IOT Based Attandance Monitoring system using RFID

A Documentation-cum-User Manual Report

By

Sumit Kumar(15010209)
Aman Ranjan Verma(15010212)
Saurabh Kumar(15010210)
Bachelor of Technology, VIth Semester

Department of Electronics and Communication Engineering
Indian Institute of Information Technology Manipur
May, 2018

Abstract

In this project a classroom based attendance system is designed using Internet of Things (IOT). A compact device is designed,where students can swipe their RFID based Id card on to mark their attendance at the start of lectures. The student verification is done by microcontroller using the student data fed in the TFT card which is placed on the TFT LCD. Once successfulrecognition of the RFID card is done, the student's attendance is ready to be pushed to the web server (here we are using Firebase as a web server). Simultaneously the student's data is displayed on the LCD display.In order for this value to reach the web-server, Wi-Fi module provides wireless connection to the access point, which is in the range, and whose credentials are available. Once the combination reaches theweb-server, a PHP script does the subsequent work, to interpret the data, and the Firebase database is updated. Data from the database is retrieved andsent to the android app for simple interpretation by the students and faculty. The whole system is implemented on a dedicated real-time web-server. As a result, the real-time behavior can be analyzed, which helps us to understand the latency and efficiency of the entire system.

Keywords - arduino, attendace system, dedicated web-server, esp8266, Internet of Things, Firebase, PHP.

Declaration

I declare that this submission represents our idea in our own words and where others' idea or words have been included, I have adequately cited and referenced the original source. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/sources in my submission. I understand that any violation of the above will be a cause for disciplinary action by the institute and can also evoke penal action from the sources which have thus not been properly cited or from proper permission has not been taken when needed.

Sumit Kumar(15010209)
Aman Ranjan Verma(15010212)
Saurabh Kumar(15010210)

Date:

Department of Electronics & Communication Engineering
Indian Institute of Information Technology Manipur

Dr. Nagesh Ch — Email: nagesh@iiitmanipur.ac.in
HOD, ECE Dept.
Dr. Ramesh Ch. Mishra — Email: m.ramesh@iiitmanipur.ac.in
Project instructor, ECE Dept.

To Whome It May Concern

This is to certify that the report entitled **IOT Based Attandance Monitoring system using RFID** submitted to by "Sumit Kumar", "Aman Ranjan Verma" and "Saurabh Kumar" has been carried out under my supervision and that their work have not been submitted elsewhere for a degree, diploma or a course.

Signature of Supervisor

(Dr. Ramesh Ch. Mishra)

Signature of Supervisor

(Dr. Nagesh Ch)

Acknowledgement

The satisfaction that accompanies the successful completion of any task would be incomplete without the mention of the people who made it possible, whose constant guidance and encouragement crown all the efforts. I would like to gratefully acknowledge our gratitude to our project guide Dr. Nagesh Ch, Head of the Department, Electronics and Communication Engineering, Indian Institute of Information Technology Manipur & project instructor Dr Ramesh Ch. Mishra. Their truly scientific intuition has made them an oasis of ideas and passion in science, which exceptionally inspired us and enriches our growth as students. As a guide his enthusiastic approach inspired us a lot. We also shall remain highly obliged towards our parents support and love because of which I was successfully able to complete this project. We would like to thank our friends and classmates for encouraging us to complete this project and making it successful.

- Sumit Kumar
- Aman Ranjan Verma
- Saurabh Kumar

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Chapter 1

Introduction

IOT has played a significant role in developing several aspects in academic sectors and domains such as student monitoring and management systems. Therefore, it is a critical subject to trackand managestudent's attendance in school, college, and university environment. Calling student's name or taking student's signature are two traditional methods for tracking the attendance of the students in the classroom and they are more time-consuming. Nevertheless, the academicperformance is influenced by counting student's presentation. So, we have developed a solution to manage the student attendance records automatically by using IOT management system in order toassist the faculties in maintaining attendance system. Hence, the attendance systems can be useful to reduce administrative complexity and cost which increases the efficiency of the education. In the digital era, technologies have been developed and emerged exponentially,and that could be used to change the future of sciences to affect people everyday life through Wireless Sensor Networks (WSNs). Previously, biometrics techniques are used to verify identification through their characteristics like face recognition, signatures, fingerprint, voice recognition, irises, barcode, Bluetooth, Near-Field Communication (NFC), and so

on. RFID is an automation technology used to identifying and positioning an object. Healthcare industry, financial institutions, cars, books, mobile phones, computer equipment,are several applications that they used RFID technology.Diverse studies have been conducted to propose student's attendance system to manage, record, and track the presenting of the students in an academic sector. Our systems used several technologies that are ranging from RFID reader, Wi-Fi interfaces, Liquid Crystal Display (LCD) and Android mobile app.

Students attendance RFID based systems thathave been proposed are also analyzed and criticized respect to systems functionalities and main findings to identify and focus on the critical and Vitalsystems or technology that need further attempts by future researchers through which the advantages of high efficiency and effectiveness can be obtained. The system functionality includes data management, tracking students, sending reports, monitoring records, maintenance records, and finally providing information services.

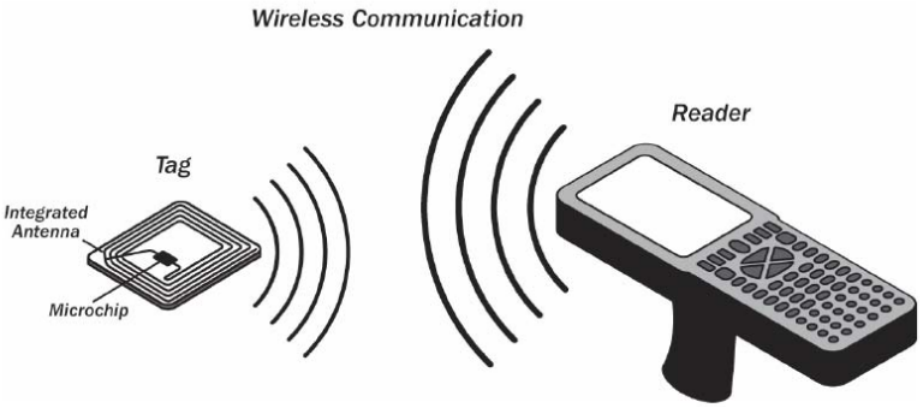

Figure 1.1: RFID Tag Communication

1.1 LITERATURE REVIEW

The RFID has come up as emerging technology which started evolving in World War II . A RFID system has several components which include tags, antennas and readers. This set up can be used either in high frequency or ultra high frequency. In 1946, Leon Theremin invented a tool for the Soviet Union which retransmitted radio waves with some audio information attached to it.Though it was not an identification device it can be considered a predecessor to the RFID technology. In 1939, The IFF transponder was used by the United Kingdom in 1939 which was then used for identifying planes as anally plane or enemy plane as early in the 19th century in the World War II . The transponder

of this kind is still used in today's aircrafts wherein the transmission and receiving of waves is used. The patent from Mario Cardullo's in 1973 which talks about a passive radio transponder attached to a memory was the true ancestor of modern RFID.

The Radio Frequency Identification Devices used in today's industry are being used in many areas that need identification, inventory control and automation. The use of high frequency and ultra high frequency signals to identify objects which can be considered as tags here, has been helpful in developing various applications. Radio frequency range is considered to be about 3 MHz to 300 GHz. This frequency corresponds to the alternating electrical signals which are used to produce and detect radio waves. The high frequency range of frequency ranges from 3–30 MHz which has a wavelength of 10–100 m and has various applications in shortwave, amateur ratio, etc. The very high frequency of radio waves consist frequencies in between 30–300 MHz with a wavelength of 1–10 m and are generally used in FM broadcasting, aviation, broadcast television, etc. The ultra high frequency or the UHF range of frequency is around 300–3000 MHz with a wavelength of 10–100 cm used for Broadcast television, mobile telephones, wireless networking, etc. The super high frequency radio waves range is from 3–30 GHz with a wavelength of 1–10 cm used in Wireless networking, and satellite links. The extremely high frequency waves range from 30-300 GHz 17 with a wavelength of 1–10 mm and have applications in radio astronomy, remote ensing and advanced weapons systems.

Chapter 2

Design and Implementation

Outline: This chapter presents the following:

1. LDR interfacing
2. RFID EM-18 Interfacing
3. Wi-Fi ESP8266E-12 interfacing
4. LCD interfacing
5. Complete circuit diagram
6. Complete Android App

In this chapter, we discuss about the hardware and sofware requirements and complete implementation in order to build the embedded system.

2.1 LDR interfacing :

LDR interfaced with the arduino to count the number of person in the class room that is bidirectional. If student enter in the class room so it increase the number of count as well as if go out of the class room so it decrese the count.Schemetics as shown in Fig.2.1 & Fig. 2.2

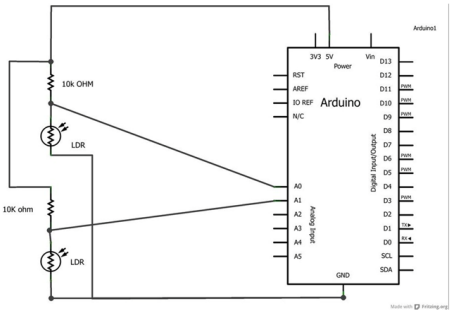

Figure 2.1: LDR interfaced with Uno

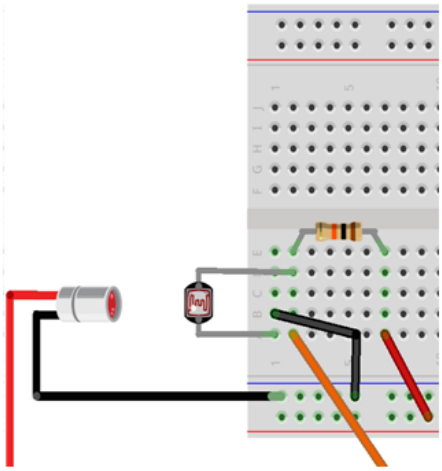

Figure 2.2: Interfaced View

In this we use the Laser diode for bidirectional counting, one for increase the count and one for decrese the count.

2.2 RFID EM-18 Interfacing :

This module directly connects to any microcontroller UART or through an RS-232 converter to PC.It gives UART/Wiegand26 output. This RFID Reader Module works with any 125 KHz RFID tags.Programming in Arduino UNO for reading serial RFID Tag Keys is very easy.Basic idea is to initialize the Serial port at some baud rate. I have initialized it at a baud rate of 9600 bits/sec. i.e Transfer of 9600 bits in a sec. Now RFID key is 12 bytes. So, initialize a vector (array) of length 12 and data type to be char.[char size is 1 byte.]. The schematic diagram is shown in the Fig.2.3

2.3 Wi-Fi ESP8266E-12 interfacing :

The instructions for interfacing esp8266E-12 are given bellow.

1. Install Arduino IDE.Whatever you have.
2. go to File > Preferences > Additional Board Manager URLs paste this link in text field $http://arduino.esp8266.com/stable/package_esp8266com_index.json$
3. goto Tools > Board > Board Manger and search for **esp8266** click on install button wait until board get install.
4. After successfully install board now take your arduino board remove controller. Now its only USB to UART converter with 5v and 3.3v power supply. Connect

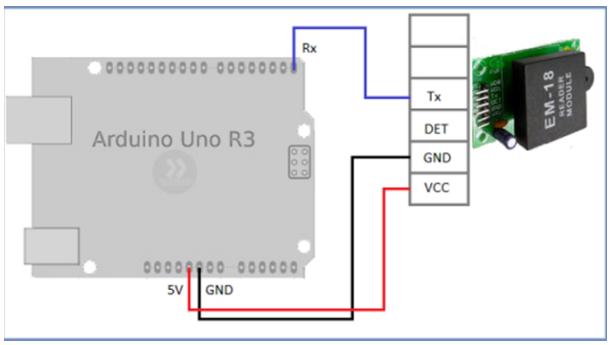

Figure 2.3: Connections of RFID Module

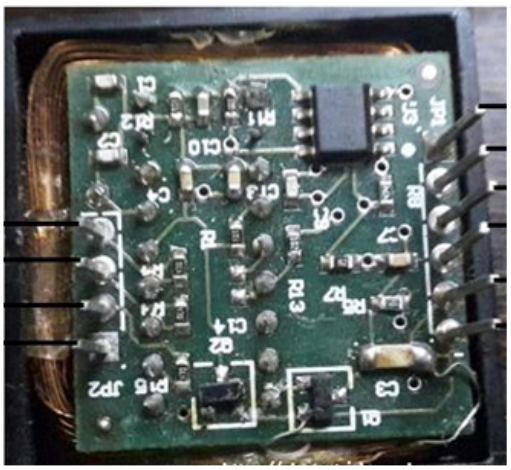

Figure 2.4: EM-18 View

ESP8266 with Arduino board as shown in Fig. As esp8266 datasheet mention it can work on 5v or 3.3v . but it affect on wifi range as 5v gives large range for module.

5. Restar Arduino IDE now connect arduino board with ESP8266 connection as in above diagram.Now goto Tools > Board >Generic ESP8266 Module
6. now install esp8266 library alredy made by developers with examples.goto Skrtch > Include library > Manage libraries Search for "ESP8266 webserver" and install ESP8266WebServer library
7. Goto File > Examples > ESP8266WebServer > AdvancedWebServer made some changes in program. ssid and password.
8. **ESP8266 is having 4 mode of operation 1)Genaral mode ,2) Boot mod, 3) Host mode, 4)AT command mode** here we only deal with genaral mode and boot mode.for load program in ESP8266 we have to go in boot mode for that Press and Hold FLASH button and then Press reset button first release reset button then FLASH button. now your ESP8266 in boot mode.
9. Upload program from Arduino IDE.
10. For testing Web server open serial terminal at 115200 baud rate and get IP adress of server. outout of serial terminal.
11. goto your browser and hit IP address 192.168.0.10 (it may vary from your router configuration) you will see the webpage stored in your ESP8266 module. The schematic diagram is shown in the Fig.2.5

2.4 LCD interfacing :

The schematic diagram is shown in the Fig.2.6

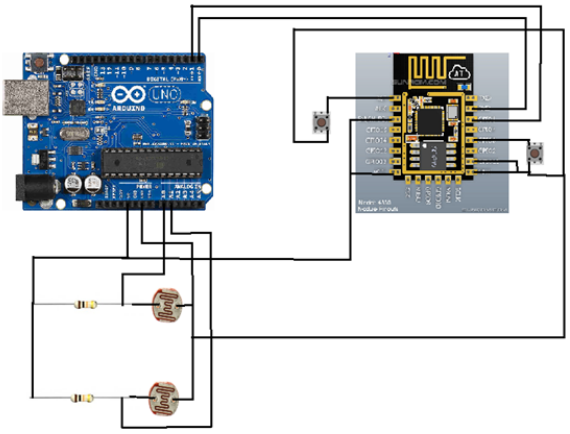

Figure 2.5: Connections of ESP8266

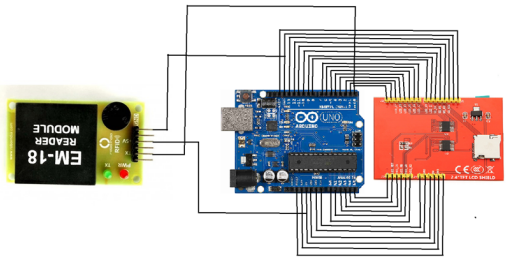

Figure 2.6: connections of the TFT LCD

2.5 Complete Block diagram:

The Block diagram is shown in the Fig.2.7

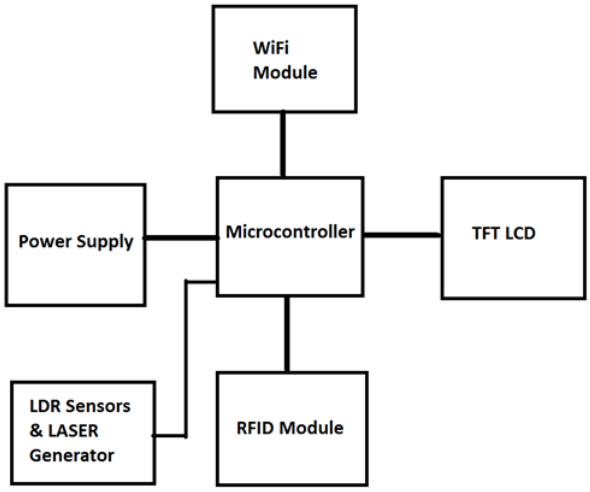

Figure 2.7: Complete block diagram of the system

2.6 Complete circuit diagram:

The schematic diagram is shown in the Fig.2.7

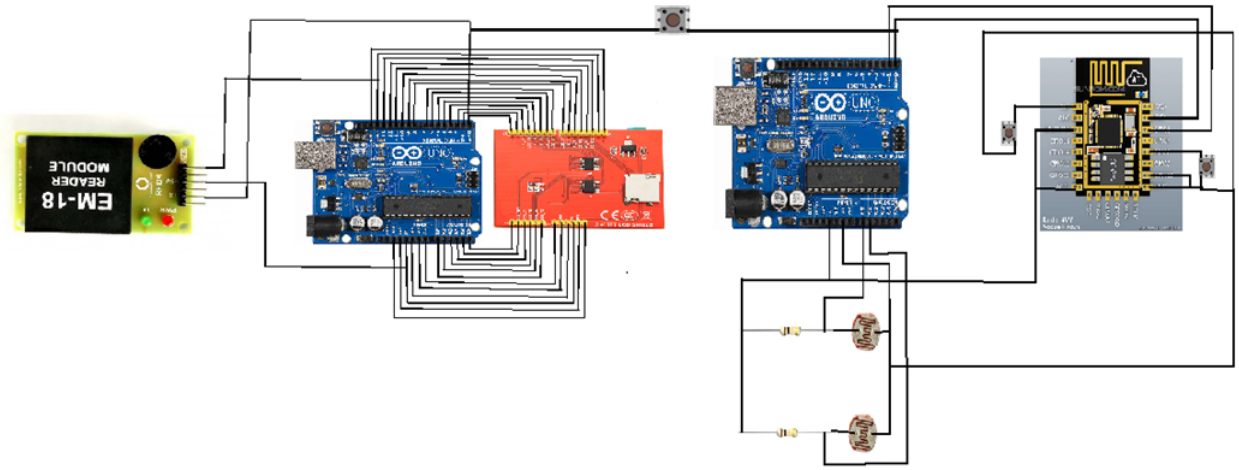

Figure 2.8: Complete circuit diagram of the system

2.7 Complete Android App:

The schematic diagram is shown in the Fig.2.8

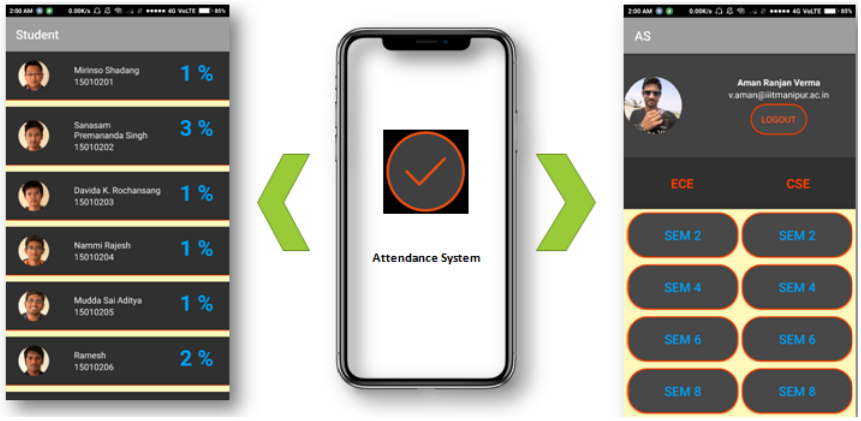

Figure 2.9: Complete android app

Chapter 3

Components and Modules

Description

Outline: This chapter presents the following:

1. Micro-controller(Arduino UNO)
2. Wi-Fi Module ESP-8266 E-12
3. RFID Module (EM-18)
4. 2.4 inch TFT LCD Display
5. Buzzer
6. LDR sensor
7. Power supply

3.1 Micro-controller(Arduino UNO)) :

Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world. Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or Breadboards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

In the project we are using Arduino UNO. The **Arduino UNO** is a widely used open-source microcontroller board based on the 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 features 14 Digital pins and 6 Analog pins. It is programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases.

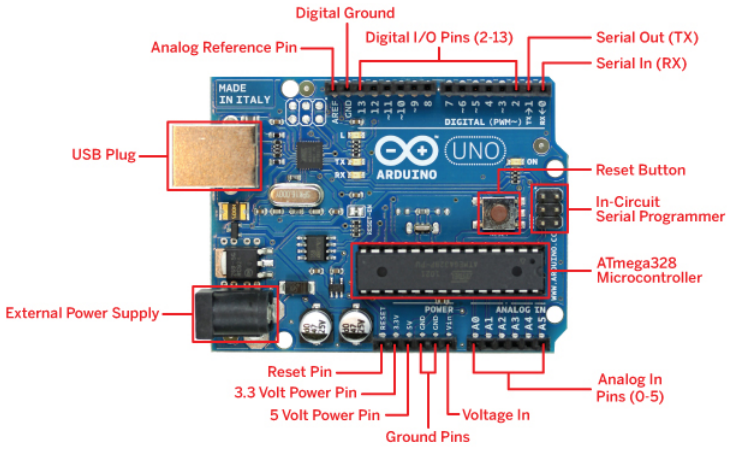

Figure 3.1: Arduino UNO Version 1.0

3.1.1 Why we used Arduino UNO ? :

The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform. The ATmega328 on the Arduino Uno comes preprogrammed with a bootloader that allows to upload new code to it without the use of an external hardware programmer.It communicates using the original STK500 protocol. The Uno also 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. The Arduino UNO is generally considered the most user-friendly and popular board, with boards being sold worldwide for less than 5$.

3.1.2 Technical Specifications of Arduino UNO board :

The technical details of the UNO board[1] are as follows :

1. Micro-controller ATmega328
2. Operating Voltage (logic level): 5 V
3. Input Voltage (recommended): 7-12 V
4. Input Voltage (limits): 6-20 V
5. Digital I/O Pins : 14 (of which 6 provide PWM output)
6. Analog Input Pins: 8
7. DC Current per I/O Pin: 40 mA
8. Flash Memory 32 KB (ATmega328) of which 2 KB used by bootloader
9. SRAM: 2 KB (ATmega328)
10. EEPROM: 1 KB (ATmega328)
11. Clock Speed: 16 MHz

3.2 Wi-Fi Module ESP-8266 E-12 :

The ESP8266 WiFi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and

[1] www.farnell.com/datasheets/1682238.pdf Access Date : 07/05/ 2018

ever growing, community. This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existance interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts. There is an almost limitless fountain of information available for the ESP8266, all of which has been provided by amazing community support. In the Documents section below you will find many resources to aid you in using the ESP8266, even instructions on how to transforming this module into an IoT (Internet of Things) solution! **Note:** The ESP8266 Module is not capable of 5-3V logic shifting and will require an external Logic Level Converter. Please do not power it directly from your 5V dev board. **Note:** This new version of the ESP8266 WiFi Module has increased the flash disk size from 512k to 1MB.

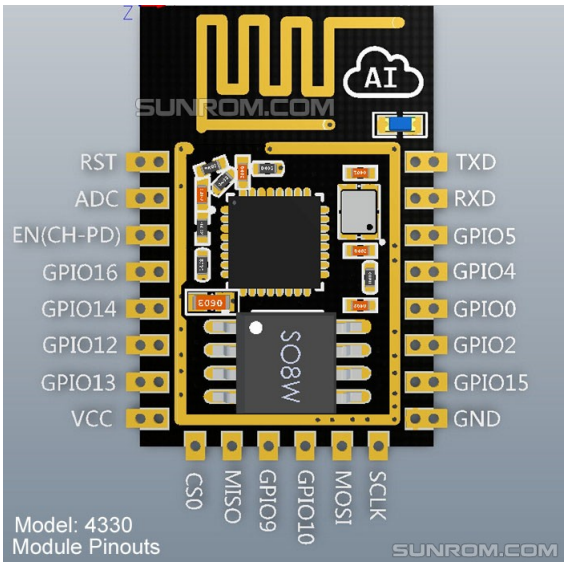

Figure 3.2: ESP8266 E-12 Module

3.3 RFID Module (EM-18) :

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. EM-18 shown in Fif. 3.3 and pin diagram shown in the Fig.3.4

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 technology may be used in a variety of applications including:

1. Passports
2. Smart cards
3. Airplane luggage
4. Toll booth passes
5. Home appliances
6. Merchandise tags
7. Animal and pet tags
8. Automobile key-and-lock
9. Monitoring heart patients
10. Pallet tracking for inventory
11. Telephone and computer networks
12. Operation of spacecraft and satellites

RFID technology uses digital data in an RFID tag, which is made up of integrated circuits containing a tiny antenna for transferring information to an RFID transceiver. The majority of RFID tags contain at least an integrated circuit for modulating and demodulating radio frequency and an antenna for transmitting and receiving signals. Frequency ranges vary from low frequencies of 125 to 134 kHz and 140 to 148.5 kHz, and high frequencies of 850 to 950 MHz and 2.4 to 2.5 GHz. Wavelengths in the 2.4 GHz range are limited because they can be absorbed by water. This module directly connects to any microcontroller UART or through a RS232 converter to PC.It gives UART/Wiegand26 output. This RFID Reader Module works with any 125 KHz RFID tags.
Specifications :

1. 5VDC through USB (External 5V supply will boost range of the module)
2. Current: <50mA
3. Operating Frequency: 125Khz
4. Read Distance: 10cm
5. Size of RFID reader module: 32mm(length) * 32mm(width) * 8mm(height)

3.4 2.4 inch TFT LCD Display :

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid

Figure 3.3: RFID EM-18

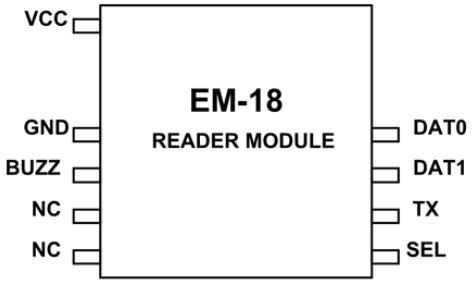

Figure 3.4: Pind Diagram of RFID EM-18

crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and seven-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements. 2.4 inch TFT LCD shown in the Fig.3.5

The 2.4 inch TFT touch Screen LCD Module For Arduino is a beautiful large touchscreen display shield with built in microSD card connection. The LCD has excellent vivid color contrast. This TFT display is big (2.4 diagonal) bright (4 white-LED backlight) and colorful (18-bit 262,000 different shades). 240×320 pixels with individual pixel control. It has way more resolution than a black and white 128×64 display. As a bonus, this display has a resistive touchscreen attached to it already, so you can detect finger presses anywhere on the screen.

3.5 Buzzer(5V) :

A Buzzer or beeper is an audio signaling device,which may be mechanical, Electromechanical, or Piezoelectric. Typical uses of buzzers and beepers include alarm devices, Timers and confirmation of user input such as a mouse click or keystroke. Buzzer Is an integrated structure of electronic transducers, DC Power supply, widely used in computers, printers, copiers, alarms, electronic toys, automotive electronic equipment, telephones, timers and other electronic products for sound devices. Active Buzzer 5V Rated Power can be directly connected to a continuous sound, this section dedicated sensor expansion

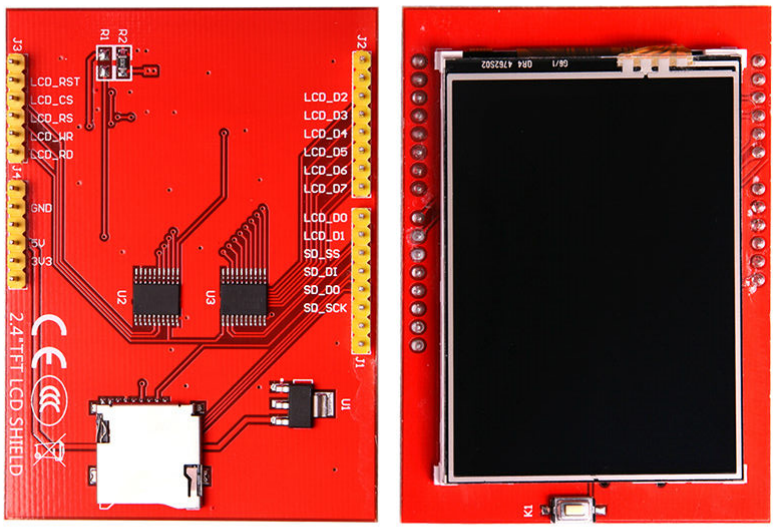

Figure 3.5: 2.4 inch TFT LCD

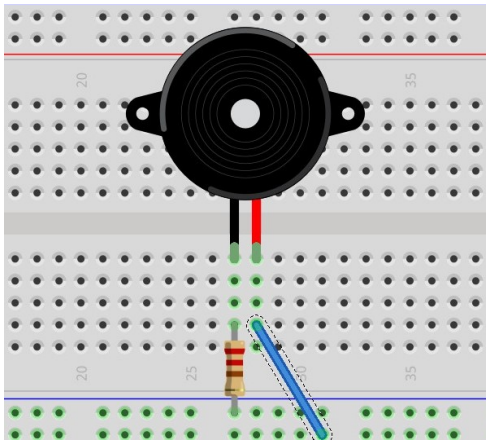

Figure 3.6: Buzzer 5 v.

Figure 3.7: Ligt Dependent Resistor

module and the board in combination, can complete a simple circuit design, to ”plug and play.” Buzzer shown in the Fig.3.6

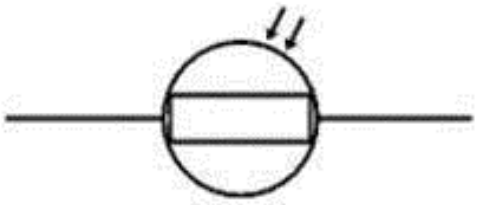

Figure 3.8: Ligt Dependent Resistor Symol

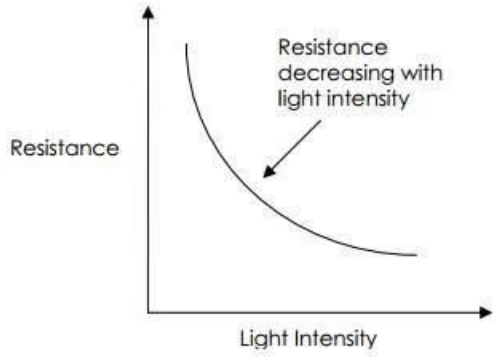

Figure 3.9: Ligt Dependent Resistive Response

3.6 LDR Sensor :

A **photoresistor** (or**light-dependent resistor**,**LDR**, or **photo-conductive cell**) is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photoresistor can be applied in light-sensitive detector circuits, and light-activated and dark-activated switching circuits. A photoresistor is made of a high resistance semiconductor. In the dark, a photoresistor can have a resistance as high as several megohms (MΩ), while in the light, a photoresistor can have a resistance as low as a few hundred ohms. If incident light on a photoresistor exceeds a certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons (and their hole partners) conduct electricity, thereby lowering resistance. The resistance range and sensitivity of a photoresistor can substantially differ among dissimilar devices. Moreover, unique photoresistors may react substantially differently to photons within certain wavelength bands. View ,symbol and resistence curve shown in the$Fig.3.7, Fig.3.8, Fig.3.9respectively.$

3.7 Power Supply :

A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment, while others are built into the load appliances that they power. Examples of the latter include power supplies found in desktop computers and consumer electronics devices. Other functions that power supplies may perform include

limiting the current drawn by the load to safe levels, shutting off the current in the event of an electrical fault, power conditioning to prevent electronic noise or voltage surges on the input from reaching the load, power-factor correction, and storing energy so it can continue to power the load in the event of a temporary interruption in the source power (uninterruptible power supply). The picture of 12 volt adapter shown in the Fig.3.10

Figure 3.10: Power Adapter

Chapter 4

Result and Conclusion

Outline: This chapter presents the following:

1. Result And Discussion
2. Conclusion And Future Works

4.1 RESULTS AND DISCUSSION

The proposed system is achieving two aims, the first objective is to register, record, and manage a student attendance using RFID tag, and the second aim is to provide student information service such as timetable, lecture time and classroom number, and other student-related data that displayed in screen or LCD. The traditional method for taking student absence report is usually done by using paper-work and handwriting son the advertisement wall. Hence, paperwork method consumes workforce requirements, duplication of the efforts, and imposes time-consuming and inefficiency.

The proposed system based on RFID technology can achieve several advantages such as userfriendliness, affordability, security, flexibility, high resources and data accuracy, automatic and tag identification without human interference, indicating work status and generating the attendance report automatically, and it does not need to spend extra time and efforts. zChild Safety is very important nowadays and everyone wants to get information from the school about their child attendance in the school.

Figure 4.1: Complete Demo System

4.2 CONCLUSION AND FUTURE WORKS

A student attendance and information system are designed and implemented to manage student's data and provide capabilities for tracking student attendance, grading student marks, giving information about timetable, lecture time, room number, and other student-related information. Also, the proposed system provides easiness for the staff where there is no need for extra paper works and additional lockers for saving data. Results achieved the innovation of developing the system proved reliable to support the attendance management system for an academic sector in the usage of the RFID technology and microcontroller board. It can be considered as a successful implementation. Two primary goals for future directions, the first goal is to extend the proposed system to include staff information as well. The second one is to extend the system to encompass more than one facility with the insertion of face detection mechanism in the attendance monitoring system to avoid proxy.

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