer
- Display

Software used:

Arduino ide

Embedded C

Arduino C

1. EMBEDDED SYSTEMS

1.1 Overview of embedded systems

An embedded system is a special-purpose computer system designed to perform one or a few dedicated functions, often with real-time computing constraints. It is usually embedded as part of a complete device including hardware and mechanical parts. In contrast, a general-purpose computer, such as a personal computer, can do many different tasks depending on programming. Embedded systems have become very important today as they control many of the common devices we use.

Since the embedded system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product, or increasing the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale.

Physically, embedded systems range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights, factory controllers, or the systems controlling nuclear power plants. Complexity varies from



low, with a single microcontroller chip, to very high with multiple units, peripherals and networks mounted inside a large chassis or enclosure.

In general, "embedded system" is not an exactly defined term, as many systems have some element of programmability. For example, Handheld computers share some elements with embedded systems — such as the operating systems and microprocessors which power them — but are not truly embedded systems, because they allow different applications to be loaded and peripherals to be connected.

Embedded systems provide several functions

- Monitor the environment; embedded systems read data from input sensors. This data is then processed and the results displayed in some format to a user or users
- Control the environment; embedded systems generate and transmit commands for actuators.
- Transform the information; embedded systems transform the data collected in some meaningful way, such as data compression/decompression

Although interaction with the external world via sensors and actuators is an important aspect of embedded systems, these systems also provide functionality specific to their applications. Embedded systems typically execute applications such as control laws, finite state machines, and signal processing algorithms. These systems must also detect and react to faults in both the internal computing environment as well as the surrounding electromechanical systems.

There are many categories of embedded systems, from communication devices to home appliances to control systems. Examples include;

- Communication devices
e. g.: modems, cellular phones
- Home Appliances
e. g.: CD player, VCR, microwave oven



- Control Systems

e. g.: Automobile anti-lock braking systems, robotics, satellite control

1.2 Block diagram of an embedded system:

An embedded system usually contains an embedded processor. Many appliances that have a digital interface -- microwaves, VCRs, cars -- utilize embedded systems. Some embedded systems include an operating system. Others are very specialized resulting in the entire logic being implemented as a single program. These systems are embedded into some device for some specific purpose other than to provide general purpose computing . A typical embedded system is shown in Fig 1.1

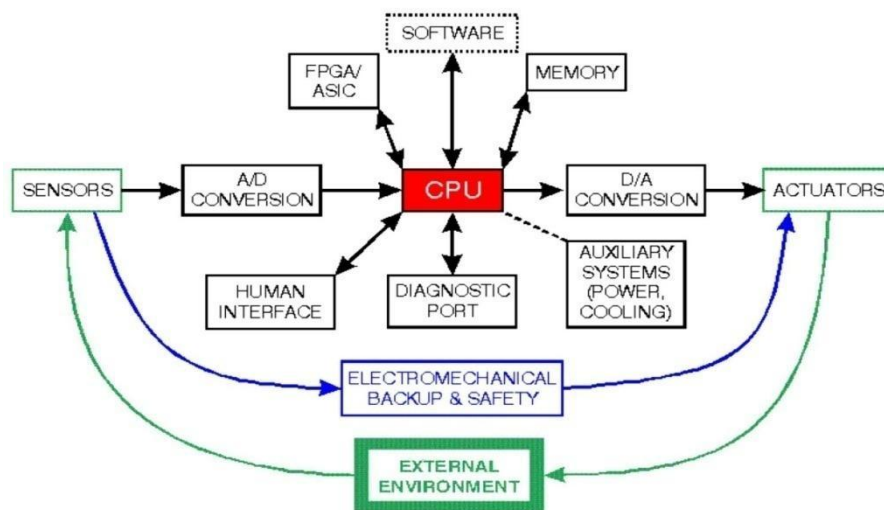


Fig 1.1 Block diagram of a typical embedded system

1.2.1 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.

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 reprogram ability. Some embedded systems, however, require the flexibility of reprogram ability. Programmable DSPs are common for such applications.

Reactive Systems

As mentioned earlier, a typical embedded systems model responds to the environment via sensors and control the environment using actuators. This requires embedded systems to run at the speed of the environment. This characteristic of embedded system is called “reactive”. Reactive computation means that the system (primarily the software component) executes in response to external events. External events can be either periodic or aperiodic. Periodic events make it easier to schedule processing to guarantee performance. Aperiodic events are harder to schedule. The maximum event arrival rate must be estimated in order to accommodate worst case situations. Most embedded systems have a significant reactive component. One of the biggest challenges for embedded system designers is performing an accurate worst case design analysis on systems with statistical performance characteristics (e.g., cache memory on a DSP or other embedded processor). Real time system operation means that the correctness of a computation depends, in part, on the time at which it is delivered. Systems with this requirement must often design to worst case performance. But accurately predicting the worst case may be difficult on complicated architectures. This often leads to overly pessimistic estimates erring on the side of caution. Many embedded systems have a significant requirement for real time operation in order to meet external I/O and control stability requirements. Many real-time systems are also reactive systems.

Distributed Systems

A common characteristic of an embedded system is one that consists of communicating processes executing on several CPUs or ASICs which are connected by communication links. The reason for this is economy. Economical 4 8-bit microcontrollers may be cheaper than a 32-bit processors. Even after adding the cost of the communication links, this approach may be preferable. In this approach, multiple



processors are usually required to handle multiple time-critical tasks. Devices under control of embedded systems may also be physically distributed.

Heterogeneous Architectures

Embedded systems often are composed of heterogeneous architectures (Fig 1.2). They may contain different processors in the same system solution. They may also be mixed signal systems. The combination of I/O interfaces, local and remote memories, and sensors and actuators makes embedded system design truly unique. Embedded systems also have tight design constraints, and heterogeneity provides better design flexibility.



Fig 1.2 Embedded Systems having Heterogeneous Architectures

Harsh environment

Many embedded systems do not operate in a controlled environment. Excessive heat is often a problem, especially in applications involving combustion (e.g., many transportation applications). Additional problems can be caused for embedded computing by a need for protection from vibration, shock, lightning, power supply fluctuations, water, corrosion, fire, and general physical abuse.

System safety and reliability

As embedded system complexity and computing power continue to grow, they are starting to control more and more of the safety aspects of the overall system. These safety measures may be in the form of software as well as hardware control. Mechanical safety backups are normally activated when the computer system loses control in order to safely shut down system operation. Software safety and reliability is

a bigger issue. Software doesn't normally "break" in the sense of hardware. However software may be so complex that a set of unexpected circumstances can cause software failures leading to unsafe situations. Discussion of this topic is outside the scope of this book, but the challenges for embedded designers include designing reliable software and building cheap, available systems using unreliable components. The main challenge for embedded system designers is to obtain low-cost reliability with minimal redundancy.

Control of physical systems

One of the main reasons for embedding a computer is to interact with the environment. This is often done by monitoring and controlling external machinery. Embedded computers transform the analog signals from sensors into digital form for processing. Outputs must be transformed back to analog signal levels. When controlling physical equipment, large current loads may need to be switched in order to operate motors and other actuators. To meet these needs, embedded systems may need large computer circuit boards with many non-digital components. Embedded system designers must carefully balance system tradeoffs among analog components, power, mechanical, network, and digital hardware with corresponding software.

Small and low weight

Many embedded computers are physically located within some larger system. The form factor for the embedded system may be dictated by aesthetics. For example, the form factor for a missile may have to fit inside the nose of the missile. One of the challenges for embedded systems designers is to develop non-rectangular geometries for certain solutions. Weight can also be a critical constraint. Embedded automobile control systems, for example, must be light weight for fuel economy. Portable CD players must be light weight for portability purposes.

Cost sensitivity

Cost is an issue in most systems, but the sensitivity to cost changes can vary dramatically in embedded systems. This is mainly due to the effect of computer costs



have on profitability and is more a function of the proportion of cost changes compared to the total system cost.

Power management

Embedded systems have strict constraints on power. Given the portability requirements of many embedded systems, the need to conserve power is important to maintain battery life as long as possible. Minimization of heat production is another obvious concern for embedded systems.

1.3 POWER SUPPLY

All electronic circuits work only in low DC voltage, so we need a power supply unit to provide the appropriate voltage supply for their proper functioning. This unit consists of transformer, rectifier, filter & regulator. AC voltage of typically 230volts rms is connected to a transformer voltage down to the level to the desired ac voltage. A diode rectifier that provides the full wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit can use this dc input to provide dc voltage that not only has much less ripple voltage but also remains the same dc value even the dc voltage varies some what, or the load connected to the output dc voltages changes.

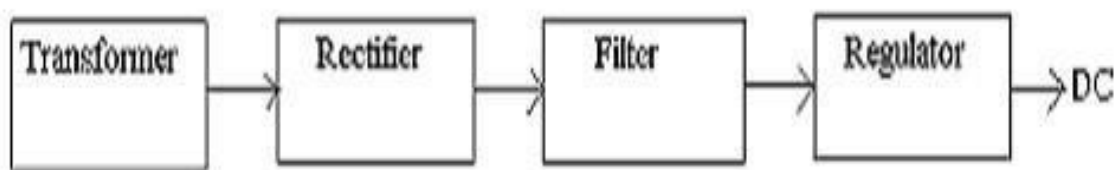


Fig 1.General Block Of Power Supply Unit



1.4 TRANSFORMER:

A transformer is a static piece of which electric power in one circuit is transformed into electric power of same frequency in another circuit. It can raise or lower the voltage in the circuit, but with a corresponding decrease or increase in current. It works with the principle of mutual induction. In our project we are using a step down transformer to providing a necessary supply for the electronic circuits. Here we step down a 230volts ac into 12volts ac.

1.5 RECTIFIER:

A dc level obtained from a sinusoidal input can be improved 100% using a process called full wave rectification. Here in our project for full wave rectification we use bridge rectifier. From the basic bridge configuration we see that two diodes(say D2 & D3) are conducting while the other two diodes (D1 & D4) are in off state during the period $t = 0$ to $T/2$. Accordingly for the negative cycle of the input the conducting diodes are D1 & D4 .Thus the polarity across the load is the same.

In the bridge rectifier the diodes may be of variable types like 1N4001, 1N4003, 1N4004, 1N4005, IN4007 etc.... can be used. But here we use 1N4007, because it can withstand up to 1000v.

1.6 FILTERS:

In order to obtain a dc voltage of 0 Hz, we have to use a low pass filter. So that a capacitive filter circuit is used where a capacitor is connected at the rectifier output & a dc is obtained across it. The filtered waveform is essentially a dc voltage with negligible ripples & it is ultimately fed to the load.



1.7 REGISTERS:

The controller IC has two 8 bit registers, an instruction register (IR) and a data register (DR). The IR stores the instruction codes and address information for display data RAM (DD RAM) and character generator RAM (CG RAM). The IR can be written, but not read by the MPU.

The DR temporally stores data to be written to /read from the DD RAM or CG RAM. The data written to DR by the MPU, is automatically written to the DD RAM or CG RAM as an internal operation.

When an address code is written to IR, the data is automatically transferred from the DD RAM or CG RAM to the DR. data transfer between the MPU is then completed when the MPU reads the DR. likewise, for the next MPU read of the DR, data in DD RAM or CG RAM at the address is sent to the DR automatically. Similarly, for the MPU write of the DR, the next DD RAM or CG RAM address is selected for the write operation.

The dot-matrix liquid crystal display controller and driver LSI displays alphanumeric, Japanese kana characters, and symbols. It can be configured to drive a dot-matrix liquid crystal display under the control of a 4- or 8-bit microprocessor. Since all the functions such as display RAM, character generator, and liquid crystal driver, required for driving a dot-matrix liquid crystal display are internally provided on one chip, a minimal system can be interfaced with this controller/driver

1.8 REGULATORS:

The output voltage from the capacitor is more filtered & finally regulated. The voltage regulator is a device, which maintains the output voltage constant irrespective of the change in supply variations, load variations & temperature changes. Here we use fixed



voltage regulator namely LM7805. The IC LM7805 is a +5v regulator which is used for microcontroller.

1.9 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

ARDUINO UNO AND ITS PROGRAMMING

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.

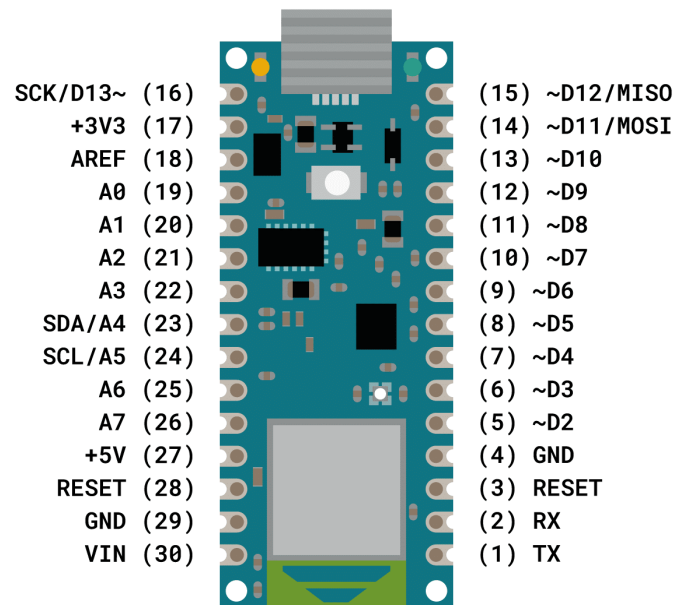
Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can be communicate with software running on your computer. The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free.

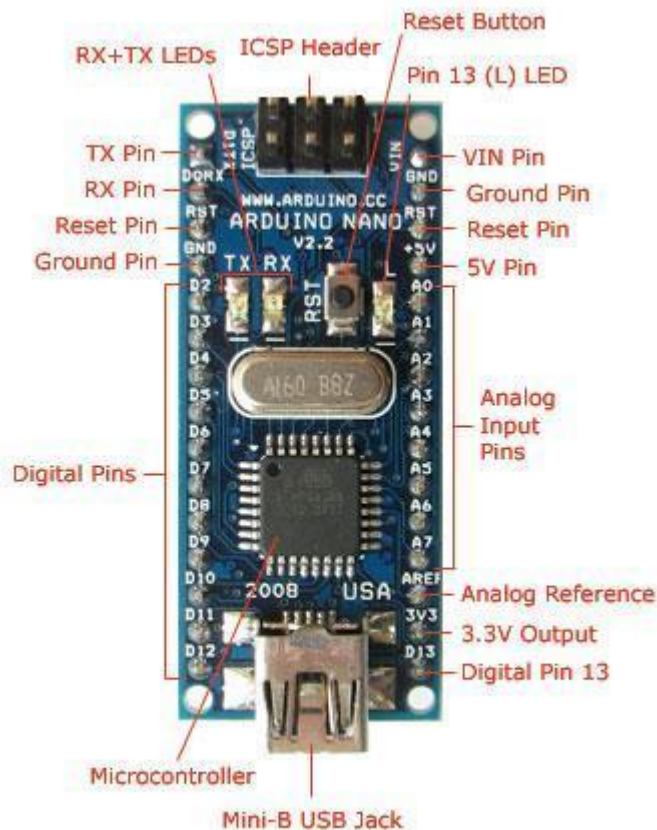
The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia



programming environment.

Arduino nano:



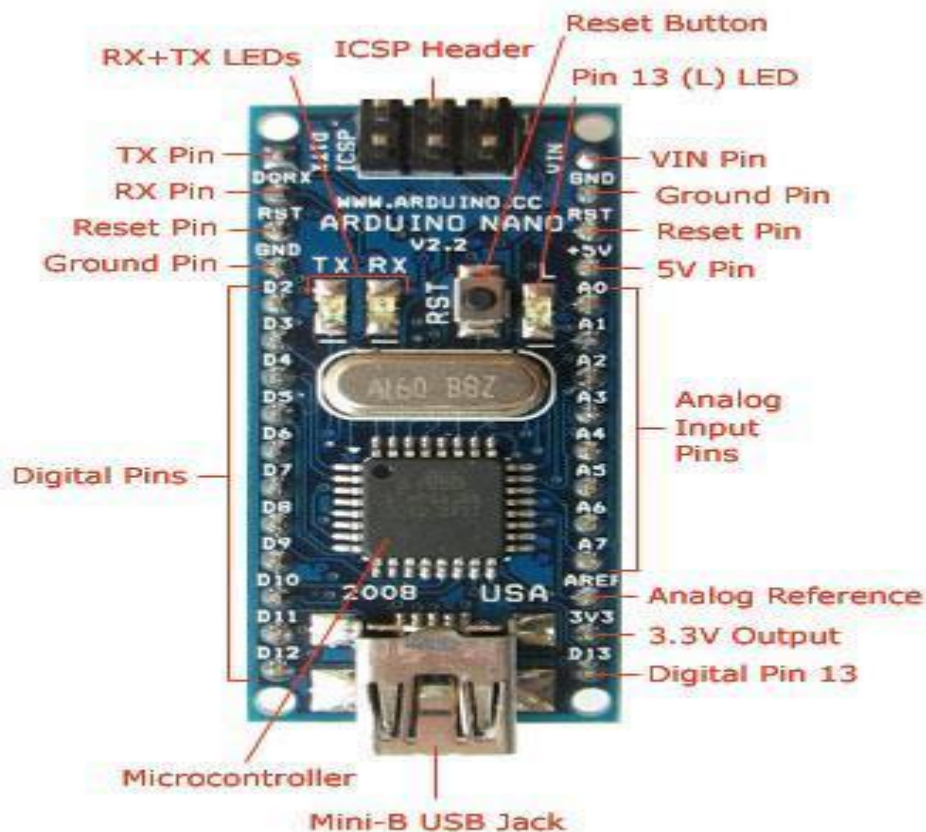


2.1 Overview

The Arduino microcontroller is an easy to use yet powerful single board computer that has gained considerable traction in the hobby and professional market. The Arduino is open-source, which means hardware is reasonably priced and development software is free. This guide is for students in ME 2011, or students anywhere who are confronting the Arduino for the first time. For advanced Arduino users, prowl the web; there are lots of resources.

This guide covers the Arduino Uno board (Spark fun DEV-09950, \$29.95), a good choice for students and educators. With the Arduino board, you can write programs and create interface circuits to read switches and other sensors, and to control motors and lights with very little effort. Many of the pictures and drawings in this guide were taken from the documentation on This is what the Arduino board looks like.





The Duemilanove board features an Atmel ATmega328 microcontroller operating at 5 V with 2 Kb of RAM, 32 Kb of flash memory for storing programs and 1 Kb of EEPROM for storing parameters. The clock speed is 16 MHz, which translates to about executing about 300,000 lines of C source code per second. The board has 14 digital I/O pins and 6 analog input pins. There is a USB connector for talking to the host computer and a DC power jack for connecting an external 6-20 V power source, for example a 9 V battery, when running a program while not connected to the host computer. Headers are provided for interfacing to the I/O pins using 22 g solid wire or header connectors.

The Arduino programming language is a simplified version of C/C++. If you know C, programming the Arduino will be familiar. If you do not know C, no need to worry as only a few commands are needed to perform useful functions.



An important feature of the Arduino is that you can create a control program on the host PC, download it to the Arduino and it will run automatically. Remove the USB cable connection to the PC, and the program will still run from the top each time you push the reset button. Remove the battery and put the Arduino board in a closet for six months. When you reconnect the battery, the last program you stored will run. This means that you connect the board to the host PC to develop and debug your program, but once that is done, you no longer need the PC to run the program.

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

2.2 Summary:

Microcontroller atmega328

Operating voltage 5v

Input voltage (recommended) 7-12v

Input voltage (limits) 6-20v

Digital i/o pins 14 (of which 6 provide pwm output)

Analog input pins 6

Dc current per i/o pin 40 ma

Dc current for 3.3v pin 50 ma



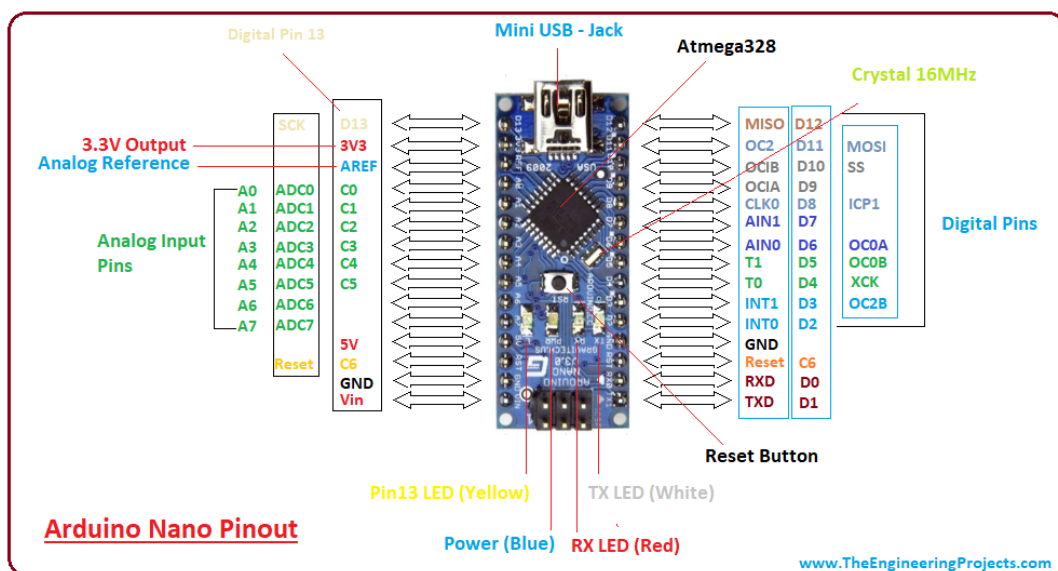
Flash memory 32 kb (atmega328) of which 0.5 kb used by bootloader

Sram 2 kb (atmega328)

Eeprom 1 kb (atmega328)

Clock speed 16 mhz

2.3 Pin Configuration



The Arduino Uno can be powered via the USB connection or with an external power

supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall- wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

- **VIN.** The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V.** this pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board.
- **3V3.** A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50mA.



- **GND.** Ground pins.

- **IOREF.** This pin on the Arduino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs for working with the 5V or 3.3V.

Memory

The ATmega328 has 32 KB (with 0.5 KB used for the bootloader). It also has 2 KB of SRAM and 1 KB of EEPROM.

Input and Output

Each of the 14 digital pins on the Uno can be used as an input or output, using `pinMode()`, `digital Write( )`, and `digital Read( )` functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kohms. In addition, some pins have specialized functions:

- **Serial: 0 (RX) and 1 (TX).** Used to receive (RX) and Transmit (TX) TTL serial data.

These pins are connected to the corresponding pins of the ATmega8U2 USB-to- TTL Serial chip.

- **External Interrupts: 2 and 3.** These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach



Interrupt () function for details.

- **PWM: 3, 5, 6, 9, 10, and 11.** Provide 8-bit PWM output with the analog Write () function.
- **SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK).** These pins support SPI communication using the SPI library.
- **LED: 13.** There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though it is possible to change the upper end of their range using the AREF pin and the analog Reference () function. Additionally, some pins have specialized functionality:

- **TWI: A4 or SDA pin and A5 or SCL pin.** Support TWI communication using the Wire library.

There are a couple of other pins on the board:

- **AREF.** Reference voltage for the analog inputs. Used with analog Reference ().

Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

2.4 Communication

Microcontrollers depend on a host computer for developing and compiling programs. The software used on the host computer is known as an integrated development



environment, or IDE. For the Arduino, the development environment is based on the open source Processing platform (www.processing.org) which is described by its creators as a “programming language and environment for people who want to program images, animation, and interactions.” The Arduino programming language leverages an open source project known as Wiring (wiring.org.co). The Arduino language is based on good old- fashioned C. If you are unfamiliar with this language, don’t worry; it’s not hard to learn, and the Arduino IDE provides some feedback when you make mistakes in your programs.

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

A Software Serial library allows for serial communication on any of the Uno's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the documentation for details. For SPI communication, use the SPI library.

As you go through the list of programming statements available in the Arduino IDE (choose Help->Reference), you might think there isn’t much power for doing things like running servos, operating stepper motors, reading potentiometers, or displaying text on an LCD. Like most any language based on C, the Arduino supports the



notion of “libraries” code

Repositories that extend core programming functionality. Libraries let you re- use code without having to physically copy and paste it into all your programs. The standard Arduino software installation comes with several libraries you may use, and you can download others from the Arduino support pages and from third-party websites that publish Arduino library code. A good example of a library you’ll use with the Robot and likely many other robot projects is

Servo. This library allows you to connect one or more hobby R/C servos to the Arduino’s digital I/O pins. The Servo library comes with the standard Arduino installation package Library->Servo. This adds the line

```
#include <Servo.h>
```

Which tells the Arduino IDE that you wish to include the Servo library in your sketch. With the functionality of the library now available to you, you can use its various functions to control one or more servos. For example, you can use the write function to rotate a servo to a specific position, from 0 to 180 degrees. The following code

```
myServo.write(90);
```

Moves a servo to its midpoint, or 90 degree position. Structurally, Arduino sketches are very straightforward and are pretty easy to read and understand. The Arduino program contains two main parts: setup () and loop (). These are programming functions that do what their names suggest: setup () sets up the Arduino hardware,



such as specifying which I/O lines you plan to use, and whether

They are inputs or outputs. The loop () function is repeated endlessly when the Arduino is operating.

Arduino IDE (Integrated development environment) is used to write the program and dump into the Arduino board

Introduction

Infrared technology addresses a wide variety of wireless applications. The main areas are sensing and remote controls. In the electromagnetic spectrum, the infrared portion is divided into three regions: near infrared region, mid infrared region and far infrared region.

The wavelengths of these regions and their applications are shown below.

- Near infrared region — 700 nm to 1400 nm — IR sensors, fiber optic
- Mid infrared region — 1400 nm to 3000 nm — Heat sensing
- Far infrared region — 3000 nm to 1 mm — Thermal imaging

The frequency range of infrared is higher than microwave and lesser than visible light.

For optical sensing and optical communication, photo optics technologies are used in the near infrared region as the light is less complex than RF when implemented as a source of signal. Optical wireless communication is done with IR data transmission for short range applications.



An infrared sensor emits and/or detects infrared radiation to sense its surroundings.

The working of any Infrared sensor is governed by three laws: Planck's Radiation law, Stephen – Boltzmann law and Wien's Displacement law.

Planck's law states that "every object emits radiation at a temperature not equal to 0°K". Stephen – Boltzmann law states that "at all wavelengths, the total energy emitted by a black body is proportional to the fourth power of the absolute temperature". According to Wien's Displacement law, "the radiation curve of a black body for different temperatures will reach its peak at a wavelength inversely proportional to the temperature".

The basic concept of an Infrared Sensor which is used as Obstacle detector is to transmit an infrared signal, this infrared signal bounces from the surface of an object and the signal is received at the infrared receiver.

There are five basic elements used in a typical infrared detection system: an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal processing. Infrared lasers and Infrared LED's of specific wavelength can be used as infrared sources. The three main types of media used for infrared transmission are vacuum, atmosphere and optical fibers. Optical components are used to focus the infrared radiation or to limit the spectral response. Optical lenses made of Quartz, Germanium and Silicon are used to focus the infrared radiation. Infrared receivers can be photodiodes, phototransistors etc. some important specifications of infrared receivers are photosensitivity, detectivity and noise equivalent power. Signal processing is done by amplifiers as the output of infrared detectors is very small.

Types of IR Sensors

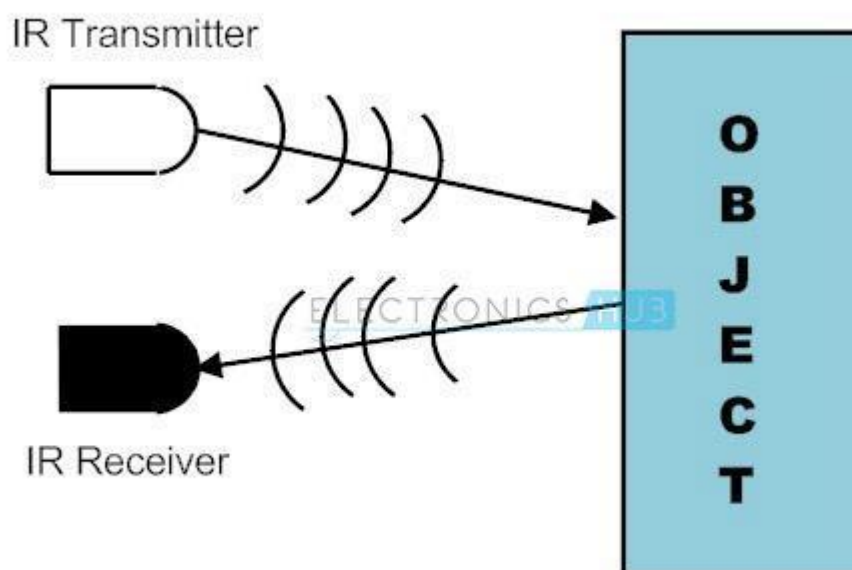
Infrared sensors can be passive or active. Passive infrared sensors are basically Infrared detectors. Passive infrared sensors do not use any infrared source and detects energy emitted by obstacles in the field of view. They are of two types:



quantum and thermal. Thermal infrared sensors use infrared energy as the source of heat and are independent of wavelength. Thermocouples, pyro electric detectors and bolometers are the common types of thermal infrared detectors.

Quantum type infrared detectors offer higher detection performance and are faster than thermal type infrared detectors. The photosensitivity of quantum type detectors is wavelength dependent. Quantum type detectors are further classified into two types: intrinsic and extrinsic types. Intrinsic type quantum detectors are photoconductive cells and photovoltaic cells.

Active infrared sensors consist of two elements: infrared source and infrared detector. Infrared sources include an LED or infrared laser diode. Infrared detectors include photodiodes or phototransistors. The energy emitted by the infrared source is reflected by an object and falls on the infrared detector.



IR Transmitter



Infrared Transmitter is a light emitting diode (LED) which emits infrared radiations. Hence, they are called IR LED's. Even though an IR LED looks like a normal LED, the radiation emitted by it is invisible to the human eye.

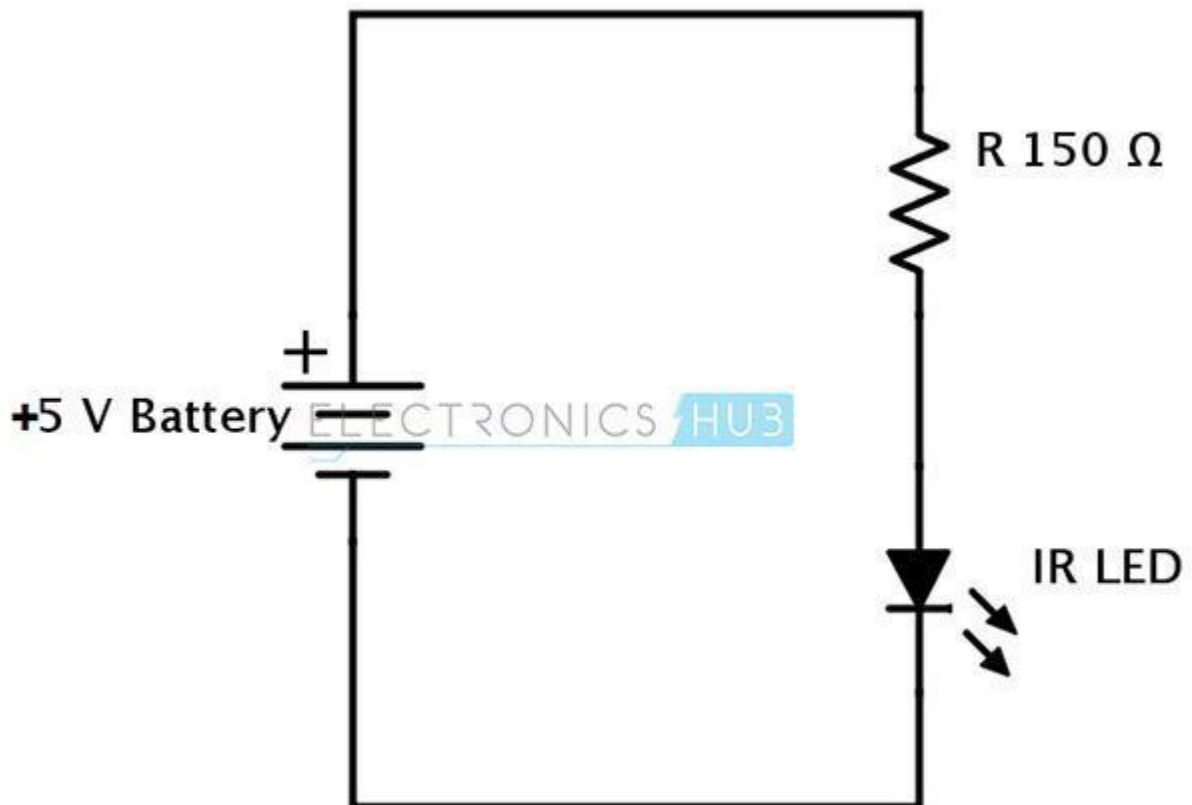
The picture of a typical Infrared LED is shown below.



There are different types of infrared transmitters depending on their wavelengths, output power and response time.

A simple infrared transmitter can be constructed using an infrared LED, a current limiting resistor and a power supply. The schematic of a typical IR transmitter is shown below.





When operated at a supply of 5V, the IR transmitter consumes about 3 to 5 mA of current. Infrared transmitters can be modulated to produce a particular frequency of infrared light. The most commonly used modulation is OOK (ON – OFF – KEYING) modulation.

IR transmitters can be found in several applications. Some applications require infrared heat and the best infrared source is infrared transmitter. When infrared emitters are used with Quartz, solar cells can be made.

IR Receiver

Infrared receivers are also called as infrared sensors as they detect the radiation from an IR transmitter. IR receivers come in the form of photodiodes and phototransistors. Infrared Photodiodes are different from normal photo diodes as they detect only infrared radiation. The picture of a typical IR receiver or a photodiode is shown below.

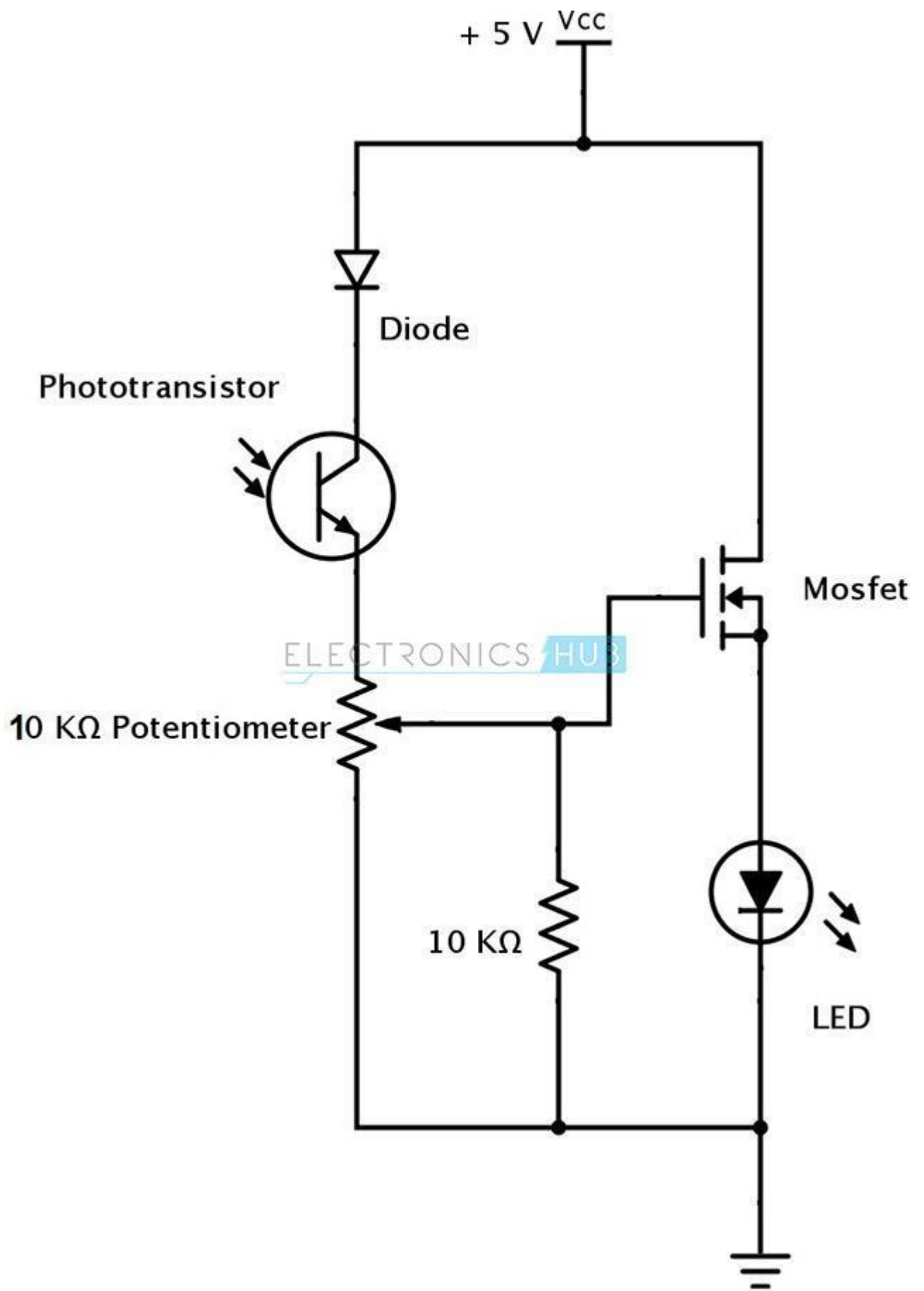




Different types of IR receivers exist based on the wavelength, voltage, package, etc. When used in an infrared transmitter – receiver combination, the wavelength of the receiver should match with that of the transmitter.

A typical infrared receiver circuit using a phototransistor is shown below.

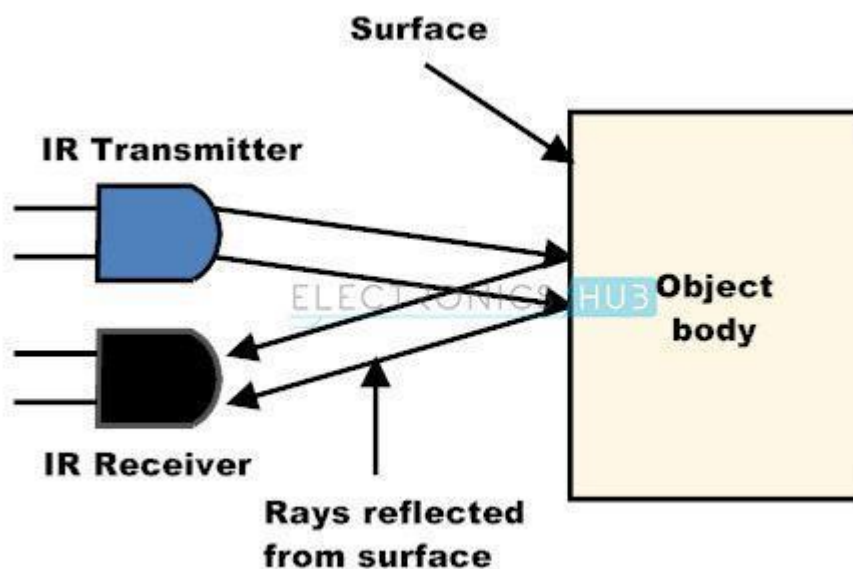




It consists of an IR phototransistor, a diode, a MOSFET, a potentiometer and an LED. When the phototransistor receives any infrared radiation, current flows through it and MOSFET turns on. This in turn lights up the LED which acts as a load. The potentiometer is used to control the sensitivity of the phototransistor.

Principle of Working

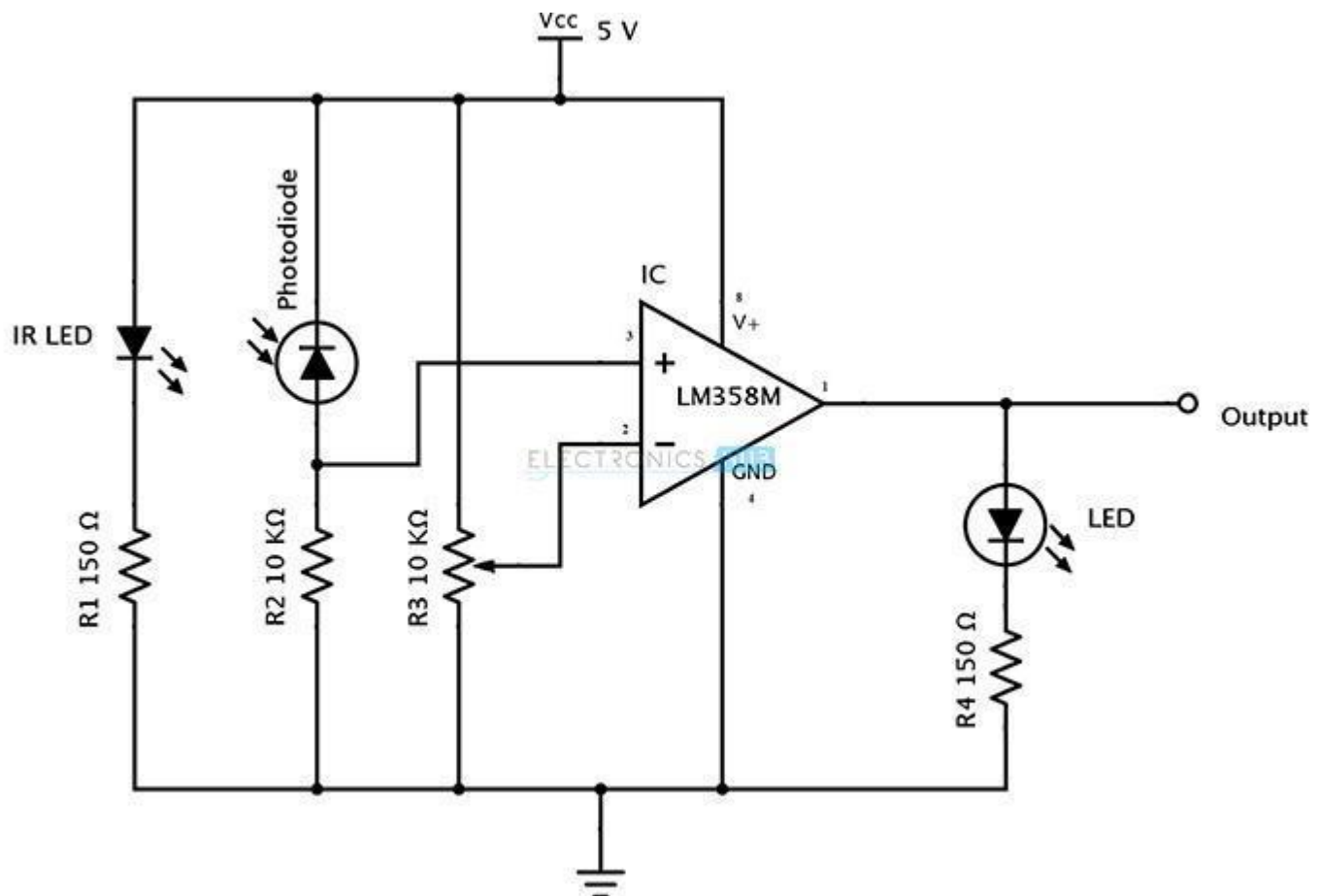
The principle of an IR sensor working as an Object Detection Sensor can be explained using the following figure. An IR sensor consists of an IR LED and an IR Photodiode; together they are called as Photo – Coupler or Opto – Coupler.



When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver. Based on the intensity of the reception by the IR receiver, the output of the sensor is defined.

Obstacle Sensing Circuit or IR Sensor Circuit

A typical IR sensing circuit is shown below.



It consists of an IR LED, a photodiode, a potentiometer, an IC Operational amplifier and an LED.

IR LED emits infrared light. The Photodiode detects the infrared light. An IC Op – Amp is used as a voltage comparator. The potentiometer is used to calibrate the output of the sensor according to the requirement.

When the light emitted by the IR LED is incident on the photodiode after hitting an object, the resistance of the photodiode falls down from a huge value. One of the



input of the op – amp is at threshold value set by the potentiometer. The other input to the op-amp is from the photodiode's series resistor. When the incident radiation is more on the photodiode, the voltage drop across the series resistor will be high. In the IC, both the threshold voltage and the voltage across the series resistor are compared. If the voltage across the resistor series to photodiode is greater than that of the threshold voltage, the output of the IC Op – Amp is high. As the output of the IC is connected to an LED, it lightens up. The threshold voltage can be adjusted by adjusting the potentiometer depending on the environmental conditions.

The positioning of the IR LED and the IR Receiver is an important factor. When the IR LED is held directly in front of the IR receiver, this setup is called Direct Incidence. In this case, almost the entire radiation from the IR LED will fall on the IR receiver. Hence there is a line of sight communication between the infrared transmitter and the receiver. If an object falls in this line, it obstructs the radiation from reaching the receiver either by reflecting the radiation or absorbing the radiation.

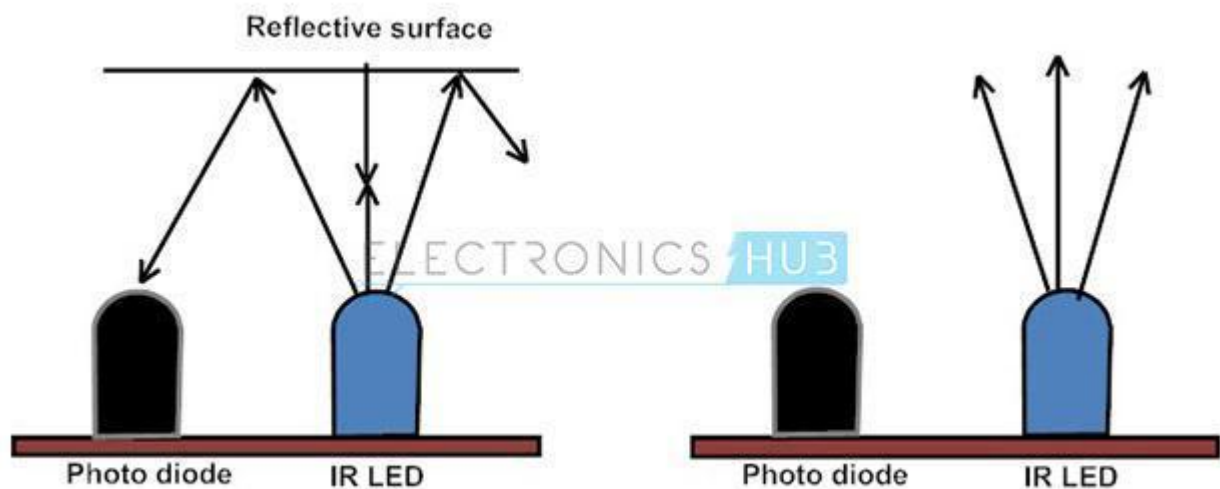
Distinguishing Between Black and White Colours

It is universal that black colour absorbs the entire radiation incident on it and white colour reflects the entire radiation incident on it. Based on this principle, the second positioning of the sensor couple can be made. The IR LED and the photodiode are placed side by side. When the IR transmitter emits infrared radiation, since there is no direct line of contact between the transmitter and receiver, the emitted radiation must reflect back to the photodiode after hitting any object. The surface of the object can be divided into two types: reflective surface and non-reflective surface. If the surface of the object is reflective in nature i.e. it is white or other light color, most of the radiation incident on it will get reflected back and reaches the photodiode. Depending on the intensity of the radiation reflected back, current flows in the photodiode.



If the surface of the object is non-reflective in nature i.e. it is black or other dark color, it absorbs almost all the radiation incident on it. As there is no reflected radiation, there is no radiation incident on the photodiode and the resistance of the photodiode remains higher allowing no current to flow. This situation is similar to there being no object at all.

The pictorial representation of the above scenarios is shown below.



The positioning and enclosing of the IR transmitter and Receiver is very important. Both the transmitter and the receiver must be placed at a certain angle, so that the detection of an object happens properly. This angle is the directivity of the sensor which is ± 45 degrees.

Radio frequency identification (RFID) is a form of wireless communication that uses radio waves to identify and track objects. RFID takes the barcoding concept and digitizes it for the modern world providing the ability to:

- Uniquely identify an individual item beyond just its product type
- Identify items without direct line-of-sight
- Identify many items (up to 1,000s) simultaneously
- Identify items within a vicinity of between a few centimetres to several meters



An RFID system has *readers* and *tags* that communicate with each other by radio. RFID tags are so small and require so little power that they don't even need a battery to store information and exchange data with readers. This makes it easy and cheap to apply tags to all kinds of things that people would like to identify or track.

Why Use RFID?

RFID technology has the capability to both greatly enhance and protect the lives of consumers, and also revolutionize the way companies do business. As the most flexible auto-identification technology, RFID can be used to track and monitor the physical world automatically and with accuracy.

RFID can tell you what an object is, where it is, and even its condition, which is why it is integral to the development of the Internet of Things—a globally interconnected web of objects allowing the physical world itself to become an information system, automatically sensing what is happening, sharing related data, and responding.

RFID use is increasing rapidly with the capability to “tag” any item with an inexpensive communications chip and then read that tag with a reader. Endless applications range from supply chain management to asset tracking to authentication of frequently counterfeited pharmaceuticals. Applications are limited, in fact, only by the imagination of the user.





RFID Applications



RFID can help:

- Automate inventory and asset-tracking in healthcare, manufacturing, retail, and business sectors
- Identify the source of products, enabling intelligent recall of defective or dangerous items, such as tainted foods, defective toys, and expired or compromised medication
- Prevent use of counterfeit products in the supply chain
- Improve shopping experience for consumers, with fewer out-of-stock items and easier returns
- Provide visibility into the supply chain, yielding a more efficient distribution channel and reduced business costs
- Decrease business revenue lost to theft or inaccurate accounting of goods
- Improve civilian security through better cargo monitoring at ports



- Wirelessly lock, unlock and configure electronic devices
- Enable access control of certain areas or devices

Whatever the application, RFID has the potential to increase efficiency of operations, improve asset visibility and traceability, decrease reliance on manual processes, reduce operations costs, and provide useful data for business analytics.

A basic RFID solution includes:

Tag

- Tag chips or integrated circuits (ICs)
- Tag antennas

Reader

- Reader antenna
- Reader control & application software

In a basic RFID system, tags are attached to all items that are to be tracked. These tags are made from a tiny tag-chip, sometimes called an integrated circuit (IC), that is connected to an antenna that can be built into many different kinds of tags including apparel hang tags, labels, and security tags, as well as a wide variety of industrial asset tags. The tag chip contains memory which stores the product's electronic product code (EPC) and other variable information so that it can be read and tracked by RFID readers anywhere.

An RFID reader is a network connected device (fixed or mobile) with an antenna that sends power as well as data and commands to the tags. The RFID reader acts like an access point for RFID tagged items so that the tags' data can be made available to business applications.



RFID Tags



An RFID tag is comprised of an integrated circuit (called an IC or chip) attached to an antenna that has been printed, etched, stamped or vapor-deposited onto a mount which is often a paper substrate or PolyEthylene Therephtalate (PET). The chip and antenna combo, called an inlay, is then converted or sandwiched between a printed label and its adhesive backing or inserted into a more durable structure.



Tag Chip

The tag's chip or integrated circuit (IC) delivers performance, memory and extended features to the tag. The chip is pre-programmed with a tag identifier (TID), a unique serial number assigned by the chip manufacturer, and includes a memory bank to store the items' unique tracking identifier (called an electronic product code or EPC).

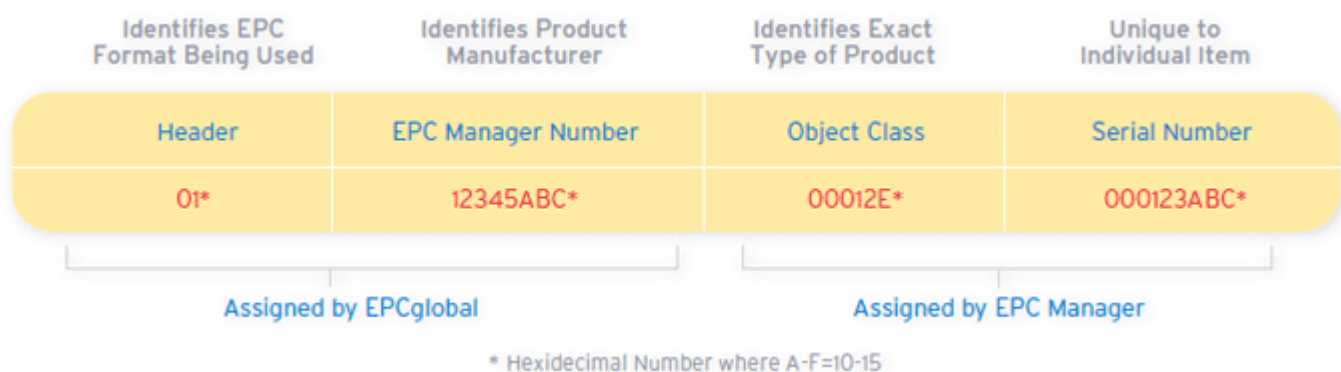
Electronic Product Code (EPC)



The electronic product code (EPC) stored in the tag chip's memory is written to the tag by an RFID printer and takes the form of a 96-bit string of data. The first eight bits are a header which identifies the version of the protocol. The next 28 bits identify the organization that manages the data for this tag; the organization number is assigned by the EPCglobal consortium. The next 24 bits are an object class,



identifying the kind of product; the last 36 bits are a unique serial number for a particular tag. These last two fields are set by the organization that issued the tag. The total electronic product code number can be used as a key into a global database to uniquely identify that particular product.



Tag Antennas

Tag antennas collect energy and channel it to the chip to turn it on. Generally, the larger the tag antenna's area, the more energy it will be able to collect and channel toward the tag chip, and the further read range the tag will have.

There is no perfect antenna for all applications. It is the application that defines the antenna specifications. Some tags might be optimized for a particular [frequency band](#), while others might be tuned for good performance when attached to materials that may not normally work well for wireless communication (certain liquids and metals, for example). Antennas can be made from a variety of materials; they can be printed, etched, or stamped with conductive ink, or even vapor deposited onto labels.

Tags that have only a single antenna are not as reliable as tags with multiple antennas. With a single antenna, a tag's orientation can result in “dead zones”, or areas on the tag where incoming signals cannot be easily harvested to provide sufficient energy to power on the chip and communicate with the reader. A tag with



dual antennas is able to eliminate these dead zones and increase its readability but requires a specialized chip.

RFID Readers



An RFID reader, also known as an interrogator, is a device that provides the connection between the tag data and the enterprise system software that needs the information. The reader communicates with tags that are within its field of operation, performing any number of tasks including simple continuous inventorying, filtering (searching for tags that meet certain criteria), writing (or encoding) to selected tags, etc.

The reader uses an attached antenna to capture data from tags. It then passes the data to a computer for processing. Just like RFID tags, there are many different sizes and types of RFID readers. Readers can be affixed in a stationary position in a store or factory, or integrated into a mobile device such as a portable, handheld scanner. Readers can also be embedded in electronic equipment or devices, and in vehicles.



Reader Antennas

RFID readers and reader antennas work together to read tags. Reader antennas convert electrical current into electromagnetic waves that are then radiated into space where they can be received by a tag antenna and converted back to electrical current. Just like tag antennas, there is a large variety of reader antennas and optimal antenna selection varies according to the solution's specific application and environment.



The two most common antenna types are linear- and circular-polarized antennas. Antennas that radiate linear electric fields have long ranges, and high levels of power that enable their signals to penetrate through different materials to read tags. Linear antennas are sensitive to tag orientation; depending on the tag angle or placement, linear antennas can have a difficult time reading tags. Conversely, antennas that radiate circular fields are less sensitive to orientation, but are not able to deliver as much power as linear antennas.

Choice of antenna is also determined by the distance between the RFID reader and the tags that it needs to read. This distance is called read range. Reader antennas operate in either a "near-field" (short range) or "far-field" (long range). In near-field applications, the read range is less than 30 cm and the antenna uses magnetic coupling so the reader and tag can transfer power. In near-field systems, the readability of the tags is not affected by the presence of dielectrics such as water and metal in the field.

In far-field applications, the range between the tag and reader is greater than 30 cm and can be up to several tens of meters. Far-field antennas utilize electromagnetic coupling and dielectrics can weaken communication between the reader and tags.



Reader Control and Application Software

Reader control and application software, also known as middleware, helps connect RFID readers with the applications they support. The middleware sends control commands to the reader and receives tag data from the reader.

Creating an RFID Solution

Deploying an RFID system necessitates multiple actors and many different components. Typically, installing a system requires basic hardware-including tag chips, tag antennas, readers, and reader antennas-as well as reader control and



application software, and solution providers to put it all together. When all of these components come together, an infinite number of creative applications are possible. RFID system applications can help improve the quality of business operations, inventory and customer experience in a variety of industries.

Frequency refers to the size of the radio waves used to communicate between RFID system components. RFID systems throughout the world operate in **low frequency (LF)**, **high frequency (HF)** and **ultra-high frequency (UHF) bands**. Radio waves behave differently at each of these frequencies with advantages and disadvantages associated with using each frequency band.

If an RFID system operates at a lower frequency, it has a shorter read range and slower data read rate, but increased capabilities for reading near or on metal or liquid surfaces. If a system operates at a higher frequency, it generally has faster data transfer rates and longer read ranges than lower frequency systems, but more sensitivity to radio wave interference caused by liquids and metals in the environment.

LF RFID

The LF band covers frequencies from 30 KHz to 300 KHz. Typically LF RFID systems operate at 125 KHz, although there are some that operate at 134 KHz. This frequency band provides a short read range of 10 cm, and has slower read speed than the higher frequencies, but is not very sensitive to radio wave interference.

LF RFID applications include access control and livestock tracking.

Standards for LF animal-tracking systems are defined in ISO 14223, and ISO/IEC 18000-2. The LF spectrum is not considered a truly global application because of slight differences in frequency and power levels throughout the world.

HF RFID



The HF band ranges from 3 to 30 MHz. Most HF RFID systems operate at 13.56 MHz with read ranges between 10 cm and 1 m. HF systems experience moderate sensitivity to interference.

HF RFID is commonly used for ticketing, payment, and data transfer applications.

There are several HF RFID standards in place, such as the ISO 15693 standard for tracking items, and the ECMA-340 and ISO/IEC 18092 standards for Near Field Communication (NFC), a shortrange technology that is commonly used for data exchange between devices. Other HF standards include the ISO/IEC 14443 A and ISO/IEC 14443 standards for MIFARE technology, which used in smart cards and proximity cards, and the JIS X 6319-4 for FeliCa, which is a smart card system commonly used in electronic money cards.

UHF RFID

The UHF frequency band covers the range from 300 MHz to 3 GHz. Systems complying with the UHF Gen2 standard for RFID use the 860 to 960 MHz band. While there is some variance in frequency from region to region, UHF Gen2 RFID systems in most countries operate between 900 and 915 MHz.

The read range of passive UHF systems can be as long as 12 m, and UHF RFID has a faster data transfer rate than LF or HF. UHF RFID is the most sensitive to interference, but many UHF product manufacturers have found ways of designing tags, antennas, and readers to keep performance high even in difficult environments. Passive UHF tags are easier and cheaper to manufacture than LF and HF tags.

UHF RFID is used in a wide variety of applications, ranging from retail inventory management, to pharmaceutical anti-counterfeiting, to wireless device configuration. The bulk of new RFID projects are using UHF opposed to LF or HF, making UHF the fastest growing segment of the RFID market.

The UHF frequency band is regulated by a single global standard called the ECPglobal Gen2 (ISO 18000-6C) UHF standard.

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UHF	HF and LF
• Single worldwide Gen2 standard • 20x the range and speed of HF • Labels cost 5¢–15¢ in 2012 • The technology for item tagging	• Multiple competing standards • HF-based NFC for secure payment • Labels, cards, inlays cost 50¢–\$2 • Used in immobilizers, ticketing, payment

Passive, Active, and BAP RFID Systems

Active RFID Systems

In active RFID systems, tags have their own transmitter and power source. Usually, the power source is a battery. Active tags broadcast their own signal to transmit the information stored on their microchips.

Active RFID systems typically operate in the **ultra-high frequency (UHF) band** and offer a range of up to 100 m. In general, active tags are used on large objects, such as rail cars, big reusable containers, and other assets that need to be tracked over long distances.

There are two main types of active tags: transponders and beacons. **Transponders** are “woken up” when they receive a radio signal from a reader, and then power on and respond by transmitting a signal back. Because transponders do not actively radiate radio waves until they receive a reader signal, they conserve battery life.

Beacons are used in most **real-time locating systems (RTLS)**, in order to track the precise location of an asset continuously. Unlike transponders, beacons are not powered on by the reader’s signal. Instead, they emit signals at pre-set intervals. Depending on the level of locating accuracy required, beacons can be set to emit signals every few seconds, or once a day. Each beacon’s signal is received by reader antennas that are positioned around the perimeter of the area being monitored, and communicates the tag’s ID information and position.



Passive RFID Systems

In passive RFID systems, the reader and reader antenna send a radio signal to the tag. The RFID tag then uses the transmitted signal to power on, and reflect energy back to the reader.

Passive RFID systems can operate in the **low frequency (LF)**, **high frequency (HF)** or **ultra-high frequency (UHF)** radio bands. As passive system ranges are limited by the power of the tag's **backscatter** (the radio signal reflected from the tag back to the reader), they are typically less than 10 m. Because passive tags do not require a power source or transmitter, and only require a tag chip and antenna, they are cheaper, smaller, and easier to manufacture than active tags.

Passive tags can be packaged in many different ways, depending on the specific RFID application requirements. For instance, they may be mounted on a substrate, or sandwiched between an adhesive layer and a paper label to create smart RFID labels. Passive tags may also be embedded in a variety of devices or packages to make the tag resistant to extreme temperatures or harsh chemicals.

Passive RFID solutions are useful for many applications, and are commonly deployed to track goods in the supply chain, to inventory assets in the retail industry, to authenticate products such as pharmaceuticals, and to embed RFID capability in a variety of devices. Passive RFID can even be used in warehouses and distribution centers, in spite of its shorter range, by setting up readers at choke points to monitor asset movement.

Battery-Assisted Passive (BAP) Systems

A Battery-Assisted Passive RFID tag is a type of passive tag which incorporates a crucial active tag feature. While most passive RFID tags use the energy from the RFID reader's signal to power on the tag's chip and backscatter to the reader, BAP tags use an integrated power source (usually a battery) to power on the chip, so all of the captured energy from the reader can be used for backscatter. Unlike transponders, BAP tags do not have their own transmitters.



		Active RFID	Passive RFID	Battery-Assisted Passive (BAP)
Tag Power Source		Internal to tag	Energy transfer from the reader via RF	Tag uses internal power source to power on, and energy transferred from the reader via RF to backscatter
Tag Battery		Yes	No	Yes
Availability of Tag Power		Continuous	Only within field of reader	Only within field of reader
Required Signal Strength from Reader to Tag		Very Low	Very high (must power the tag)	Moderate (does not need to power tag, but must power backscatter)
Available Signal Strength from Tag to Reader		High	Very Low	Moderate
Communication Range		Long Range (100m or more)	Short range (up to 10m)	Moderate range (up to 100m)
Sensor Capability		Ability to continuously monitor and record sensor input	Ability to read and transfer sensor values only when tag is powered by reader	Ability to read and transfer sensor values only when tag receives RF signal from reader



LCD Display

Liquid crystal displays (LCDs) have materials which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal.

An LCD consists of two glass panels, with the liquid crystal material sandwiched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed. Polymeric layers are present in between the electrodes and the liquid crystal, which makes the liquid crystal molecules to maintain a defined orientation angle.

On each polariser is pasted outside the two glass panels. These polarisers would rotate the light rays passing through them to a definite angle, in a particular direction.

When the LCD is in the off state, light rays are rotated by the two polarisers and the liquid crystal, such that the light rays come out of the LCD without any orientation, and hence the LCD appears transparent.

When sufficient voltage is applied to the electrodes, the liquid crystal molecules would be aligned in a specific direction. The light rays passing through the LCD would be rotated by the polarisers, which would result in activating / highlighting the desired characters.

The LCD's are lightweight with only a few millimeters thickness. Since the LCD's consume less power, they are compatible with low power electronic circuits, and can be powered for long durations.

The LCD's don't generate light and so light is needed to read the display. By using backlighting, reading is possible in the dark. The LCD's have long life and a wide operating temperature range.



Changing the display size or the layout size is relatively simple which makes the LCD's more customer friendly.

The LCDs used exclusively in watches, calculators and measuring instruments are the simple seven-segment displays, having a limited amount of numeric data. The recent advances in technology have resulted in better legibility, more information displaying capability and a wider temperature range. These have resulted in the LCDs being extensively used in telecommunications and entertainment electronics. The LCDs have even started replacing the cathode ray tubes (CRTs) used for the display of text and graphics, and also in small TV applications.

Crystalonics dot –matrix (alphanumeric) liquid crystal displays are available in TN, STN types, with or without backlight. The use of C-MOS LCD controller and driver ICs result in low power consumption. These modules can be interfaced with a 4-bit or 8-bit micro processor /Micro controller.

The built-in controller IC has the following features:

Correspond to high speed MPU interface (2MHz)

80 x 8 bit display RAM (80 Characters max)

9,920 bit character generator ROM for a total of 240 character fonts. 208 character fonts (5 x 8 dots) 32 character fonts (5 x 10 dots)

64 x 8 bit character generator RAM 8 character generator RAM 8 character fonts (5 x 8 dots) 4 characters fonts (5 x 10 dots)

Programmable duty cycles

1/8 – for one line of 5 x 8 dots with cursor

1/11 – for one line of 5 x 10 dots with cursor

1/16 – for one line of 5 x 8 dots with cursor



Wide range of instruction functions display clear, cursor home, display on/off, cursor on/off, display character blink, cursor shift, display shift.

FUNCTIONAL DESCRIPTION OF THE CONTROLLER IC

REGISTERS:

The controller IC has two 8 bit registers, an instruction register (IR) and a data register (DR). The IR stores the instruction codes and address information for display data RAM (DD RAM) and character generator RAM (CG RAM). The IR can be written, but not read by the MPU.

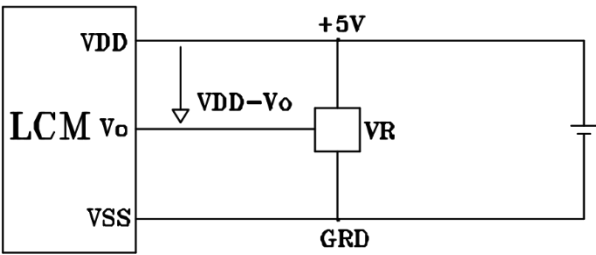
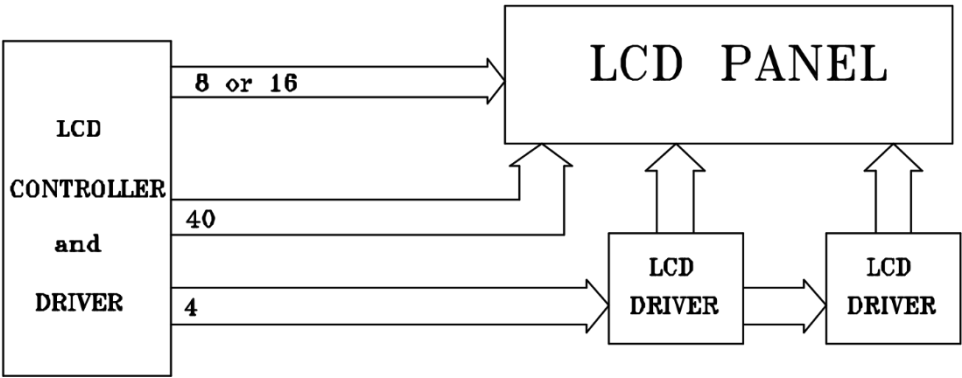
The DR temporally stores data to be written to /read from the DD RAM or CG RAM. The data written to DR by the MPU, is automatically written to the DD RAM or CG RAM as an internal operation.

When an address code is written to IR, the data is automatically transferred from the DD RAM or CG RAM to the DR. data transfer between the MPU is then completed when the MPU reads the DR. likewise, for the next MPU read of the DR, data in DD RAM or CG RAM at the address is sent to the DR automatically. Similarly, for the MPU write of the DR, the next DD RAM or CG RAM address is selected for the write operation.

The dot-matrix liquid crystal display controller and driver LSI displays alphanumeric, Japanese kana characters, and symbols. It can be configured to drive a dot-matrix liquid crystal display under the control of a 4- or 8-bit microprocessor. Since all the functions such as display RAM, character generator, and liquid crystal driver, required for driving a dot-matrix liquid crystal display are internally provided on one chip, a minimal system can be interfaced with this controller/driver.

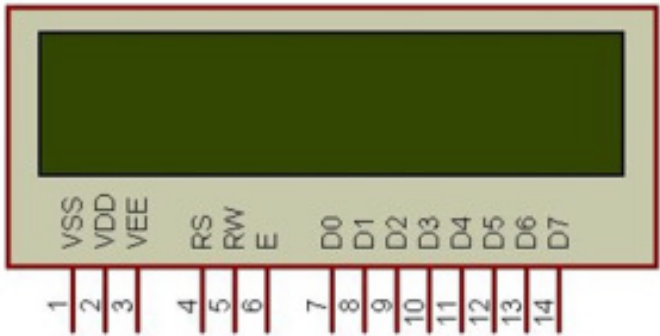
Block Diagram





VDD-Vo: LCD DRIVING VOLTAGE

VR: 10K-20K



Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit
Power Voltage	VDD -VSS	0	7.0	V



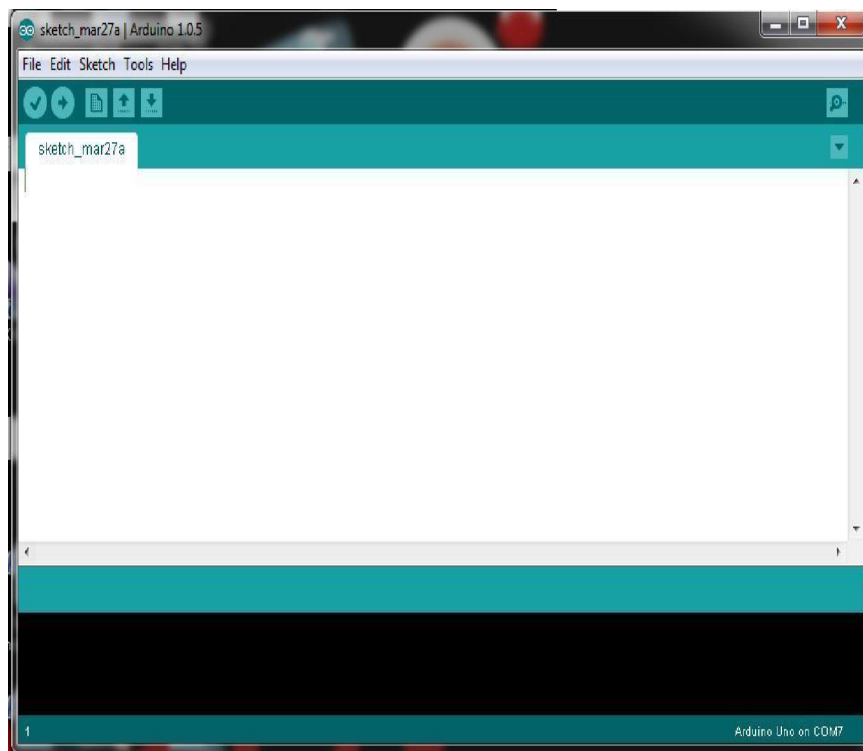
Input Voltage	V_{in}	V_{ss}	VDD	
Operating Temperature Range	TOP	0	+50	T
Storage Temperature Range	T_{ST}	-20	+60	



2.5 ARDUINO SOFTWARE:

1. Open Arduino IDE as shown below

Open Arduino IDE



2. Select the COM Port from tool

Select the COM

Port

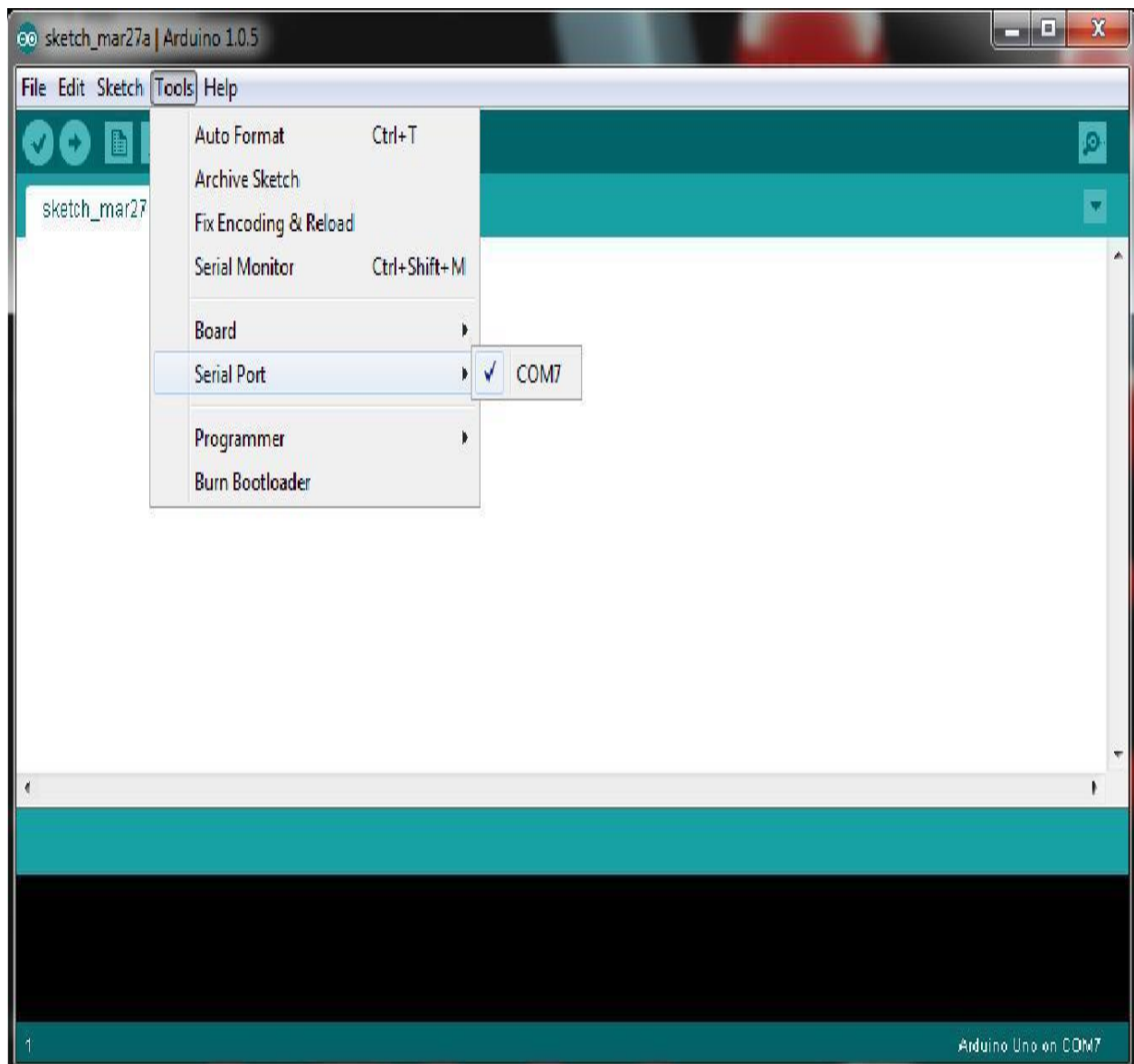
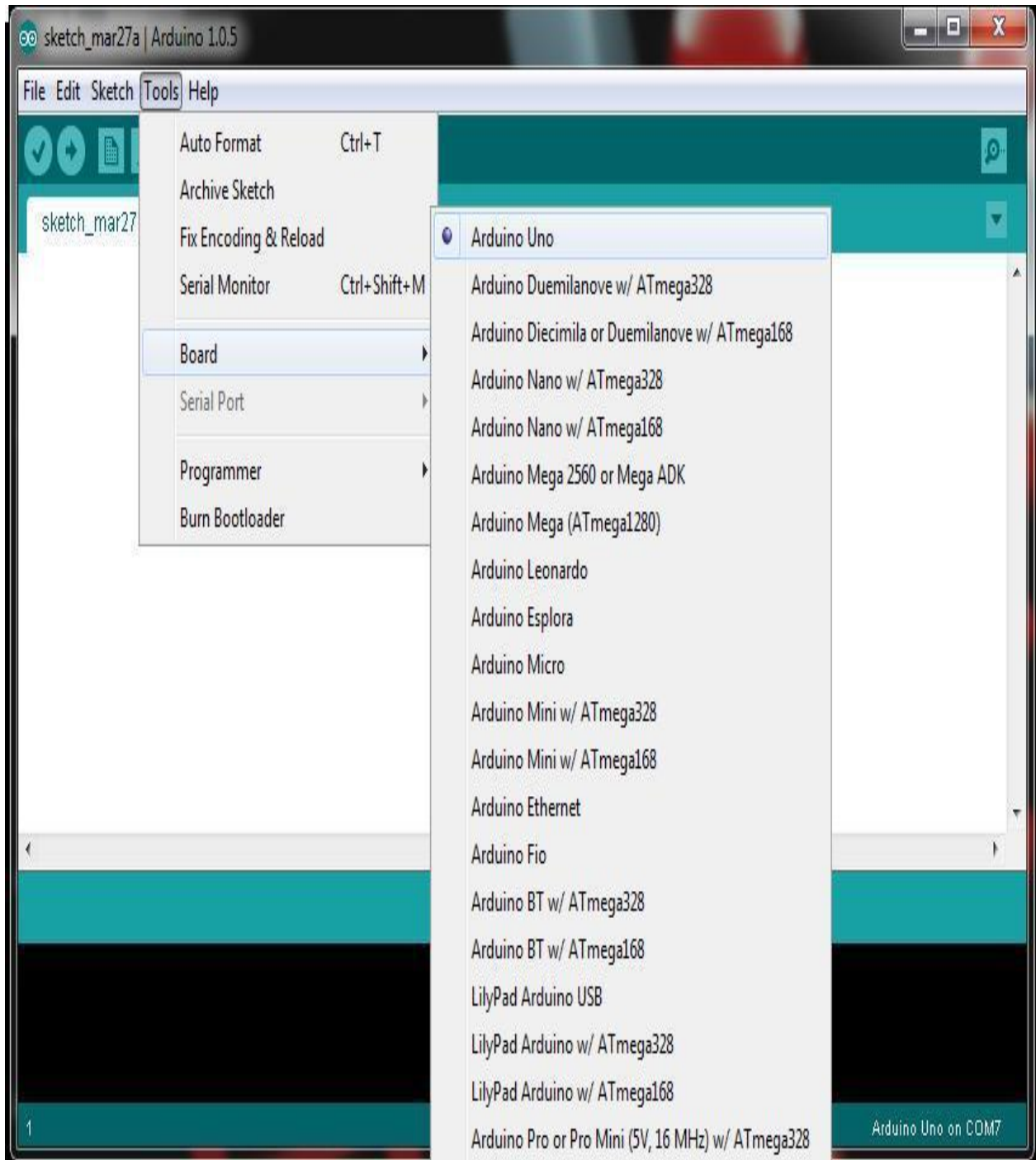


Fig 3.3

3. Select the required Arduino board from Tools as shown below





Select the required Arduino board

fig 3.4

4. Write the sketch in Arduino IDE

Sketch in Arduino IDE



```
sketch_mar28a$
#include <Servo.h> //includes the servo library
int motor_pin1 = 4;
int motor_pin2 = 5;
int motor_pin3 = 6;
int motor_pin4 = 7;
int servopin = 8;
int sensorpin = 0;
int dist = 0;
int leftdist = 0;
int rightdist = 0;
int object = 500; //distance at which the robot should look for another route
const int RightSensor = 1; // This pin is used to read the value of the Right Sensor.
const int LeftSensor = 2; // This pin is used to read the value of the Left Sensor.
int SensorLeft; // This stores the value of the Left Sensor pin to use later on in the sketch
int SensorRight; // This stores the value of the Right Sensor pin to use later on in the sketch
int SensorDifference; // This value is used to determine the difference between the Left and Right
```

1 Arduino Uno on COM7

5. Compile and upload the Sketch to Arduino
board upload the Sketch to Arduino board



Conclusion:

In this system we can create a ticket using
RFID tags normally as metro and we have

count the how many tickets are taken by passengers and how many people entering in to the railway station.

Here we are using two Arduino nano microcontroller one is for reading the RFID tags like tickets, these data share to the next verification section.

For example 3 tickets are taken by passengers and 5 members are entry in to the railway station and the IR sensor is counts how many members the entering and how many members leave the station these and all maintenance by the Arduino nano. When the Ticket collector is collect data of tickets and press the fool proof tickets alarm button. Then the microcontroller process and alerts.

Result:



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