RFID Based Attendance System

A

Project Report

Submitted in partial fulfillment of the requirement for the award of the degree of

Bachelor of Technology

In

Electronics and Communication Engineering

Submitted to

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CHAMELI DEVI GROUP OF INSTITUTIONS

INDORE (M.P.) 452020

2019-20

DECLARATION

We certify that the work contained in this report is original and has been done by us under the guidance of our supervisor.

a. The work has not been submitted to any other Institute for any degree or diploma.
b. We have followed the guidelines provided by the Institute in preparing the report.
c. We have confirmed to the norms and guidelines given in the Ethical Code of Conduct of the Institute.
d. Whenever we have used materials (data, theoretical analysis, figures, and text) from other sources, we have given due credit to them by citing them in the text of the report and giving their details in the references. Further, I have taken permission from the copyright owners of the sources, whenever necessary.

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CERTIFICATE

Certified that the project report entitled, "***RFID Based Attendance System***" is a bonafide work done under my guidance by, **Ms. Bhavya Chourey (0832EC171009), Ms. Harshita Chouhan (0832EC171012), Mr. Mayank Kesarwani (0832EC171020) & Mr. Shubham Rohit (0832EC171035)** in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology in **Electronics and Communication Engineering.**

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Abstract

Nowadays, due to the digitalization and advancement in technology, regular way of marking the attendance with pen and paper is a bit old fashioned. This project is to simplify attendance recorder system by using Radio Frequency Identification (RFID) technology. RFID based Attendance System is a simple microcontroller-based system that will be developed to overcome this problem. With the RFID kit and required components, the system will be controlled by using basic arduino architecture. The system is also integrated with the RFID Data Handling System for a fully functional system. The information from RFID Data handling System will be used for attendance and for storage of the student data. Therefore, the system functionality is to not only record the student attendance, but also to upload the real time data to the server. Basically, attendance is manually done and record is maintained in files. Our main idea of approach is to reduce manual work and to automate the attendance system. The attendance system is an embedded one. Embedded stands for hardware controlled by software. Here, the software using a Microcontroller controls all the hardware components. The microcontroller plays an important role in the system. The main objective of the system is to uniquely identify and to mark attendance for a person. This requires a unique product, which has the capability of distinguishing different people. This is possible by the new emerging technology RFID (Radio Frequency Identification). RFID system has two parts namely RFID tag (with unique ID number) and RFID reader (for reading the RFID tag). RFID tag and RFID reader used in the system are operating at 13.56 KHz. The EEPROM used for storing the details has the capability of storing details of 256 peoples at a time. This data can be directly uploaded to the server.

This report provides a clear picture of hardware and software used in the system. It also provides an overall view with detailed discussion of the operation of the system.

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CHAPTER 1

1.1 INTRODUCTION

The attendance system is an embedded one. Embedded stands for 'hardware controlled by software'. Here, the software using a Microcontroller controls all the hardware components. The microcontroller plays an important role in the system. The main objective of the system is to uniquely identify and to mark attendance for a person which requires a unique system, which has the capability of distinguishing different people. This is possible by the new emerging technology RFID (Radio Frequency Identification). RFID system has two main parts namely RFID Tag (with unique ID number) and RFID reader (for reading the RFID tag). In this system, RFID tag and RFID reader used are operating at 13.56 KHz. The EEPROM used for storage has the capability of storing details of 256 peoples at a time.

Fig.1 RFID Attendance system

In this project we have shown an advance and automatic attendance system. In this project we have used a hardware circuit with RFID reader interface and RFID passive card. RF reader is serially connected to the Arduino for data capturing. Whenever any card is waved near the reader then the reader gets the data of RFID card of the 13.56 kHz frequency. Reader gets the data and transfers this data to the microcontroller. Microcontroller immediately processes this data and compares it with data base in access. In the database we have already registered the card's unique code with student's name and roll number. If the student waves the card on time then a present is marked, but in case if the student leaves the class without registering the departure attendance then microcontroller marks an absent. Every time when the card is waved to the RF reader the LCD connected with the microcontroller show the respective student's name. If the card is not registered with the data base then LCD display shows a sorry message. We can register the new card any time with assigning the UID to the student. Every student's data is stored in the server and can be extracted from there.

RFID, which is an acronym for Radio Frequency Identification, is not a new technology. It was first used in the late 1960's, but it has only become more widespread with advances in technology. RFID Systems consist of a transponder, also known as a tag, which is basically a microchip connected to an antenna. The tag is mounted to an item, such as a pallet of goods in a warehouse, and a device called a reader communicates with the tag via radio waves. Depending on the type of tag that is used, the reader can receive detailed information or it can receive data as simple as an identification number. RFID is similar to barcode systems in which data, such as a price, is accessed when the barcode is read.

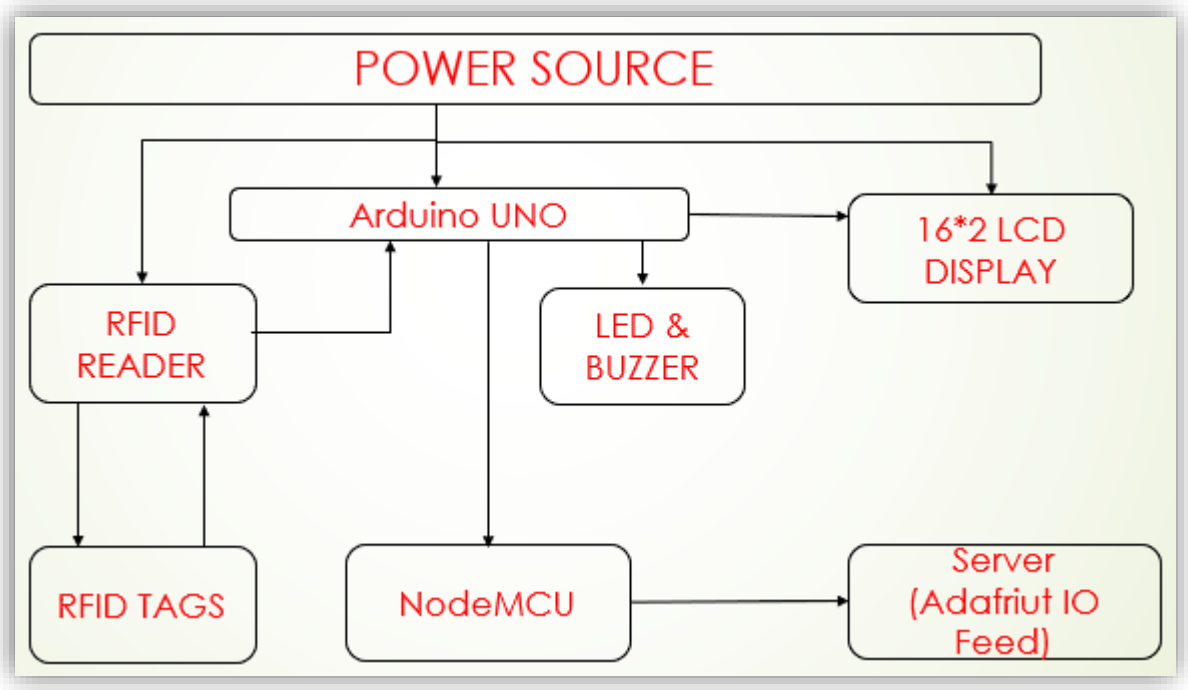

Fig.2 Block Diagram

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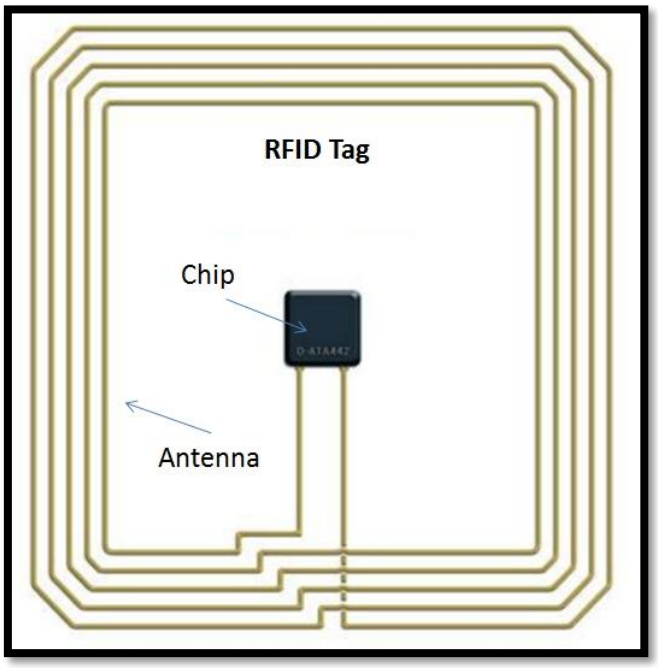


Fig.3 Passive RFID tag

1.2 GOAL AND OBJECTIVES

The aim of the project is to utilize RFID system in a different and developmental side. We all know that RFID is used in each and every industrial and manufacturing field. Our major focus is to utilize this tool towards the residents and commercial users especially the old and disabled ones. This form of system is called RFID based attendance system which focuses on making it possible for the elderly and disabled to remain at school, safe and comfortable. Attendance system is becoming a viable option for the elderly and disabled who would prefer to stay in the comfort of their homes rather than move to a healthcare facility.

1.3 OVERVIEW OF THE TECHNICAL AREA

We are expressing this development tool as an example to illustrate how this RFID system thing can be invested for future. We are going to show this at a large-scale automation on small scale via Breadboard connection designing respectively. On Breadboard we will attach components that are required to provide an example of automation. These components connected onto Breadboard will function in such a way to illustrate RFID system. Over and above this is the fundamental or basic step to illustrate RFID system to our viewers.

1.4 RFID communication

- Host manages Reader(s) and issues Commands
- Reader and tag communicate via RF signal
- Carrier signal generated by the reader
- Carrier signal sent out through the antennas
- Carrier signal hits tag(s)
- Tag receives and modifies carrier signal
  – “sends back” modulated signal (Passive Backscatter – also referred to as “field disturbance device”)
- Antennas receive the modulated signal and send them to the Reader
- Reader decodes the data
- Results returned to the host application

1.5 ATmega 328p Microcontrollers

The AVR® core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the arithmetic logic unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers. The Atmel® ATmega328P provides the following features: 32K bytes of in-system programmable flash with read-while-write capabilities, 1K bytes EEPROM, 2K bytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible Timer/Counters with compare modes, internal and external interrupts, a serial programmable USART, a byte oriented 2-wire serial interface, an SPI serial port, a 6-channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages), a programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The idle mode stops the CPU while allowing the SRAM, Timer/Counters, USART, 2-wire serial interface, SPI port, and interrupt system to continue functioning. The power-down mode saves the register contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset. In power-save mode, the asynchronous timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping.

The ADC noise reduction mode stops the CPU and all I/O modules except asynchronous timer and ADC, to minimize switching noise during ADC conversions. In standby mode, the crystal/resonator oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low power consumption. The device is manufactured using Atmel high density non-volatile memory technology. The on-chip ISP flash allows the program memory to be reprogrammed in-system through an SPI serial interface, by a conventional non-volatile memory programmer, or by an on-chip boot program running on the AVR core. The boot program can use any interface to download the application program in the application flash memory. Software in the boot flash section will continue to run while the application flash section is updated, providing true read-while-write operation. By combining an 8-bit RISC CPU with in-system self-programmable flash on a monolithic chip,

the Atmel ATmega328P is a powerful microcontroller that provides a highly flexible and cost-effective solution to many embedded control applications.

The ATmega328P AVR is supported with a full suite of program and system development tools including: C compilers, macro assemblers, program debugger/simulators, in-circuit emulators, and evaluation kits.

The Atmel® ATmega328P is a low-power CMOS 8-bit microcontroller based on the AVR® enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega328P achieves through puts approaching 1MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

1.5.1 FEATURES

● High performance, low power AVR® 8-bit microcontroller

- Advanced RISC architecture
  - ●131 powerful instructions – most single clock cycle execution
  - ●32 □ 8 general purpose working registers
  - ● Fully static operation
  - ● Up to 16MIPS throughput at 16MHz
  - ● On-chip 2-cycle multiplier

● High endurance non-volatile memory segments

- ● 32K bytes of in-system self-programmable flash program memory
- ● 1Kbytes EEPROM
- ● 2Kbytes internal SRAM
- ● Write/erase cycles: 10,000 flash/100,000 EEPROM

- Optional boot code section with independent lock bits
    - In-system programming by on-chip boot program
    - True read-while-write operation
- Programming lock for software security

- Peripheral features
    - Two 8-bit Timer/Counters with separate pre-scaler and compare mode
    - One 16-bit Timer/Counter with separate pre-scaler, compare mode, and capture mode
    - Real time counter with separate oscillator
    - Six PWM channels
    - 8-channel 10-bit ADC in TQFP and QFN/MLF package
    - Temperature measurement
    - Programmable serial USART
    - Master/slave SPI serial interface
    - Byte-oriented 2-wire serial interface (Phillips I2 C compatible)
    - Programmable watchdog timer with separate on-chip oscillator
    - On-chip analog comparator
    - Interrupt and wake-up on pin change

- Special microcontroller features
    - Power-on reset and programmable brown-out detection
    - Internal calibrated oscillator

- External and internal interrupt sources
- Six sleep modes: Idle, ADC noise reduction, power-save, power-down, standby, and extended standby

- I/O and packages
  - 23 programmable I/O lines
  - 32-lead TQFP, and 32-pad QFN/MLF

- Operating voltage:
  - 2.7V to 5.5V for ATmega328P

- Temperature range:
  - Automotive temperature range: –40°C to +125°C

- Speed grade:
  - 0 to 8MHz at 2.7 to 5.5V (automotive temperature range: –40°C to +125°C)
  - 0 to 16MHz at 4.5 to 5.5V (automotive temperature range: –40°C to +125°C)

- Low power consumption
  - Active mode: 1.5mA at 3V - 4MHz
  - Power-down mode: 1µA at 3V

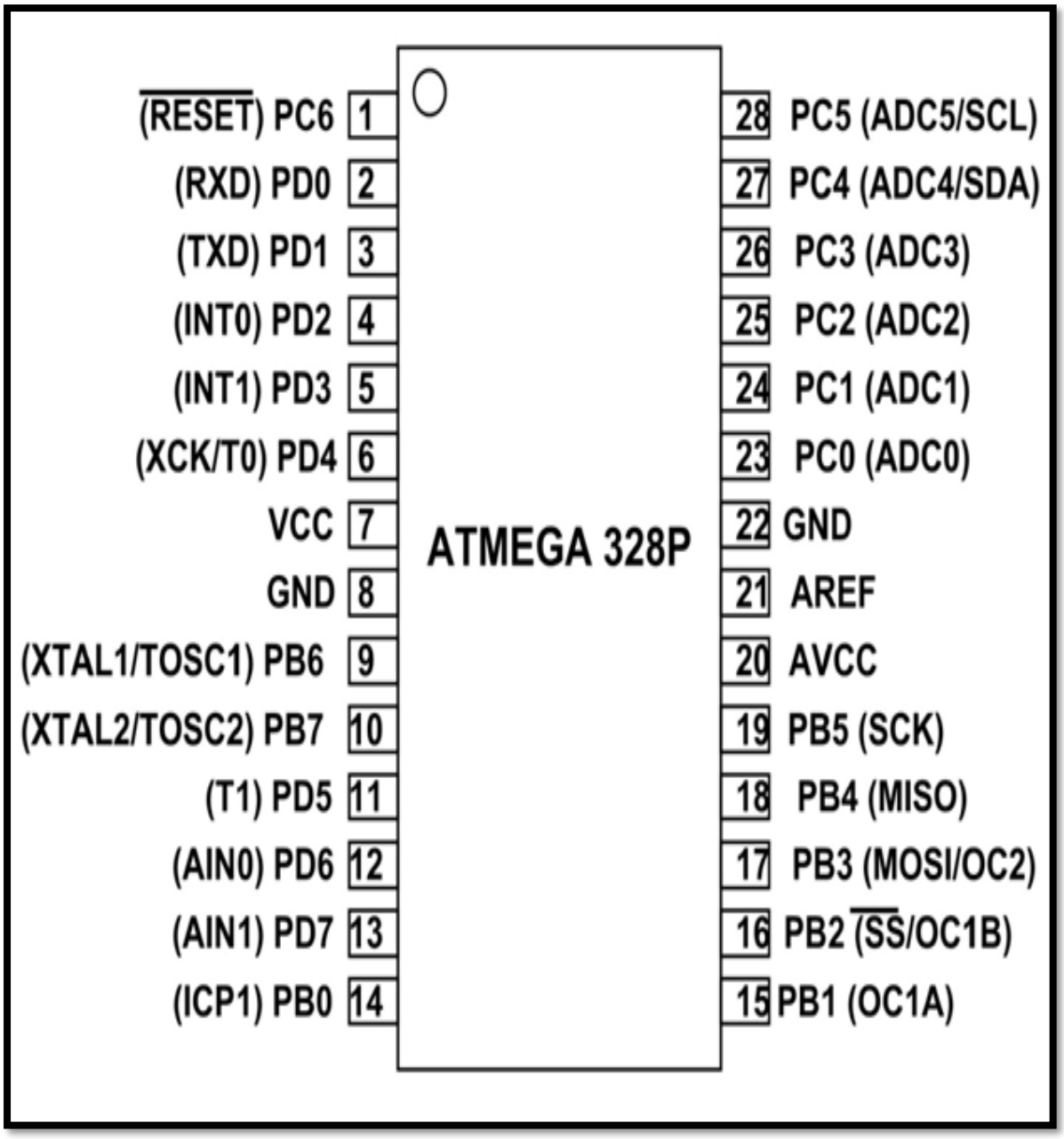


Fig.4 Pin Diagram of Microcontroller

1.6 Contribution of the project

1.6.1 Market Potential:

Today the trend of wireless technology is increasing rapidly and everyone want to move on to the new technology in every aspect and there is a huge demand for this type of product in the market but the devices available in market are costly and this project is low cost and highly effective for attendance marking in large institutions and Due to this, the demand for this type of technology is increasing. In the future, this type of technology is going to change the way of attendance marking.

1.6.2 Innovativeness:

RFID is a technology which operates on very less power, with providing us great benefit. RFID Based Attendance System has lot of advantages and innovations Such as;

- Automatized attendance just by waving a card.
- Real time uploading of data to the server.
- Higher data storage capacity in tags (enough for personal information).
- Cost-effectiveness.
- Safe and secure.
- The project is environment-friendly.

1.6.3 Usefulness:

Nowadays, attendance system in schools and colleges is generally based on pen and paper. Sometimes this process causes errors and also takes more time. So, this project uses RFID technology to make a note of every student entering into the classroom and also to calculate the time resides in the class. In this proposed system, every student is allotted with an RFID tag. The process of attendance can be done by placing the card near the RFID reader.

There are some useful things that RFID Based Attendance System will do:

- Proxy attendance can be caught
- Hard copy work of attendance sheets is reduced
- Data can be stored for a long time
- Fully automated and does not require any human interaction

1.7 Overview of the report

As mentioned above that we are providing an example to display one kind of automation. Throughout this report will cover the complete package towards the introduction to RFID system, example to display RFID based attendance system on Breadboard, components required to build the same system, components declaration, definition and explanation. Over and above, we are covering all the technical topics which are associated with this minor project. We hope that after reading this project report readers will be benefited and will build smart systems for better future. This project report comprises simple English and therefore nontechnical background or people who are unaware of RFID based attendance system will be benefited of the boons of this technology that is touching lives everywhere. This project report will be beneficial to not only the technical pupil but also to nontechnical friends. The report will cover firstly the introduction of student particulars like certificate, declaration etc. After that introduction section is present in which we have laid our best efforts to make you understand what RFID based attendance system is. Aftermath consists of goals and objectives, motivation, overview of technical area and report. Then literature review is available in which elaboration of RFID based attendance system is written. The next sections are problem solving and design implementation. After design implementation testing & deployment, conclusion and future enhancements will be covered. References and Bibliography will be available on the later part of the project report. Special section of

appendix is also there in the report in order to gain extra and trivial knowledge regarding the project. We hope that this content will be sufficient enough to make you understand and have better ideas towards RFID based attendance system. At last of the overview we hope that after these coverage readers who knew earlier regarding the same will be more technical and unaware will become aware of the RFID based attendance system. This is a small seed that we have sown into the ground to illustrate you how small things will become and count big in the long term. After all PCB implementation will motivate you to control your home, office, and living environment very easily and accordingly. At last thanks for your attention till kindly follow the literature part now

CHAPTER 2

2.1 Problem Definition

Regular attendance system is a time-consuming process and Sometimes it is difficult to mark attendance for a huge crowd and even leads to human error. Usually Handling of data becomes difficult when the attendance is marked on any paper

As starts the real problem is now what we have to build on the PCB. What are the electronic components required, what is the software used to build and how to burn the program into our brain i.e. microcontroller such that our problem gets solved? First of all, the need is to memorize the definition of RFID based attendance system back again one more time i.e. to build one room having appliances controlled automatically rather than manually. The components, PCB(s), software etc. need to be assembled in such a way that our goal to complete the project is accomplished.

2.2 ADAFRUIT IO

Adafruit.io is a cloud service where we can connect our project with online services over the Internet. It's meant primarily for storing and then retrieving the data. it can Display our data in real-time, online, it can make our project internet-connected: Control motors, read sensor data, etc. the Adafruit services are absolutely free of cost. We can also monitor real time data being fed.

Adafruit IO is a platform designed to display, respond, and interact with your project's data. It also keeps the data private (data feeds are private by default) and secure. It's the internet of things - for everyone!

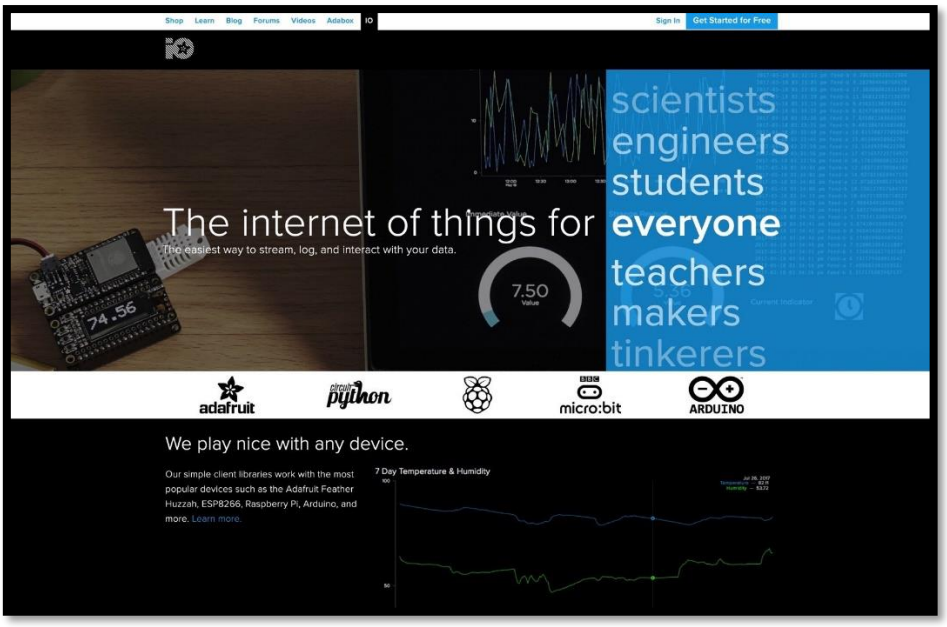


Fig.5 ADAFRUIT IO

2.3 Material Requirements

The requirements include both hardware and software parts respectively. Down under are the components specified -

- Hardware requirements--
  1. Arduino UNO microcontroller
  2. ATmega328p IC
  3. RFID Reader and Tags
  4. Node MCU
  5. ESP8266
  6. LCD display (16*2)
  7. Breadboard
  8. LEDs and Buzzer
  9. Connecting wires
  10. Additional electronic components
- Software Requirements—
  1. Arduino IDE.
  2. EAGLE

- **HARDWARE REQUIREMENT**

2.3.1 Arduino Uno Microcontroller

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type-B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

The word "UNO" means "one" in Italian and was chosen to mark the initial release of the Arduino Software. The Uno board is the first in a series of USB-based Arduino boards, and it and version 1.0 of the Arduino IDE were the reference versions of Arduino, now evolved to newer releases. The ATmega328 on the board comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.

While the Uno communicates using the original STK500 protocol, it differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

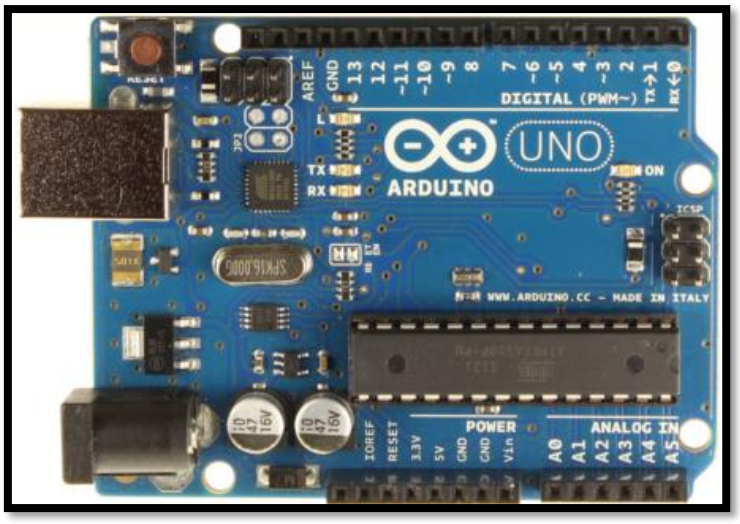


Fig.6 Arduino UNO R3

2.3.2 ATmega328p IC

The ATmega328 is a single-chip microcontroller created by Atmel in the mega AVR family (later Microchip Technology acquired Atmel in 2016). It has a modified Harvard architecture 8-bit RISC processor core.

The Atmel 8-bit AVR RISC-based microcontroller combines 32 KB ISP flash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughput approaching 1 MIPS per MHz

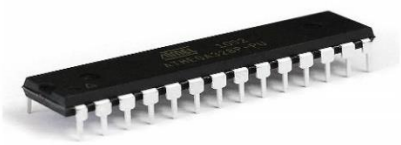


Fig.7 ATmega328p IC

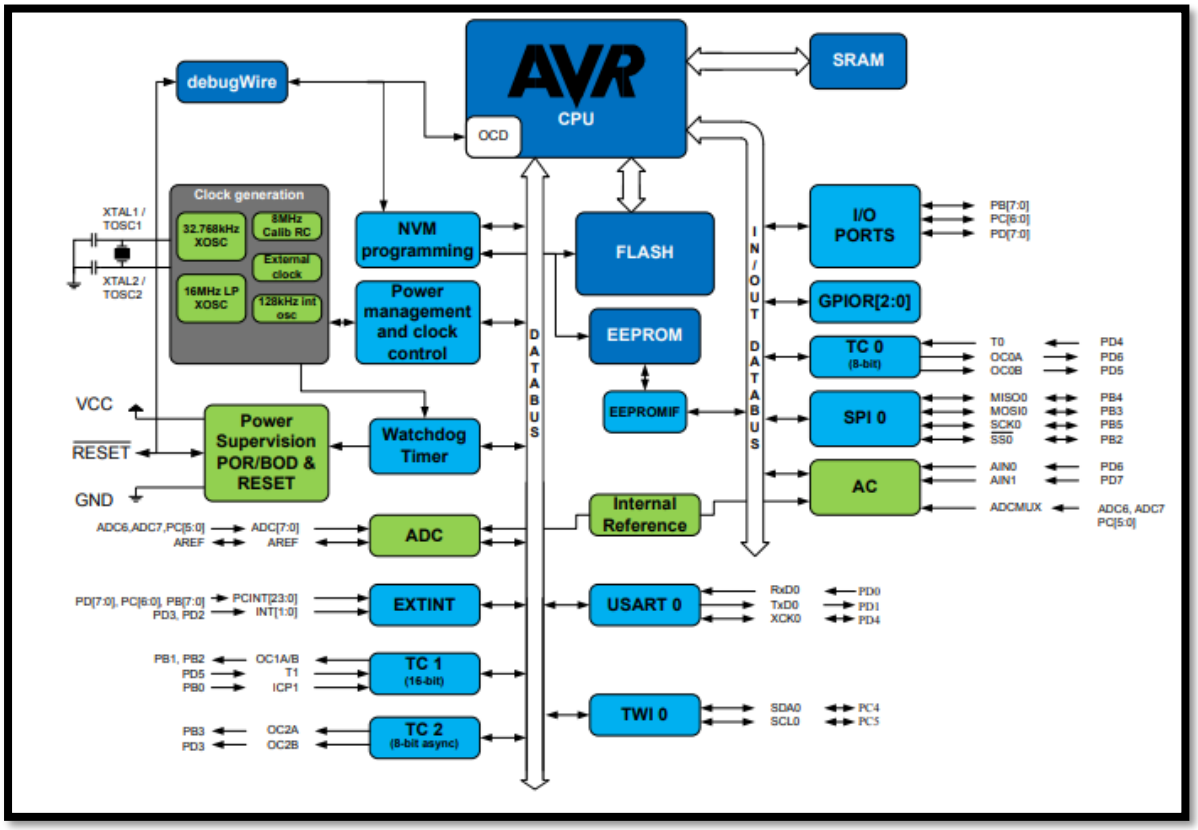


Fig.8 IC functional block diagram

2.3.3 RFID Readers and Tags

a) RFID Reader:

A radio frequency identification reader (RFID reader) is a device used to gather information from an RFID tag, which is used to track individual objects. Radio waves are used to transfer data from the tag to a reader.

RFID is a technology similar in theory to bar codes. However, the RFID tag does not have to be scanned directly, nor does it require line-of-sight to a reader. The RFID tag it must be within the range of an RFID reader, which ranges from 3 to 300 feet, in order to be read. RFID technology allows several items to be quickly scanned and enables fast identification of a particular product, even when it is surrounded by several other items. RFID tags have not replaced bar codes because of their cost and the need to individually identify every item.

RFID systems can be classified by the type of tag and reader. A Passive Reader Active Tag (PRAT) system has a passive reader which only receives radio signals from active tags (battery operated, transmit only). The reception range of a PRAT system reader can be adjusted from 1–2,000 feet (0–600 m), allowing flexibility in applications such as asset protection and supervision.

An Active Reader Passive Tag (ARPT) system has an active reader, which transmits interrogator signals and also receives authentication replies from passive tags.

An Active Reader Active Tag (ARAT) system uses active tags awoken with an interrogator signal from the active reader. A variation of this system could also use a Battery-Assisted Passive (BAP) tag which acts like a passive tag but has a small battery to power the tag's return reporting signal.
Fixed readers are set up to create a specific interrogation zone which can be tightly controlled. This allows a highly defined reading area for when tags go in and out of the interrogation zone. Mobile readers may be handheld or mounted on carts or vehicles.

b) RFID Tags:

A radio-frequency identification system uses tags, or labels attached to the objects to be identified. Two-way radio transmitter-receivers called interrogators or readers send a signal to the tag and read its response.

RFID tags can be either passive, active or battery-assisted passive. An active tag has an on-board battery and periodically transmits its ID signal. A battery-assisted passive (BAP) has a small battery on board and is activated when in the presence of an RFID reader. A passive tag is cheaper and smaller because it has no battery; instead, the tag uses the radio energy transmitted by the reader. However, to operate a passive tag, it must be illuminated with a power level roughly a thousand times stronger than for signal transmission. That makes a difference in interference and in exposure to radiation.

Tags may either be read-only, having a factory-assigned serial number that is used as a key into a database, or may be read/write, where object-specific data can be written into the tag by the system user. Field programmable tags may be write-once, read-multiple; "blank" tags may be written with an electronic product code by the user.

RFID tags contain at least three parts: an integrated circuit that stores and processes information and that modulates and demodulates radio-frequency (RF) signals; a means of collecting DC power from the incident reader signal; and an antenna for receiving and transmitting the signal. The tag information is stored in a non-volatile memory. The RFID tag includes either fixed or programmable logic for processing the transmission and sensor data, respectively.

An RFID reader transmits an encoded radio signal to interrogate the tag. The RFID tag receives the message and then responds with its identification and other information. This may be only a unique tag serial number, or may be product-related information such as a stock number, lot or batch number, production date, or other specific information. Since tags have individual serial numbers, the RFID system design can discriminate among several tags that might be within the range of the RFID reader and read them simultaneously.

Frequency Ranges	LF 125 KHz	HF 13.56 MHz	UHF 868 - 915 MHz	Microwave 2.45 GHz & 5.8 GHz
Typical Max Read Range (Passive Tags)	Shortest 1"-12"	Short 2"-24"	Medium 1'-10'	Longest 1'-15'
Tag Power Source	Generally passive tags only, using inductive coupling	Generally passive tags only, using inductive or capacitive coupling	Active tags with integral battery or passive tags using capacitive storage, E-field coupling	Active tags with integral battery or passive tags using capacitive storage, E-field coupling
Data Rate	Slower	Moderate	Fast	Faster
Ability to read near metal or wet surfaces	Better	Moderate	Poor	Worse
Applications	Access Control & Security Identifying widgets through manufacturing processes or in harsh environments Ranch animal identification Employee IDs	Library books Laundry identification Access Control Employee IDs	supply chain tracking Highway toll Tags	Highway toll Tags Identification of private vehicle fleets in/out of a yard or facility Asset tracking

Fig.9 Operational frequencies of RFID tags

Fig.10 RFID Reader and Tag

2.3.4 Node MCU:

Node MCU is a low-cost open source IoT platform.it includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The firmware uses the Lua scripting language. The firmware is based on the e Lua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as “lua-cjson”. The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards. The design was initially was based on the ESP-12 module of the ESP8266, widely used in IoT applications.

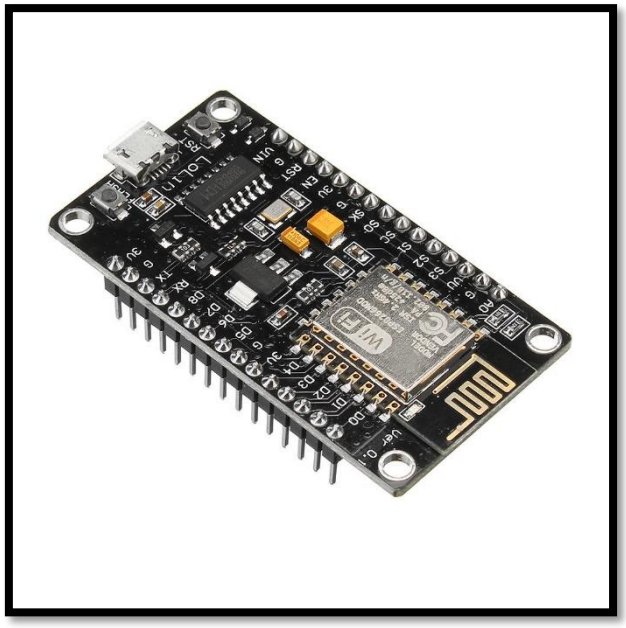


Fig.11 Node MCU

2.2.5 ESP8266:

The ESP8266 is a low-cost Wi-Fi microchip, with a full TCP/IP stack and microcontroller capability, produced by Espressif Systems. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. The ESP8285 is an ESP8266 with 1 MB of built-in flash, allowing the building of single-chip devices capable of connecting to Wi-Fi. The successor to these microcontroller chips is the ESP32.

- Features of ESP8266

Memory:

32 KB instruction RAM

32 KB instruction cache RAM

80 KB user-data RAM

16 KB ETS system-data RAM

IEEE 802.11 b/g/n Wi-Fi

Integrated TR switch, power amplifier and matching network

WEP or WPA/WPA2 authentication, or open networks

16 PIO pins

SPI

I²C (software implementation)

I²S interfaces with DMA (sharing pins with GPIO)

UART on dedicated pins, plus a transmit-only UART can be enabled on GPIO2

10-bit ADC (successive approximation ADC)

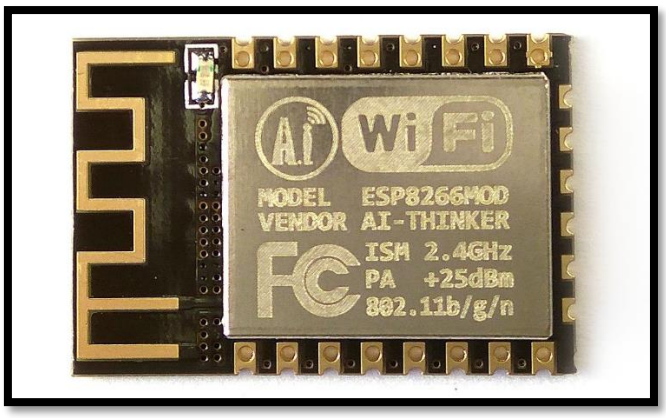
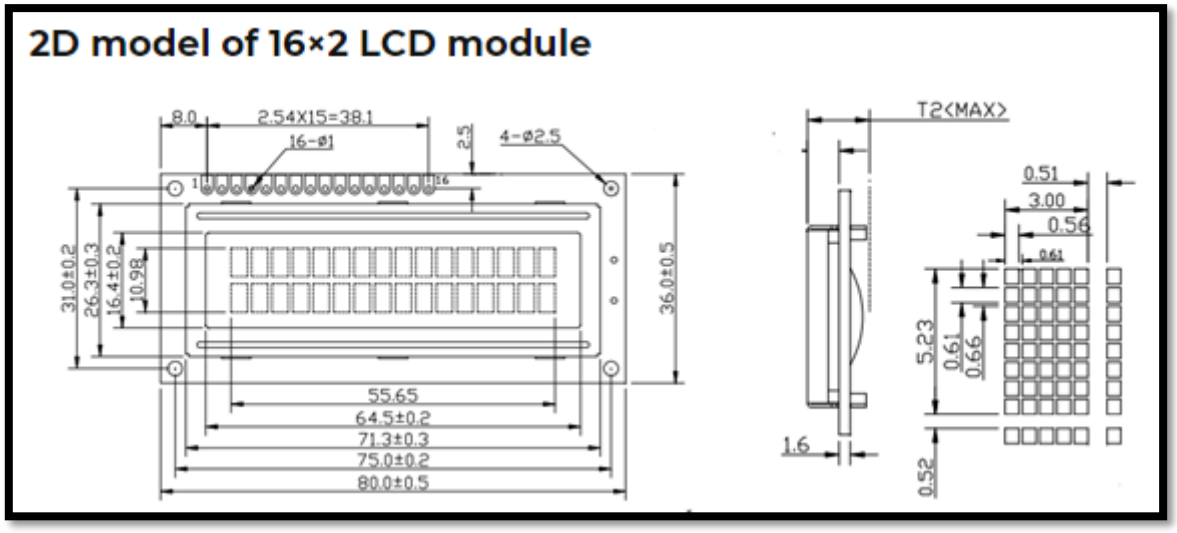


Fig.12 ESP8266

2.2.6 LCD Display (16*2):

LCD modules are very commonly used in most embedded projects, the reason being its cheap price, availability and programmer friendly. Most of us would have come across these displays in our day to day life, either at PCO's or calculators. The appearance and the pinouts have already been visualized above now let us get a bit technical.

16×2 LCD is named so because; it has 16 Columns and 2 Rows. There are a lot of combinations available like, 8×1, 8×2, 10×2, 16×1, etc. but the most used one is the 16×2 LCD. So, it will have (16×2=32) 32 characters in total and each character will be made of 5×8 Pixel Dots.



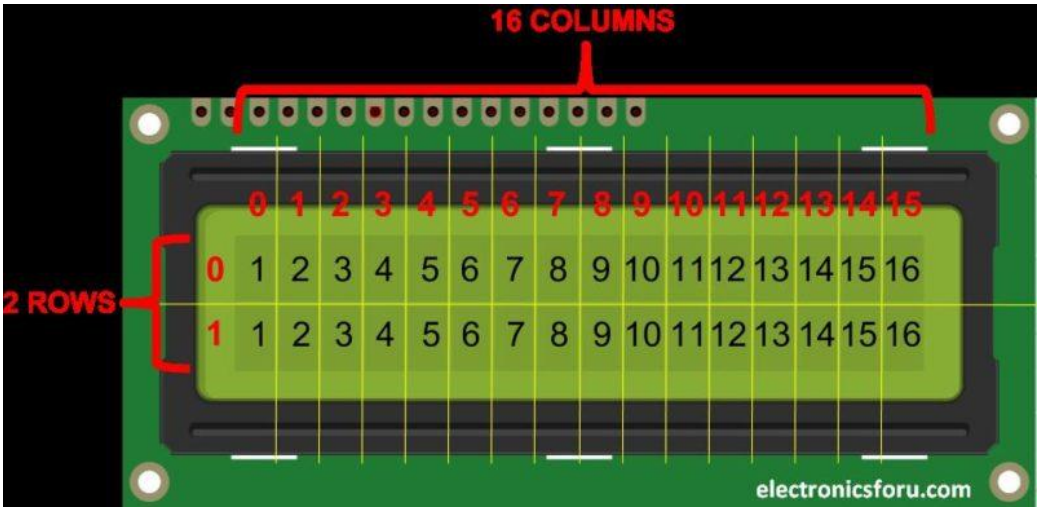


*Fig.13 16*2 LCD Display*

2.2.7 Breadboard:

A breadboard is a construction base for prototyping of electronics. Originally the word referred to a literal bread board, a polished piece of wood used for slicing bread. In the 1970s the solderless breadboard (a.k.a. plugboard, a terminal array board) became available and nowadays the term “breadboard” is commonly used to refer to these.

Because the solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solderless breadboards are also popular with students and in technological education. Older breadboard types did not have this property. A stripboard (Veroboard) and similar prototyping printed circuit boards, which are used to build semi-permanent soldered prototypes or one-offs, cannot easily be reused. A variety of electronic systems may be prototyped by using breadboards, from small Analog and digital circuits to complete central processing units (CPUs).

Breadboards are designed to work with through-hole electronic components. These components have long metal leads that are designed to be inserted through holes in a printed circuit board (PCB) that are plated with a thin copper coating, which allows the components’ leads to be soldered to the board.

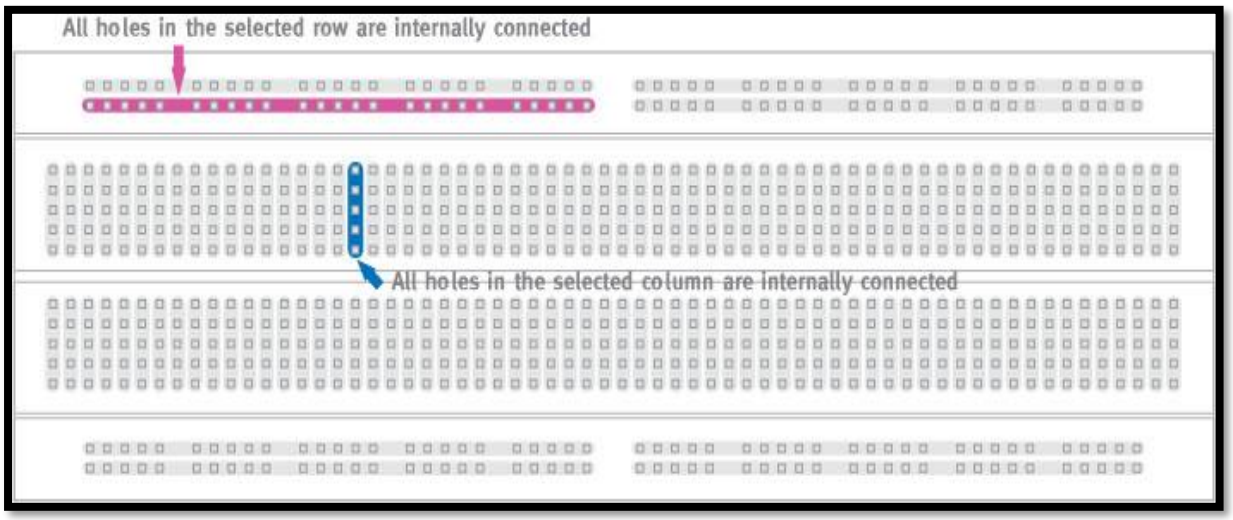


Fig.14 Breadboard connections

2.2.8 LEDs and Buzzer:

a) LED:

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The colour of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.

Appearing as practical electronic components in 1962, the earliest LEDs emitted low-intensity infrared light. Infrared LEDs are used in remote-control circuits, such as those used with a wide variety of consumer electronics. The first visible-light LEDs were of low intensity and limited to red. Modern LEDs are available across the visible, ultraviolet, and infrared wavelengths, with high light output.

Unlike a laser, the light emitted from an LED is neither spectrally coherent nor even highly monochromatic. However, its spectrum is sufficiently narrow that it appears to the human eye as a pure (saturated) colour. Nor, unlike most lasers, is its radiation spatially coherent, so that it cannot approach the very high brightness characteristic of lasers.

b) BUZZER:

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

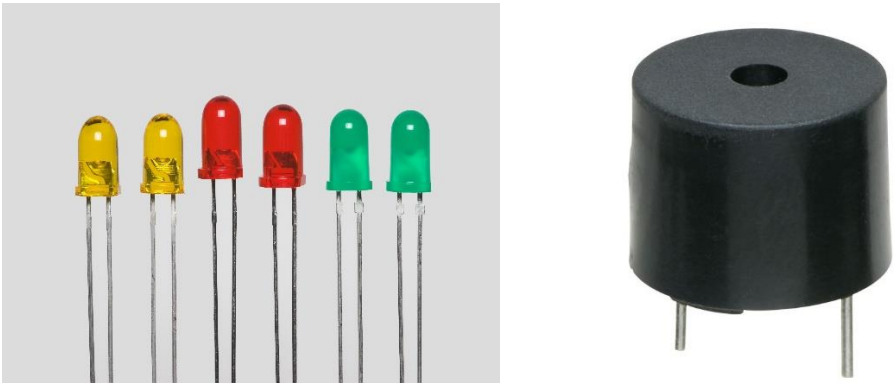


Fig.15 LEDs and BUZZER

2.2.9 Connecting wires:

A connecting wire (also known as jumper wire, or jumper) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

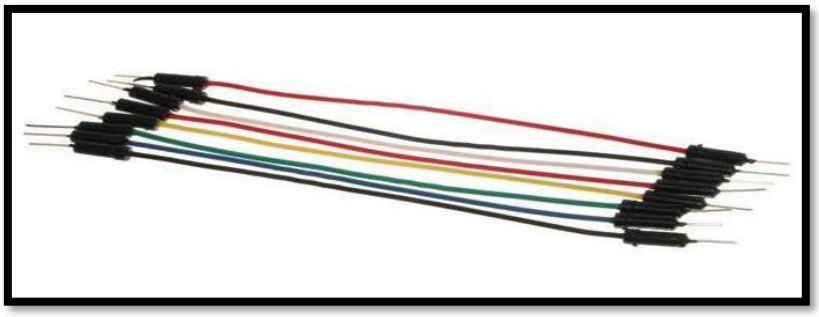


Fig.16 Connecting Wires

2.2.10 Additional Electronic Components:

Passive electronic components:

passive electronic components are those that don't have the ability to control electric current by means of another electrical signal. Examples of passive electronic components are ***capacitors, resistors, inductors, transformers, and some diodes***. These can be either Thru-Hole of SMD Components.

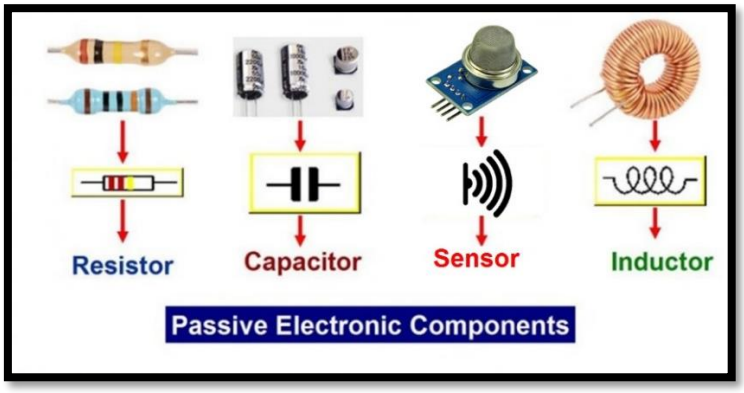


Fig.17 Electronic components

- **SOFTWARE REQUIREMENTS**

1. Arduino IDE:

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards.

The source code for the IDE is released under the GNU (General Public License), version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main () into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program AVR dude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

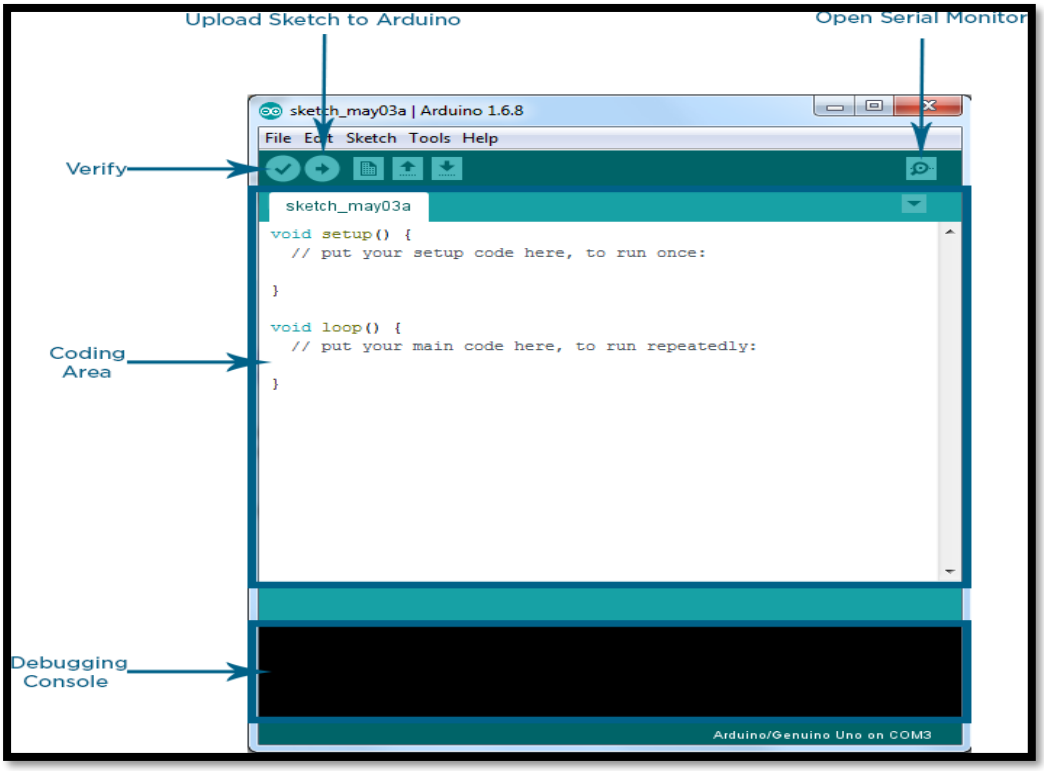
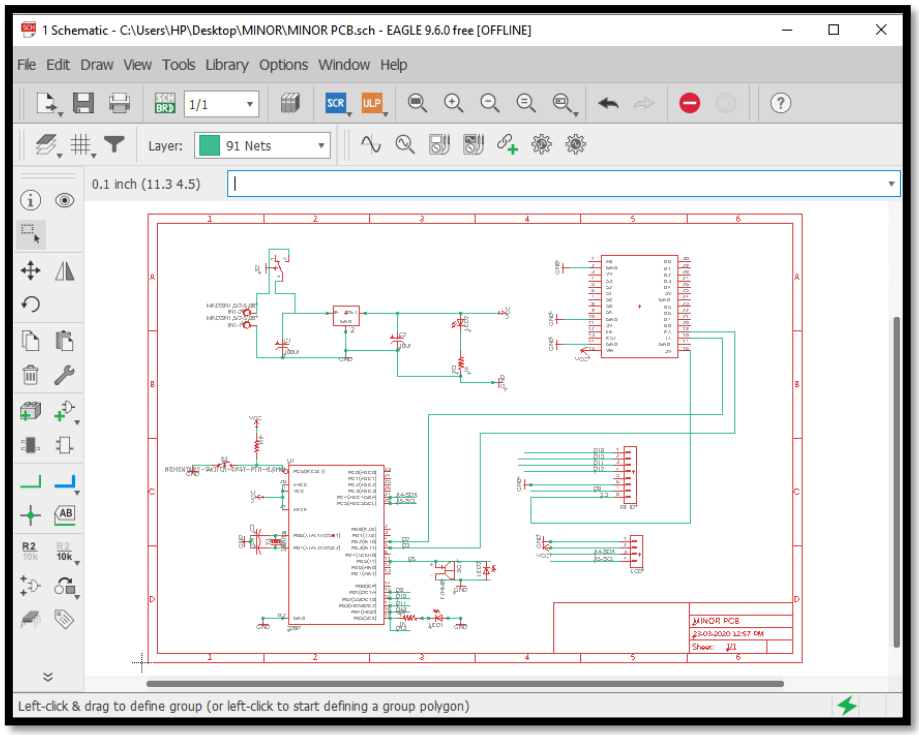


Fig.18 Arduino IDE user interface

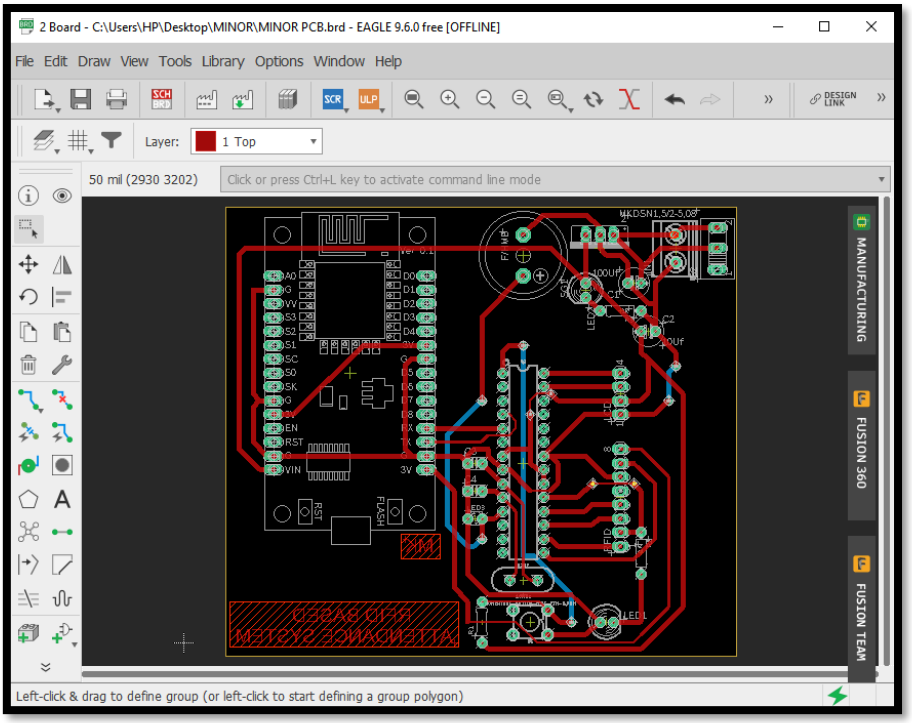
2. EAGLE:

EAGLE is a scriptable electronic design automation (EDA) application with schematic capture, printed circuit board (PCB) layout, auto-router and computer-aided manufacturing (CAM) features. EAGLE stands for Easily Applicable Graphical Layout Editor is developed by Cad Soft Computer GmbH. The company was acquired by Autodesk Inc. in 2016. EAGLE contains a schematic editor, for designing circuit diagrams. Schematics are stored in files with '.SCH' extension, parts are defined in device libraries with '.LBR' extension. Parts can be placed on many sheets and connected together through ports. The PCB layout editor stores board files with the extension'. BRD'. It allows back-annotation to the schematic and auto-routing to automatically connect traces based on the connections defined in the schematic. EAGLE provides a multi-window graphical user interface and menu system for editing, project management and to customize the interface and design parameters. The system can be controlled via mouse, keyboard hotkeys or by entering specific commands at an embedded command line. Multiple repeating commands can be combined into script files (with file extension .SCR). It is also possible to explore design files utilizing an EAGLE-specific object-oriented programming language.

The code used to control the RFID Reader and LCD are burnt on ATmega328p microprocessor, and the code to connect and upload the data to the server is burnt to the Node MCU.



Schematic



Board

Fig.19 EAGLE user interface

Chapter 3

3.1 Design

Designing the project means to gather all the information about the required components and to interface them in right order to generate the correct output.

Displays his/her information with the current time and then the data is transferred to server.

Designing this circuit or the project is quite simple with proper knowledge.

The circuit is designed in order to meet the expected output, with minimum power loss.

The circuit contains RFID reader which provides the information, when the tag comes in range, to the microcontroller and that information or ID is compared with the pre-loaded IDs, if the ID is matched with any of the stored one, the controller marks the attendance and displays on the LCD.

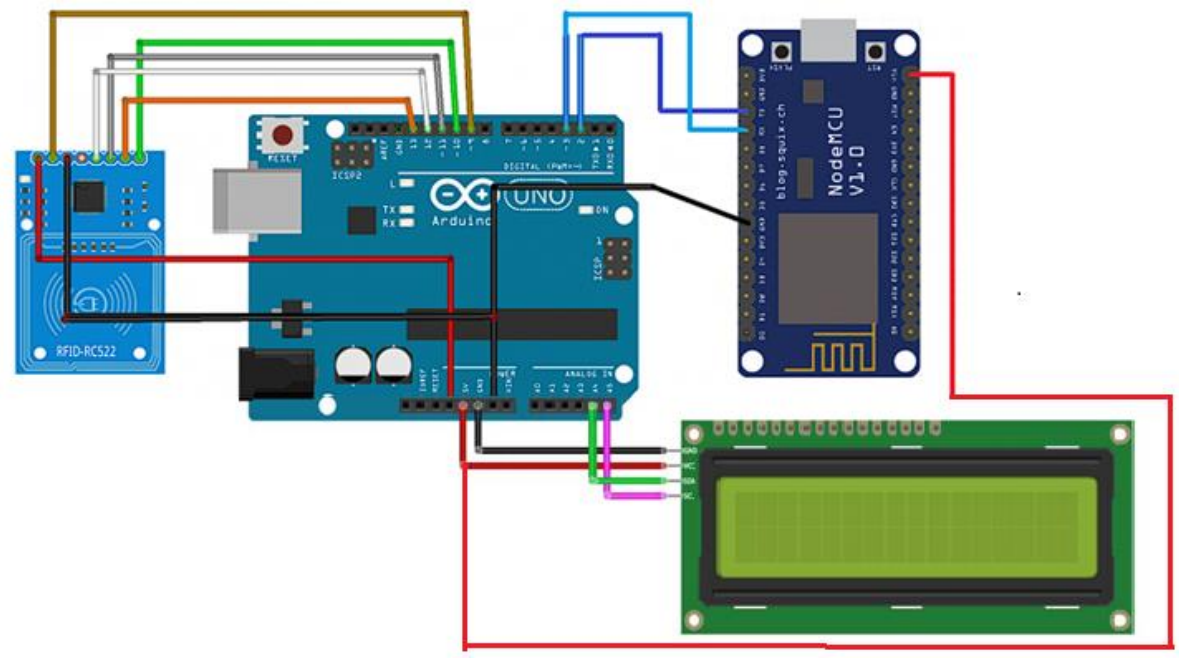


Fig.20 Circuit Diagram

3.2 Implementation

As per our component selection and schematic of the project, we divided our project in two different part. First, part is called the input processing and controlling unit and the second output and storage. The main aim of the dividing project in two units is for preventing the radio waves in getting interfered. It also helped in circuitry reduction and more Reliability on a single microprocessor.

Implementation steps:

- Circuit design: After finalization of circuit design we build it on simulation tool.
- Breadboard circuit: when the simulated circuit meets with our requirements than we implemented it on the breadboard.
- PCB: The same circuit will be implemented on PCB.
- Testing: Once all the components and devices on the PCB are firmly connected. We tested our final PCB circuit.
- The data on the server is also checked after uploading.

3.3 Testing

As we have already mentioned that we are not looking at this project as a project. We are considering that we are making a product. So, we try to pass this project from all the difficulties that it can face in the real world.

3.3.1 Component Testing

In this, we test all the component that we got from the market are satisfy all the requirement mention in the datasheets. We are considering a maximum of 5% error in the components.

3.3.2 Project Testing

In the project testing, First, we tested our project using computer simulation tool, its circuit, working, connections, etc.

In basic component testing we interfaced all the peripherals with Arduino to check their operation. After this, basic circuit testing was done in which we tested this project in a real condition more than a week in the college and home as well.

After testing at all the applicable places, we countered the issues and solved it there and then.

Then the circuit was implemented on the breadboard and final testing was done before implementing the project on PCB.

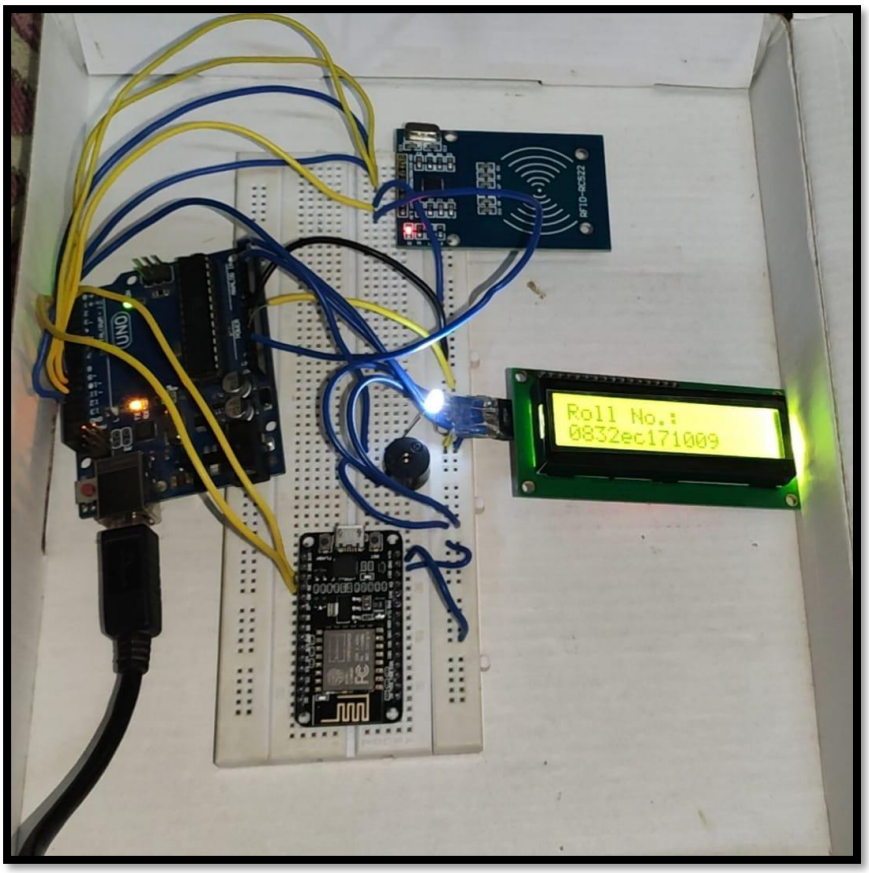


Fig.21 Breadboard Project Testing

CHAPTER 4

4.1 INTRODUCTION

It is predicted that RFID use will continue to increase. It is unlikely to ever be as cost-effective as barcoding, but it will become dominant in areas where barcoding and other optically read technologies are not effective. RFID Tag Categories The basic types of RFID tags can be classified as read/write and read only. The data stored on read/write tags can be edited, added to, or completely rewritten, but only if the tag is within the range of the reader. The data stored on a read only tag can be read, but cannot be edited in any way. Read/write tags are much more expensive than read only tags, so they are not used for tracking most commodity items. RFID tags are further categorized as: Active tags, which contain a battery that powers the microchip and allows it to transmit a signal to the reader. Semi-active (or semi-passive) tags, which contain a battery to run the circuitry of the chip, but must draw power from the magnetic field created by the reader in order to communicate with the reader. Passive tags, which rely solely on the magnetic field created by the radio waves sent out by the reader to create a current that can be received by the antenna within the passive tag. RFID Construction RF-ID Technology Overview A RF-ID reader sends out a radio frequency wave to the 'Tag' and the 'Tag' broadcasts back its stored data to the reader. The system works basically as two separate antennas, one on the 'Tag' and the other on the reader.

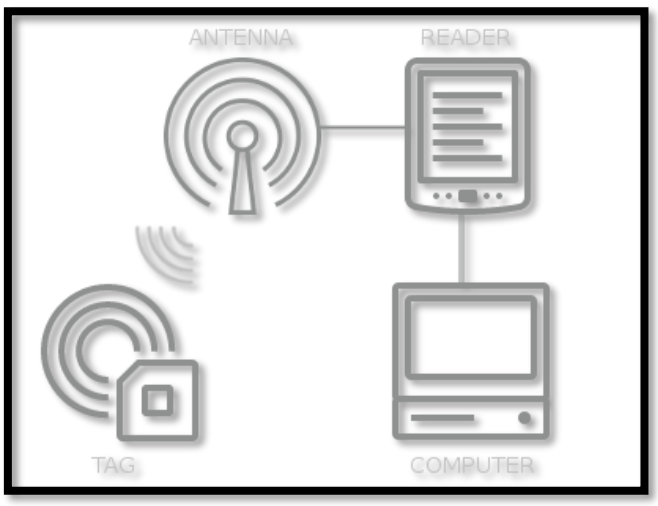


Fig. 22 RFID Tag system

The data collected from the 'Tag' can either be sent directly to a host computer through standard interfaces, or it can be stored in a portable reader and later uploaded to the computer for data processing. The automatic reading and direct use of the 'Tag' data is often called AIDC (automatic identification and data capture) and with a RF-ID tag system, which works just as effectively in environments with excessive dirt, dust, moisture and poor visibility, you can be assured that it overcomes the limitations of other automatic identification approaches.

4.2 System Performances

Reading Distance-one of the key benefits of the TIRIS system is its superior reading range with low power-consumption. The actual reading distance that can be achieved depends on many factors, transponder type, electromagnetic noise, transponder orientation, antenna type, and government regulations. In general a standard 32mm glass capsule can be read with a stationary reader and a gate antenna from a distance of up to 1 meter Larger transponders can achieve ranges up to 2 meters with handheld readers offering lower ranges up to 250mm. Data Accuracy The TIRIS system uses a 16-bit Cyclic Redundancy Check algorithm (CRC-CCITT) which ensures that only 'valid' data is sent from the reader to its associated controller. To date there have been no cases of an incorrect identification number being read from a transponder. Antenna Selection of the two standard antenna types (ferrite rod and gate) the larger gate antennas give the best reading range. Although in some environments an overall better performance can be achieved with smaller antennas. Each antenna has its own specific 'readout pattern' i.e. the electromagnetic field emanating from the transponder during its reply stage. The shape and size of this pattern depends on the specific readout antenna selected and a country's government regulations that define the amount of electromagnetic field strength that can be generated. Electromagnetic noise in the environment can also affect readout ranges. Transponder Orientation the orientation of the transponder with respect to the antenna also impacts the reading range. For maximum range the orientation of the antenna with respect to the transponder must be optimized to achieve maximum coupling.

4.3 Survey

As we all know that RFID based attendance system is the demand of the hour and is used in hotels, hospitals, office environments, homes, workshops, campuses, universities etc. The project we are building is the miniature from of automation used nowadays. The components utilized are of sufficient parameters compared to large scale automation. This same smart home project that we have built by our own knowledge and experience on purchasing from a manufacturing shop or Engineering project selling shop will cost you Rs.2500 to Rs.3000 /- excluding their additional charges. These shops vendors can plant electronic components on the PCB of low cost but on the paper, they will show you a terrific cost. We searched on Internet, roamed into the markets in our quest to have an acknowledgment of the required components and PCB(s). We build the same project on our own which one can purchase after paying an unreasonable cost to the vendor.

4.4 Future scope of Study

As per the increasing usage and advancement of RFID technology, there are several future implementations for our project RFID Based Attendance System the RF range can be increased in order to detect the card from long distance, RF transceiver module can be used for long distance data sharing, attendance systems database can be linked with the college website and can be shared and monitored by student's parents and can even be recollected afterwards for further use. Now, as per the advancement of this system, RFID can be synced with GSM technology and can be directly implemented. For Further implementations, IoT based attendance system can be made.

Above all were the additional technologies and ideas on how the project can be advanced, studying about the RFID and its implementations can be very helpful, because in future this type of wireless and very less power consuming devices will uplift the technological world.

4.5 Conclusions

The conclusion is that RFID based attendance system is not as complex as it sounds. It is much easier, friendly and fun to implement. Any individual can purchase the electronic components listed in the later section of report and can solder it on a PCB to view the example of automation. RFID based attendance system aims at making our lives automatic rather than manual. After reading this we request to build a same project as we did to demonstrate smart system. The first step is to purchase all the required components from a component selling shop and then solder it to burn a program into the microcontroller. After burning the program into the microcontroller, the project will work automatically. The output will be displayed by LCD display and LEDs. The LEDs will correspond to the particular extension port of the power strip attached. User can plug in any electrical appliance like mobile phone charger, table fan, or any other circuit like Digital Visitor Counter also. User can plug out any electrical appliance corresponding its indicating LED also.

Project Snapshots

Fig.23 Project Snapshot

List of References:

- **Articles:**

  https://www.sciencedirect.com/science/article/abs/pii/S09255273070019

  https://how2electronics.com/iot-based-rfid-attendance-system-using-arduino-esp8266-adafruit-io/

- **Websites**:

  electronicshub.org

  how2electronics.com

  Adafruit.IO

- **Research papers & previous projects**

  1. http://www.circuitstoday.com/rfid-based-attendance-system
  2. https://create.arduino.cc/projecthub/highvoltages/rfid-based-attendance-system-using-arduino-f3602f
  3. https://www.slideshare.net/Edgefx/rfid-based-attendance-system-47672505
  4. https://www.academia.edu/7426832/A_PROJECT_REPORT_ON_RFID_BASED_ATTENDENCE_SYSTEM_USING_GSM

Appendix A

Arduino UNO R3

Overview

Features

• High Performance, Low Power AVR® 8-Bit Microcontroller

• Advanced RISC Architecture – 131 Powerful Instructions – Most Single Clock Cycle Execution – 32 x 8 General Purpose Working Registers – Fully Static Operation – Up to 20 MIPS Throughput at 20 MHz – On-chip 2-cycle Multiplier

• High Endurance Non-volatile Memory Segments – 4/8/16/32K Bytes of In-System Self-Programmable Flash program memory (ATmega48PA/88PA/168PA/328P) – 256/512/512/1K Bytes EEPROM (ATmega48PA/88PA/168PA/328P) – 512/1K/1K/2K Bytes Internal SRAM (ATmega48PA/88PA/168PA/328P) – Write/Erase Cycles: 10,000 Flash/100,000 EEPROM – Data retention: 20 years at 85°C/100 years at 25°C(1) – Optional Boot Code Section with Independent Lock Bits In-System Programming by On-chip Boot Program True Read-While-Write Operation – Programming Lock for Software Security

• Peripheral Features – Two 8-bit Timer/Counters with Separate Pre-scaler and Compare Mode – One 16-bit Timer/Counter with Separate Pre-scaler, Compare Mode, and Capture Mode – Real Time Counter with Separate Oscillator – Six PWM Channels – 8-channel 10-bit ADC in TQFP and QFN/MLF package Temperature Measurement – 6-channel 10-bit ADC in PDIP Package Temperature Measurement – Programmable Serial USART – Master/Slave SPI Serial Interface – Byte-oriented 2-wire Serial Interface (Philips I2 C compatible) – Programmable Watchdog Timer with Separate On-chip Oscillator – On-chip Analog Comparator – Interrupt and Wake-up on Pin Change

• Special Microcontroller Features – Power-on Reset and Programmable Brown-out Detection – Internal Calibrated Oscillator – External and Internal Interrupt Sources – Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby

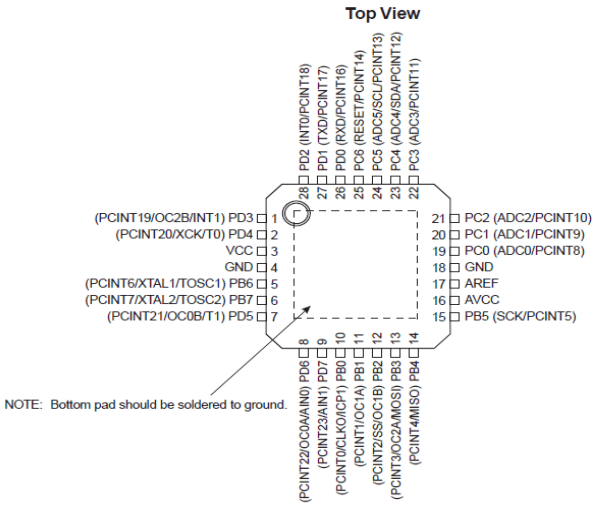
• I/O and Packages – 23 Programmable I/O Lines – 28-pin PDIP, 32-lead TQFP, 28-pad QFN/MLF and 32-pad QFN/MLF

• Operating Voltage: – 1.8 - 5.5V for ATmega48PA/88PA/168PA/328P

• Temperature Range: – -40°C to 85°C

• Speed Grade: – 0 - 20 MHz @ 1.8 - 5.5V

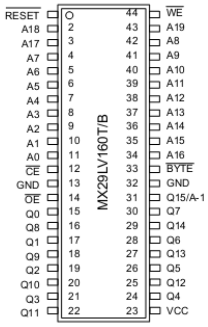
• Low Power Consumption at 1 MHz, 1.8V, 25°C for ATmega48PA/88PA/168P/328P– Active Mode: 0.2 mA – Power-down Mode: 0.1 µA – Power-save Mode: 0.75 µA (Including 32 kHz RTC)



MX29LV160T/B & MX29LV160AT/AB

PIN CONFIGURATIONS

44 SOP(500 mil)



PIN DESCRIPTION

SYMBOL	PIN NAME
A0~A19	Address Input
Q0~Q14	Data Input/Output
Q15/A-1	Q15(Word mode)/LSB addr(Byte mode)
$\overline{CE}$	Chip Enable Input
$\overline{WE}$	Write Enable Input
$\overline{BYTE}$	Word/Byte Selection input
$\overline{RESET}$	Hardware Reset Pin/Sector Protect Unlock
$\overline{OE}$	Output Enable Input
RY/$\overline{BY}$	Ready/Busy Output
VCC	Power Supply Pin (2.7V~3.6V)
GND	Ground Pin

Appendix B

BC547

Overview

BC547 Transistor Features

- Bi-Polar NPN Transistor
- DC Current Gain (h_{FE}) is 800 -maximum
- Continuous Collector current (I_C) is 100mA
- Emitter Base Voltage (V_{BE}) is 6V
- Base Current (I_B) is 5mA maximum
- Available in To-92 Package

FAIRCHILD
SEMICONDUCTOR®

BC546/547/548/549/550

Switching and Applications

- High Voltage: BC546, V_{CEO}=65V
- Low Noise: BC549, BC550
- Complement to BC556 ... BC560

TO-92
1. Collector 2. Base 3. Emitter

NPN Epitaxial Silicon Transistor

Absolute Maximum Ratings T_a=25°C unless otherwise noted

Symbol	Parameter		Value	Units
V_{CBO}	Collector-Base Voltage	: BC546 : BC547/550 : BC548/549	80 50 30	V V V
V_{CEO}	Collector-Emitter Voltage	: BC546 : BC547/550 : BC548/549	65 45 30	V V V
V_{EBO}	Emitter-Base Voltage	: BC546/547 : BC548/549/550	6 5	V V
I_C	Collector Current (DC)		100	mA
P_C	Collector Power Dissipation		500	mW
T_J	Junction Temperature		150	°C
T_{STG}	Storage Temperature		-65 ~ 150	°C

Electrical Characteristics T_a=25°C unless otherwise noted

Symbol	Parameter		Test Condition	Min.	Typ.	Max.	Units
I_{CBO}	Collector Cut-off Current		V_{CB}=30V, I_E=0			15	nA
h_{FE}	DC Current Gain		V_{CE}=5V, I_C=2mA	110		800	
V_{CE} (sat)	Collector-Emitter Saturation Voltage		I_C=10mA, I_B=0.5mA I_C=100mA, I_B=5mA		90 200	250 600	mV mV
V_{BE} (sat)	Base-Emitter Saturation Voltage		I_C=10mA, I_B=0.5mA I_C=100mA, I_B=5mA		700 900		mV mV
V_{BE} (on)	Base-Emitter On Voltage		V_{CE}=5V, I_C=2mA V_{CE}=5V, I_C=10mA	580	660	700 720	mV mV
f_T	Current Gain Bandwidth Product		V_{CE}=5V, I_C=10mA, f=100MHz		300		MHz
C_{ob}	Output Capacitance		V_{CB}=10V, I_E=0, f=1MHz		3.5	6	pF
C_{ib}	Input Capacitance		V_{EB}=0.5V, I_C=0, f=1MHz		9		pF
NF	Noise Figure	: BC546/547/548 : BC549/550 : BC549 : BC550	V_{CE}=5V, I_C=200μA f=1KHz, R_G=2KΩ V_{CE}=5V, I_C=200μA R_G=2KΩ, f=30~15000MHz		2 1.2 1.4 1.4	10 4 4 3	dB dB dB dB

h_{FE} Classification

Classification	A	B	C
h_{FE}	110 ~ 220	200 ~ 450	420 ~ 800

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Rev. A2, August 2002

BC546/547/548/549/550