IoT BASED COLLEGE ATTENDANCE AND TRANSPORTATION MONITORING SYSTEM

A PROJECT REPORT

Submitted by

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We hereby declare that the project report entitled **"IoT BASED COLLEGE ATTENDANCE AND TRANSPORTATION MONITORING SYSTEM"** is submitted to the Department of Electronics and Communication Engineering in Kings Engineering College, Chennai.

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ABSTRACT

- This paper presents an IoT Based College Attendance and Transportation Monitoring System using Arduino Uno R3 (ATmega328p), NodeMCU (ESP-8266) is used to monitor the attendance of students and staff in a college. The system also tracks the movement of college buses and provides real-time information to the parents.

- The Attendance of students and staff is recorded by the Fingerprint sensor (Biometric Authentication), while the movement and speed of college buses is tracked by the GPS Module. The Web Camera is used for monitor the students, staffs and driver. The Force sensor will detect the crash of the bus and send alert message to the institution, Parents, including institution website. The data collected by the system is stored in a Cloud Database and can be accessed by the college authorities as well as the parents. The system is cost-effective and efficient in Monitoring the Attendance and Transportation of students and staff at the college.

KEYWORDS: IoT, Attendance, Transportation, Monitoring system, Real time Location, Biometric Authentication.

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ABBREVATIONS AND NOMENCLATURE

ABBREVATION		FULL FORM
WIFI	-	Wireless Fidelity
ESP	-	Espressif Systems
NodeMCU	-	Node Micro Controller Unit
PIC	-	Programmable Interface Controller
PIR	-	Passive Infrared
GSM	-	Global System for Mobile
SDK	-	Software Development Kit
OPAMP	-	Operational Amplifier
SPIFFS	-	Serial Peripheral Interface Flash File System
DIP	-	Dual Inline Package
UART	-	Universal Asynchronous Receiver Transmitter
SRAM	-	Static Random Access Memory
RISC	-	Reduced Instruction Set Computer
USB	-	Universal Serial Bus
TTL	-	Transistor to Transistor Logic
PWM	-	Pulse Width Modulation
ADC	-	Analog to Digital Convertor
DAC	-	Digital to Analog Convertor
GPIO	-	General Purpose Input Output
SPI	-	Serial Peripheral Interface
PCB	-	Printed Circuit Board

API	-	Application Program Interface
SDIO	-	Secure Digital Input Output
RST	-	Reset
NC	-	No Connection
FTDI	-	Future Technology Devices International
TF	-	Trans Flash
RTOS	-	Real Time Operating System
FOTA	-	Firmware Over The Air
STA/AP	-	Station Access Point / Access Point
CH EN	-	Chip Enable
IDE	-	Integrated Development Environment
TxD0	-	Serial Transmit Data pin
RxD0	-	Serial Receive Data pin
DFU	-	Device Firmware Update
ICSP	-	In-Circuit Serial Programming
STK	-	Systems Tool Kit
FIFO	-	First In First Out
ISP	-	In circuit Serial Programmer
GPS	-	Global Positioning System

1.INTRODUCTION

1.1GENERAL

- The Internet of Things (IoT) based College Attendance and Transportation Monitoring System is an innovative solution to improve the efficiency of college attendance and transportation management.
- This system uses IoT technology to track the attendance and transportation of students in real-time. It helps college administrators to monitor the attendance of students and the transportation of students to and from the college.
- The system also helps to improve the safety of students by providing real-time alerts and notifications in case of any emergency.
- The system also provides analytics and reports to the college administrators to help them make informed decisions. This system can be used to improve the efficiency of college attendance and transportation management and ensure the safety of students.

1.2 OBJECTIVE

- The objective of the IoT-based College Attendance and Transportation Monitoring System is to provide a secure, reliable, and automated system to monitor student's attendance and transportation.
- The system will be able to accurately detect the attendance and transportation of students, while also providing real-time Location to parents and the institute. Additionally it will enable the institute to track student's whereabouts, monitor the safety of students, and control the use of transportation services.

1.3 EXISTING SYSTEM

- The existing system involves manual work to manage the college.
- Transportation which may lead to human error.
- Only driver can monitor the speed of the bus.
- Lack of security to the students.

1.4 PROPOSED SYSTEM

- This project helps both parents and college administration to manage and monitor numerous factors like number of students, location etc.Along with the student's fingerprint data the geographical coordinates of the bus are fetched by the GPS Module and then uploaded to a server using Node MCU (WIFI Module).
- Speed of the bus is monitored and if the bus exceeds the normal speed then the speed of the bus is updated to college administration with its GPS location if the bus faces any accident the location is updated to both parents and college administration.

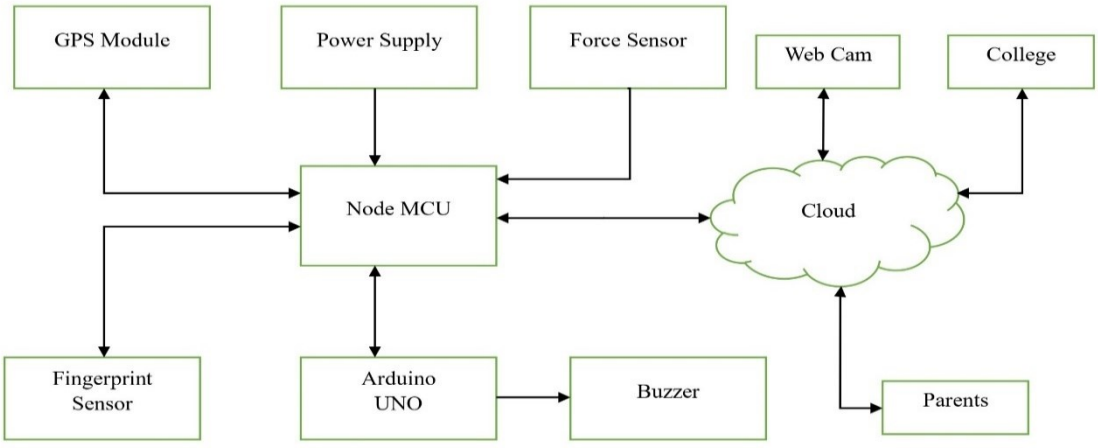

Figure 1.1 Block Diagram

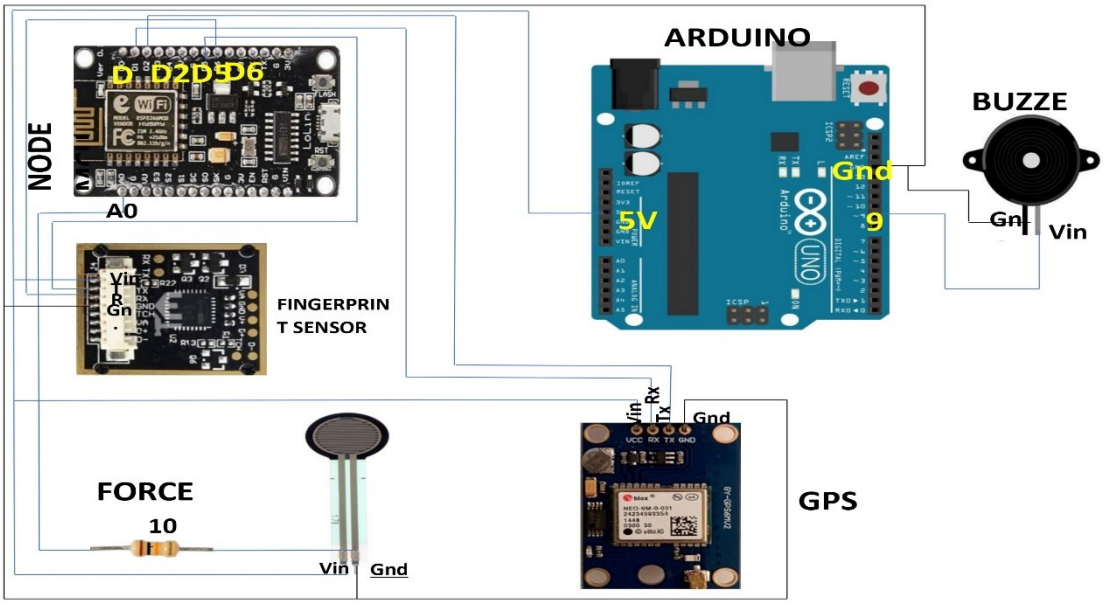

Fig 1.2 Circuit Diagram of Proposed System

1.5 METHODOLOGY

- Arduino UNO is used as the controller. Arduino receives fingerprint data as Input from a fingerprint sensor. Sensor data are used in updating students In and Out time with location.
- GPS module is used to fetch the location coordinates of the student and to monitor the speed of the bus.
- Force sensor output are continuously monitored by the controller if the output is abnormal then the controller updates college administration with the location coordinates
- Wi-fi module is used in updating process. Location and sensor data's are uploaded to Cloud. administration and parents can access the data uploaded to the cloud.

1.5ORGANISATION OF THE REPORT

The report is organized in the form of 8 chapters.

Chapter 1 of the thesis provides the required introductory concept of IoT Based College Attendance and Transportation Monitoring System. The provide a secure, reliable, and automated system to monitor student's attendance and transportation.

Chapter 2 reviews the existing Internet of Things (IoT) techniques in the literature. An extensive survey on conventional bus-based on-chip College Attendance and Transportation systems and interconnecting techniques that are listed and a detailed analysis is carried out.

Chapter 3 discusses the developed implementation of Internet of Things based Arduino Uno open-source hardware and software company, project and user community that designs and manufactures single board microcontrollers and microcontroller kits for building digital devices.

Chapter 4 discusses the developed implementation of Internet of Things based NodeMCU open-source hardware low-cost opensource IOT platform. Initially includes firmware which runs on the ESP8266 Wi-Fi Soc from Espress-if Systems, and hardware which was based on the ESP-12 module.

Chapter 5 discusses about Hardware module requirement and their applications and features based on Internet of Things Technology.

Chapter 6 discusses about Software requirement and their applications and features based on Internet of Things Technology

Chapter 7 discusses about our project output and results.

Chapter 8 concludes the study with a summary of the outcomes of the research work. Future research issues related to the present work are discussed.

2.LITERATURE SURVEY

2.1 GENERAL

To address this issue, researchers and developers have explored various methodologies and technologies used in IoT based college attendance and transportation monitoring for institutions. This literature survey aims to provide an overview of the existing work in this domain, some project papers survey are listed below.

1. **“Cloud Based Smart Attendance System for Educational Institutions” Vikas Yadav;G. P. Bhole2019 International Conference on Machine Learning, Big Data, Cloud and Parallel Computing (COMITCon)Year: 2019 | Conference Paper | Publisher: IEEE**

   To reduce the overall time required to take the attendance in the class the attendance device is made portable, so that it can be easily circulated among students to mark their attendance. The system has been tested and results are encouraging to catapult further study and research in this area.

2. **Bhaskar M. Srivighnesh, "RFID and Pose Invariant Face Verification based automated classroom attendance system", International Conference on Microelectronics Computing and Communications (MicroCom), *2016.***

   The performance of the system is tested for frontal face verification, head pose varied face verification and detection of proxy attendance is carried out. It is found that the proposed scheme verifies the identity of the student correctly of about 98% for frontal face and two attempts on poses varied face verification.

3. **“Attendance Monitoring in Classroom Using Smartphone & Wi-Fi Fingerprinting” S. Anand;Kamal Bijlani;Sheeja Suresh;P. Praphul 2016 IEEE Eighth International Conference on Technology for Education (T4E) Year: 2016 | Conference Paper | Publisher: IEEE**

The proposed system does not require high monetary cost or specialized hardware and yet incorporates adequate foolproof measures to counter fake or proxy attendance. Experimental studies with our system show that fingerprinting, which is the technique used here to determine indoor location, can achieve very good positioning accuracy even in classroom environments, where signal interference is usually very high.

4. **“An Intelligent and Secured Tracking System for Monitoring School Bus” Asif Ahmed;M M Rayhan Parvez;Md Hridoy Hasan;Fernez Narin Nur;Nazmun Nessa Moon;Asif Karim;Sami Azam;Bharanidharan Shanmugam;Mirjam Jonkman2019 International Conference on Computer Communication and Informatics(ICCCI)Year: 2019 | Conference Paper | Publisher: IEEE**

The focus of the research is to display the feasibility of a safe and intelligent school bus using secured tracking system based on dual authentication procedures. It is expected that the offshoot of this research initiative will regain the confidence and reliability of parents in school bus and reduce the use of individual transport. A smart school bus will keep the student safe, easing the tension for parents and the city will have a smooth traffic system.

5. **A Al-Lawati, S Al-Jahdhami, A Al-Belushi, D Al-Adawi, M Awadalla and D. Al-Abri, "RFID-based system for school children transportation safety enhancement", In GCC Conference and Exhibition (GCCCE) 2015 IEEE 8th 2015 Feb, pp. 1-6.**

The system has a developed web-based database-driven application that facilities its management provides useful information about the children to authorized personal. A complete prototype of proposed system was implemented and tested to validate the system functionality. The results show that the system is promising for daily transportation safety.

6. **V. Mota, S. Azam, B. Shanmugam, K.C. Yeo and K. Kannoorpatti, "Comparative analysis of different techniques of encryption for secured data transmission", IEEE International Conference on Power Control Signals and Instrumentation Engineering ICPCSI, *2017.***

The comparison of commonly used symmetric encryption algorithms Blowfish, AES, DES and 3DES concluded that Blowfish is best in all parameters. On the other hand, the comparison asymmetric algorithms RSA ECC and Elgamal showed that ECC is best in almost in parameters in comparison with RSA except in signature verification time. The hashing algorithm of SHA256 are more secure than SHA1 and MD5.

7. **M Saifuzzaman, AH Khan, NN Moon and FN Nur, "Smart Security for an Organization based on IoT", International Journal of Computer Applications, vol. 165, no. 10, pp. 33-8, 2017.**

This research ensures the safety of organization from unwanted occurrence and theft. The main contribution of this paper is that it not only helps to ensure the security of an organization but also energy efficient and time saving.

8. **The Design of Cold Chain Transportation Monitoring System Based on NB-IoT Guomin Li; Meng Li 2020 International Conference on Virtual Reality and Intelligent system (ICVRIS) Year: 2020 | Conference Paper | Publisher: IEEE**

   At present, cold chain transportation is an important link to ensure product quality. If the lack of real-time monitoring and effective management of the cold chain transportation process will lead to economic losses and safety accidents.

9. **NB-IoT Drives Intelligent Cold_Chain for Best Application Ning Zhang;Yingjie Liu2019 IEEE 9th International Conference on Electronics Information and Emergency Communication (ICEIEC) Year: 2019 | Conference Paper | Publisher: IEEE**

   NB-IoT as the communication method, it can realize the monitoring of the position, status and safety of all reefer containers equipped with the intelligent terminal control. The actual operation shows that the scheme is reliable and the data transmission is stable, which has certain promotion and application value.

10. **Online Attendance Monitoring System using QR Code (OAMS) Shubham Mishra;Chandan Kumar;Ahmad Ali;Jeevan Bala 2021 2nd International Conference on Intelligent Engineering and Management(ICIEM)Year: 021 | ConferencePaper | Publisher: IEEE**

    The proposed framework has three segments, one for producing the QR Code by entering the student's subtleties and the second application for taking the attendance, and the third for creating the attendance in CSV or XLS design. The educator should check the QR code of the specific understudy to affirm their attendance. The understudy QR code will be given to the teacher to mark their attendance.

3. ARDUINO UNO

3.1 GENERAL

- Arduino is an open-source hardware and software company, project and user community that designs and manufactures single board microcontrollers and microcontroller kits for building digital devices. Its products are licensed under the GNU Lesser General Public License (LGPL) permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form.

- 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 ('shields') or breadboards for prototyping 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 can be programmed using C and C++ programming languages. In addition to using traditional compiler tool chains, the Arduino project provides an integrated development environment (IDE) based on the processing language project. Arduino microcontrollers are pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory. The default bootloader of the Arduino UNO is the optiboot bootloader.

- Boards are loaded with program code via a serial connection to another computer. Some serial Arduino boards contain a level shifter circuit to convert between RS232 logic levels and transistor–transistor logic (TTL) level signals. Current Arduino boards are programmed via Universal Serial Bus (USB), implemented using USB-to-serial adapter chips such as the FTDI FT232.
- Some boards, such as later-model Uno boards, substitute the FTDI chip with a separate AVR chip containing USB-to-serial firmware, which is reprogrammable via its own ICSP header. Other variants, such as the Arduino Mini and the unofficial Board uno, use a detachable USB-to-serial adapter board or cable, Bluetooth or other methods. When used with traditional microcontroller tools, instead of the Arduino IDE, standard AVR in-system programming (ISP) programming is used.

- It is open source and the Arduino Uno is a widely used opensource microcontroller board based on the microchip ATmega328p microcontroller. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards and other circuits. The board features 14 Digital pins and 6 Analog pins. Operating Voltage at 5 Volts, Input Voltage at 7 to 20 Volts, Clock Speed at 16 MHz, in that 32 KB flash memory, 2 KB SRAM and 1

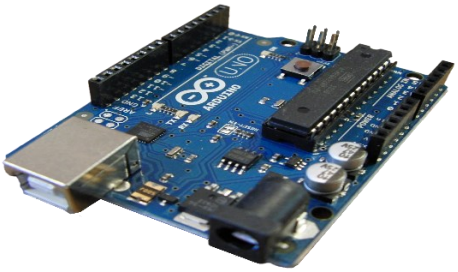

Fig 3.1 Arduino Uno

3.2 TECHNICAL SPECIFICATION

- Microcontroller: ATmega328P
- Operating Voltage: 5V
- Input Voltage (recommended): 7-12V
- Input Voltage (limit): 6-20V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- PWM Digital I/O Pins: 6
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB (ATmega328P) of which 0.5 KB used by bootloader
- EEPROM: 1 KB (ATmega328P)

- Clock Speed: 16 MHz
- LED_BUILTIN: 13
- Length: 68.6 mm
- Width: 58.4 mm
- Weight: 25

3.3 ARDUINO UNO PIN CONFIGURATION

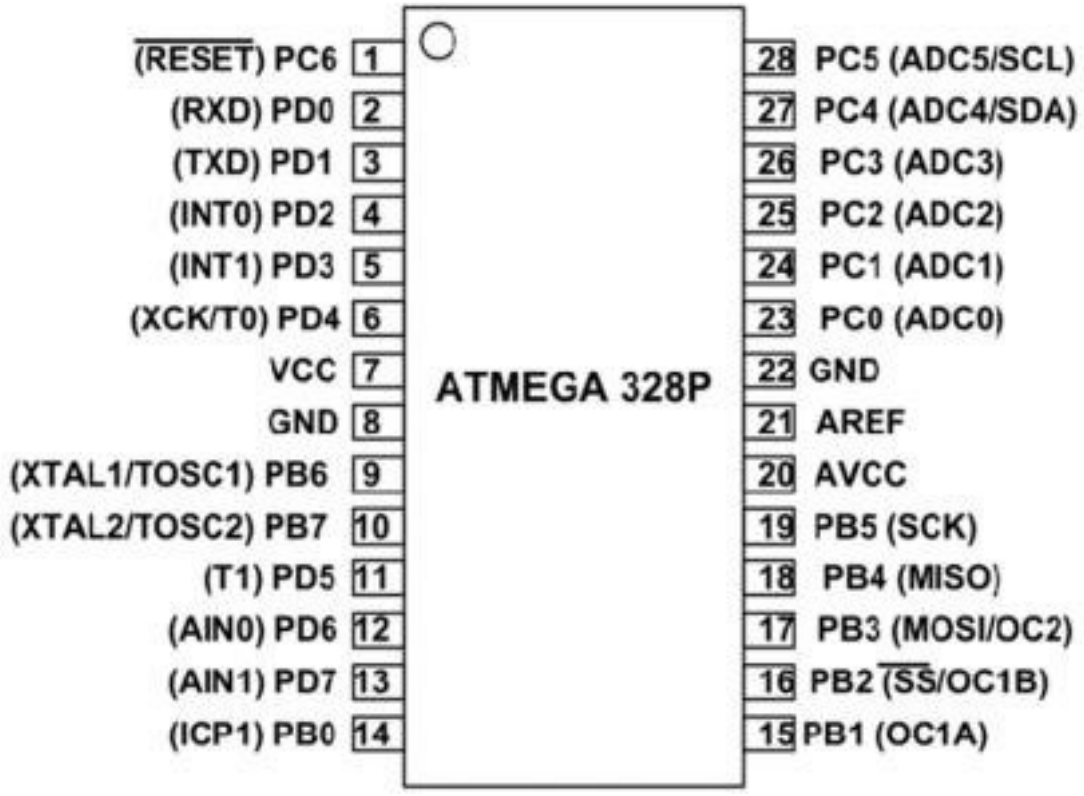

Fig 3.2 Arduino UNO Pin Configuration

3.4POWER SUPPLY

- The Arduino Uno power supply can be done with the help of a USB cable or an external power supply. The external power supplies mainly include AC to DC adapter otherwise a battery.

- The adapter can be connected to the Arduino Uno by plugging into the power jack of the Arduino board. Similarly, the battery leads can be connected to the Vin pin and the GND pin of the POWER connector. The suggested voltage range will be 7 volts to 12V.

3.5 Input & Output

The 14 digital pins on the Arduino Uno can be used as input & output with the help of the functions like pinMode(), digitalWrite(), & Digital Read().

- Pin1 (TX) & Pin0 (RX) (Serial): This pin is used to transmit & receive TTL serial data, and these are connected to the ATmega8U2 USB to TTL Serial chip equivalent pins.
- Pin 2 & Pin 3 (External Interrupts): External pins can be connected to activate an interrupt over a low value, change in value. Pins 3, 5, 6, 9, 10, & 11 (PWM): This pin gives 8-bit PWM o/p by the function of analog Write().

- SPI Pins (Pin-10 (SS), Pin-11 (MOSI), Pin-12 (MISO), Pin-13 (SCK): These pins maintain SPI-communication, even though offered by the fundamental hardware, are not presently included within the Arduino language.

- Pin-13(LED): The inbuilt LED can be connected to pin-13 (digital pin). As the HIGH-value pin, the light emitting diode is activated, whenever the pin is LOW.

- Pin-4 (SDA) & Pin-5 (SCL) (I2C): It supports TWI-communication with the help of the Wire library.

- AREF (Reference Voltage): The reference voltage is for the analog i/ps with analogReference().

- Reset Pin: This pin is used for resetting (RST) the microcontroller.

4. NODE MCU

4.1 GENERAL

- NodeMCU is a low-cost opensource IOT platform. Initially includes firmware which runs on the ESP8266 Wi-Fi Soc from Espressif Systems, and hardware which was based on the ESP-12 module. Later, supportfor the ESP32 32-bit MCU was added.NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node"and "MCU" (micro-controller unit). The term "NodeMCU" strictly speaking refers to the firmware rather than the associated. Both the firmware and prototyping board designs are open source. The firmware uses the Lua scripting language. The firmware is based on the elua project, and built on the Espressif Non-OS SDK for ESP8266.

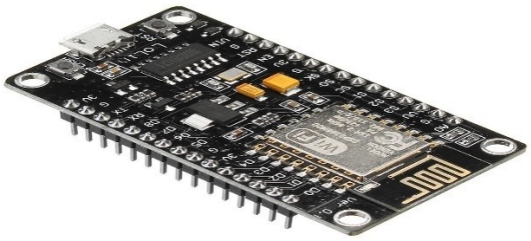

Figure 4.1 Node MCU

- It uses many open source projects, such as lua-cjsonand SPIFFS. Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. 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 initially was based on the ESP-12 module of the ESP8266, which is a Wi-Fi soc integrated

4.2 Technical Specification

- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
- Developer : ESP8266 Opensource Community
- Type : Single-board microcontroller
- Operating system : XTOS
- CPU : ESP8266
- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1
- UARTs: 1
- SPIs: 1
- I2Cs: 1
- Flash Memory: 4 MB
- SRAM: 64 KB
- Clock Speed: 80 Mhz
- Memory : 4Mb
- Power By : USB
- Power Voltage : 3v,5v (used with 3.3v Regulator which inbuilton
- Board using Pin VIN)
- Code : Arduino Cpp
- IDE Used : Arduino IDE
- GPIO : 10

4.3 Programming:

- NodeMCU is an open source development board and firmware based in the widely used ESP8266 -12E WiFi module. It allows you to program the ESP8266 WiFi module with the simple and powerful LUA programing language orArduino IDE.With just a few lines of code you can establish a WiFi connection and define input/output pins according to your needs exactly like arduino, turning your ESP8266 into a web server and a lot more. It is the WiFi equivalent of ethernet module.

4.4 Features:

- With its USB-TTL, the NodeMCU Dev board supports directly flashing from USB port. It combines features of WIFI accesspoint and station + microcontroller. These features make the NodeMCUextremly powerful tool for Wifi networking. It can be used as access point and/or station, host a webserver or connect to internet to fetch or upload data.Finally, programmable WiFi module.
- Arduino-like (software defined) hardware IO.
- Can be programmed with the simple and powerful Lua programming language or Arduino IDE.
- USB-TTL included, plug & play.
- 10 GPIOs D0-D10, PWM functionality, IIC and SPI communication, 1-Wire and ADC A0 etc. all in one board.
- Wifi networking (can be used as access point and/or station, host a web server), connect to internet to fetch or upload data.
- Event-driven API for network applications.

4.5 Pin definition

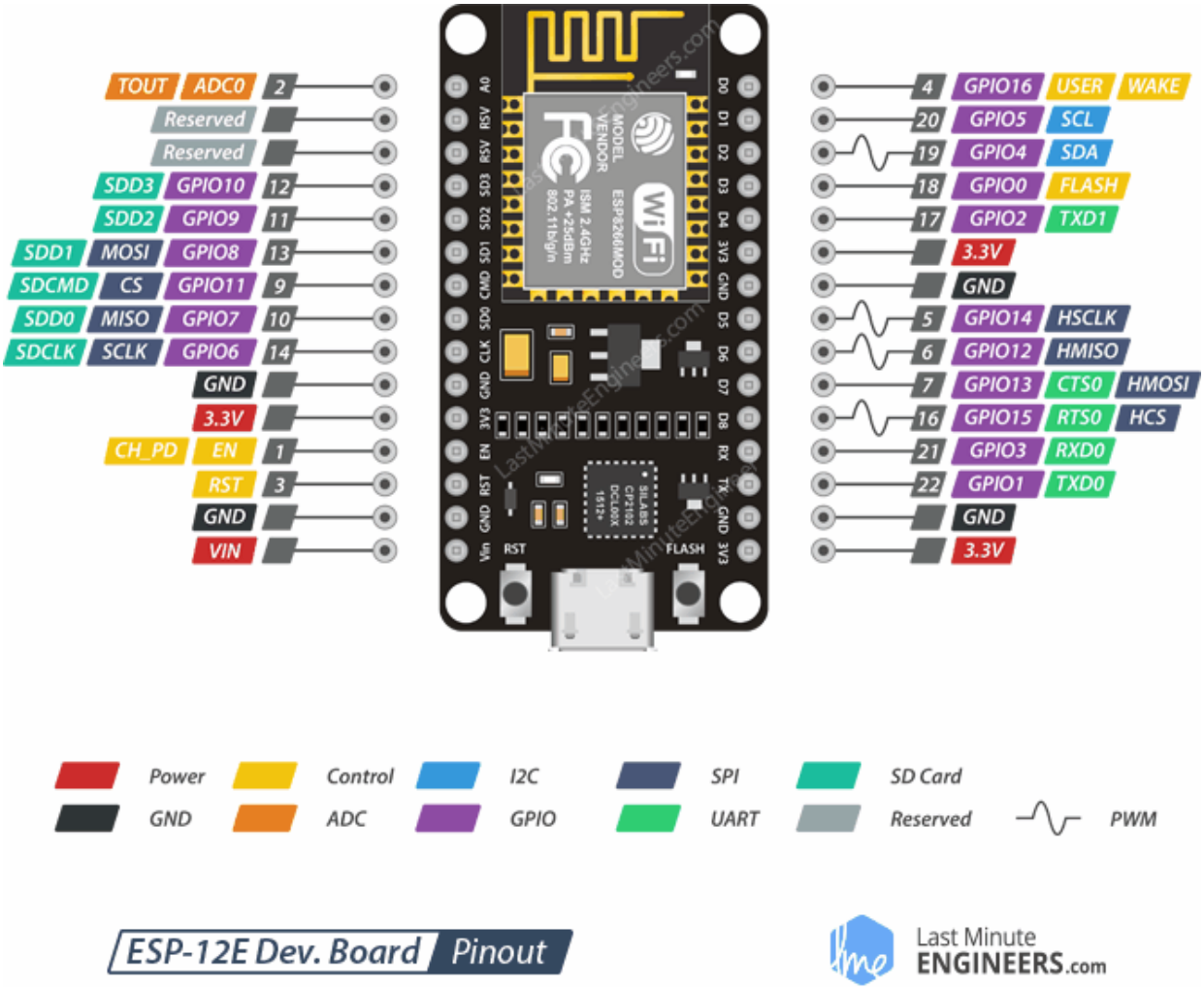

Figure 4.2 Pin definition

- Power pins There are four power pins viz. one VIN pin & three 3.3V pins. The VIN pin can be used to directly supply the ESP8266 and its peripherals, if you have a regulated 5V voltage source. The 3.3V pins are the output of an on-board voltage regulator. These pins can be used to supply power to external components.
- GND is a ground pin of ESP8266 NodeMCU development board.
- I2C Pins are used to hook up all sorts of I2C sensors and peripherals in your project. Both I2C Master and I2C Slave are supported. I2C interface functionality can be realized programmatically, and the clock frequency

is 100 kHz at a maximum. It should be noted that I2C clock frequency should be higher than the slowest clock frequency of the slave device.

- GPIO Pins ESP8266 NodeMCU has 17 GPIO pins which can be assigned to various functions such as I2C, I2S, UART, PWM, IR Remote Control, LED Light and Button programmatically. Each digital enabled GPIO can be configured to internal pull-up or pull-down, or set to high impedance. When configured as an input, it can also be set to edge-trigger or level-trigger to generate CPU interrupts.

- ADC Channels The NodeMCU is embedded with a 10-bit precision SAR ADC. The two functions can be implemented using ADC viz. Testing power supply voltage of VDD3P3 pin and testing input voltage of TOUT pin. However, they cannot be implemented at the same time.

- SPI Pins ESP8266 features two SPIs (SPI and HSPI) in slave and master modes. These SPIs also support the following general-purpose SPI features:

- 4 timing modes of the SPI format transfer

- Up to 80 MHz and the divided clocks of 80 MHz

- Up to 64-Byte FIFO

- SDIO Pins ESP8266 features Secure Digital Input/Output Interface (SDIO) which is used to directly interface SD cards. 4-bit 25 MHz SDIO v1.1 and 4-bit 50 MHz SDIO v2.0 are supported.

4.6 Pin configuration:

TABLE 4.1 Node MCU pin configuration

Pin No	Pin Name	Alternate Name	Normally used for	Alternate purpose
1	Ground	-	Connected to the ground of the circuit	-
2	TX	GPIO – 1	Connected to Rx pin of programmer/uC to upload program	Can act as a General purpose-Input/output in when not used as TX
3	GPIO-2	-	General purpose Input/output pin	-
4	CH_EN	-	Chip Enable –Active high	-
5	GPIO – 0	Flash	General purpose Input/output pin	Takes module into serial-programming when held low during start up
6	Reset	-	Resets the module	-
7	RX	GPIO – 3	General purpose Input/output pin	Actas General purposeInput/output pin when not used as RX

8	Vcc	-	Connect to +3.3V only	

4.7 Node MCU is better than the other boards

- Cost –NodeMCU is cheaper compared to Arduino original
- Flash - 32KB for Arduino , 4MB for NodeMCU
- SRAM - 2KB for Arduino, upto 50KB for NodeMCU
- Clock Speed - 16MHz(ATMEGA328 can handle upto 20MHz) for Arduino, 24–52MHZ(CPU can handle 80MHz) for NodeMCU
- GPIO pins - 14(6 PWM) for Arduino, 17(All PWM) for NodeMCU
- Operating Voltage - 5V for Arduino, 3.3V for NodeMCU

4.8 Power:

- As the operating voltage range of ESP8266 is 3V to 3.6V, the board comes with a LDO voltage regulator to keep the voltage steady at 3.3V. It can reliably supply up to 600mA, which should be more than enough when ESP8266 pulls as much as 80mA during RF transmissions.
- The output of the regulator is also broken out to one of the sides of the board and labeled as 3V3. This pin can be used to supply power to external components.
- Power to the ESP8266 NodeMCU is supplied via the on-board MicroB USB connector. Alternatively, if you have a regulated 5V voltage source, the VIN pin can be used to directly supply the ESP8266 and its peripherals.

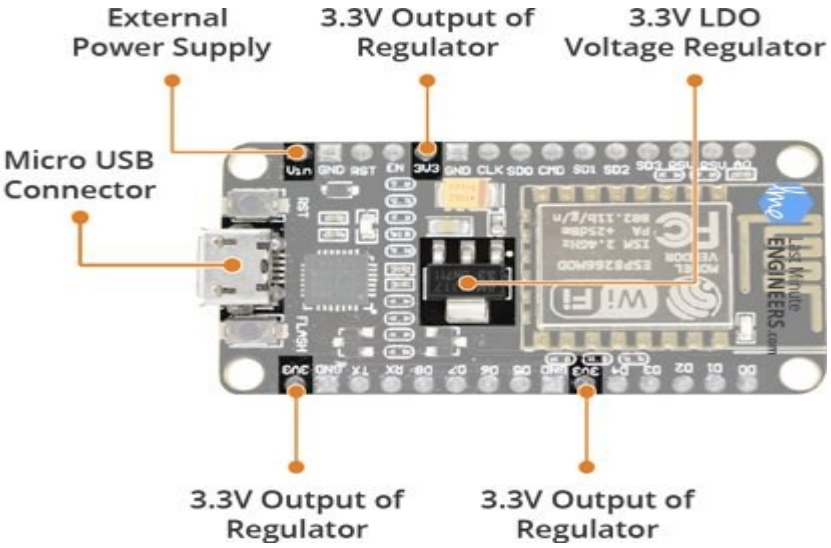

Figure 4.3 Power Supply of NodeMCU

4.9 Serial Communication

- The board includes CP2102 USB-to-UART Bridge Controller from Silicon Labs, which converts USB signal to serial and allows your computer to program and communicate with the ESP8266 chip. CP2102 USB-to-UART converter. 4.5 Mbps communication spe

5.HARDWARE MODULE

5.1 GENERAL

- To address what are the hardware requirements need for IoT based college attendance and transportation monitoring system. Then we see about that requirements of applications and features given below.

5.2 HARDWARE REQUIREMENTS

- FINGERPRINT SENSOR
- GPSMODULE
- WEB CAMERA
- FORCE SENSOR

5.3FINGERPRINT SENSOR

- R307 fingerprint module consists of optical fingerprint sensor, high speed DSP processor and other hardware and software composition, stable performance, simple structure with fingerprint entry, image processing.
- The R307 fingerprint module has two interface TTL UART and USB 2.0.USB 2.0 interface can be connected to the computer; RS232 interface.

Figure 5.1 Fingerprint sensor

5.3.1 APPLICATIONS OF FINGERPRINT SENSOR

- Fingerprint sensors are primarily used for security applications such as securing phones, computers, access buildings and even capturing data.
- They are also used in security industries, police stations, mobile devices and many more.
- Fingerprint sensors can be used to identify criminals in crime scenes.

5.3.2 R307 FINGERPRINT SENSOR FEATURES

- It has stable performance andsimple structure with fingerprint entry
- image processing, fingerprint matching, search and template storage functions.
- The module has two interfaces: TTL UART and USB2.0[3]. The user can store the finger print data in the module and can configure it in 1:1 or 1: N mode for identifying the person.

5.4 GPS Module

- GPS-NEO-6M GPS module that can track up to 22 satellites and identifies locations anywhere in the world.It may serve as a great launch pad for anyone looking to get into the world of GPS.
- At the heart of the module is a NEO-6M GPS chip from u–blox.The chip measures less than the size of a postage stamp but packs a surprising amount of features into its little frame.
- It can track up to 22 satellites on 50 channels and achieves the industry's highest level of sensitivity

5.4.1APPLICATIONS OF GPS MODULE:

- GPS modules are used for real-time positioning in transportation field.
- In the security field, GPS modules are used for tracking and anti-theft purposes.

5.4.2FEATURES:

- High sensitivity for tracking.
- Low supply current (~45mA).
- Is able to track 5 locations per second with an accuracy of 2.5m (horizontal).

Figure: 5.2 GPS Module

5.5 WEB CAMERA

- A webcam is a video camera that feeds or streams an image or video in real time to or through a computer to a computer network. When "captured" by the computer, the video stream may be saved, viewed or sent on to other networks via the internet.

5.5.1 APPLICATIONS OF WEBCAMERA

- Web cameras are used for online classes and remote learning.
- Web cameras are used for security surveillance in homes and offices.
- Web cameras are used for video recording in vlogging and content creation.

5.5.2 FEATURES

- **Frame rate:** A decent webcam will have a frame rate of at least 30 frames per second (fps). Anything less than this is out of date, and images may appear jerky or laggy.
- **Resolution:** The more pixels, the finer the image. 720p and 1080p will suffice for most home offices or remote learning tasks.

- **Autofocus:** This feature allows the camera to adjust focus automatically so that the subject is always in focus.
- **Microphone:** Most webcams come with a built-in microphone that can capture sound within a few feet of the camera.
- **Video Effects:** Some webcams come with built-in video effects that allow users to add fun filters or backgrounds to their video.

Figure 5.3 Camera module

5.5.3 ACCESSING THE VIDEO STREAMING SERVER

- Open a browser and type the EAZYCAM IP address. Press the Start Streaming button to start video streaming. You also have the option to take photos by clicking the Get Still button.

- Can be modified it to use the onboard microSD Card to store the captured photos. There are also several camera settings that you can play with to adjust the image settings.

5.6 FORCE SENSOR

- The Force sensor is also known as force sensing resistor, force sensitive resistor, or just FSR.
- The Force sensor is basically a resistor that changes its resistive value depending on how much it has been pressed.

- Good and detecting physical pressure, squeeze.
- The Force sensor is used in electronic drums, mobile phones, handheld gaming devices and many more portable electronics.

Figure 5.4 Force sensor

5.6.1 APPLICATIONS OF FORCE SENSOR:

- Force sensors are used in on-board weighing for vehicles to carry loads of maximum capacity.
- Force sensors are used in scales to weigh luggage at the airport.
- Force sensors are used in aerospace applications.

5.6.2 FEATURES OF FORCE SENSOR:

- Force sensors can transform mechanical input forces like weight, tension, compression, torque, strain, stress or pressure into an electrical output signal whose value can be used to represent the force's magnitude.
- There are different types of force sensors such as load cells, strain gages and force sensing resistors.

5.7 BUZZER

- It is a simple device which can generate beeps and tones.
- Working principle of the device is a piezoelectric effect.
- The main component of this device is a piezo electric crystal, a special material that change shape when a voltage applied to it.

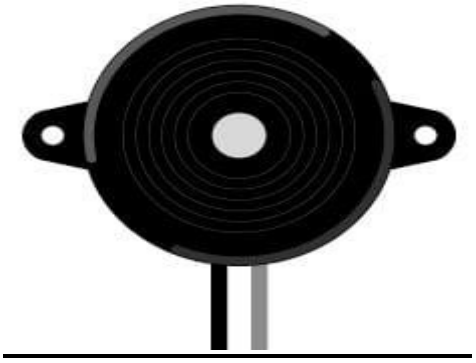

Figure 5.5 Buzzer

5.8 BATTERY

- The lead–acid battery was invented in 1859 by French physicist Gaston Plante and is the earliest type of rechargeable battery. Despite having a very low energy-to-weight ratio and a low energy-to-volume ratio, its ability to supply high surge currents means that the cells have a relatively large power-to-weight ratio. These features, along with their low cost, make them attractive for use in motor vehicles to provide the high current required by starter motors.

- As they are inexpensive compared to newer technologies, lead–acid batteries are widely used even when surge current is not important and other designs could provide higher energy densities. In 1999 lead–acid

battery sales accounted for 40–45% of the value from batteries sold world-wide, equivalent to a manufacturing market value of about $15 billion. Large-format lead–acid designs are widely used for storage in backup power supplies in cell phone towers, high-availability settings like hospitals, and stand-alone power systems. For these roles, modified versions of the standard cell may be used to improve storage times and reduce maintenance requirements.

- In the charged state, the chemical energy of the battery is stored in the potential difference between the pure lead at the negative side and the PbO_2 on the positive side, plus the aqueous sulphuric acid. The electrical energy produced by a discharging lead–acid battery can be attributed to the energy released when the strong chemical bonds of water (H_2O) molecules are formed from H^+ ions of the acid and O^{2-} ions of PbO_2.Conversely, during charging the battery acts as a water–splitting device.

6. SOFTWARES

6.1 GENERAL

- To address what are the software requirements need for IoT based college attendance and transportation monitoring system given below.

6.2 SOFTWARE REQUIREMENTS

- ARDUINO IDE
- HTML
- CSS
- MY SQL
- PHP

6.3 ARDUINO IDE

Arduino programs can be divided in three main parts: **Structure, Values**(variables and constants), and **Functions**.In this tutorial, we will learn about the Arduino software program, step by step, and how we can write the program without any syntax or compilation error.Let us start with the **Structure**. Software structure consist of two main functions

- Setup( ) function
- Loop( ) function

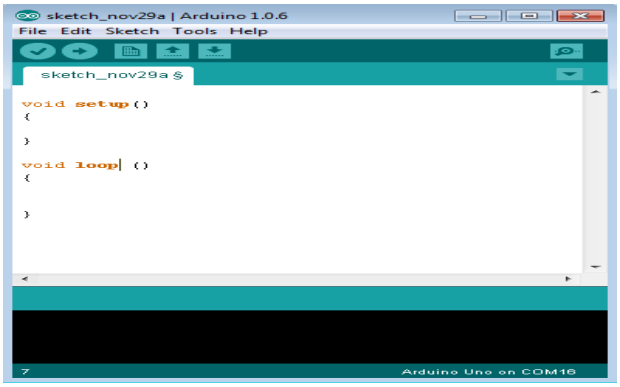

Figure 6.1 IDE SOFTWARE

6.3.1 PURPOSE

The **setup()** function is called when a sketch starts. Use it to initialize the variables, pin modes, start using libraries, etc. The setup function will only run once, after each power up or reset of the Arduino board.

- **INPUT**
- **OUTPUT**
- **RETURN**

6.3.2Arduino - I/O Functions

Pins Configured as INPUT

- Arduino pins are by default configured as inputs, so they do not need to be explicitly declared as inputs with **pinMode()** when you are using them as inputs. Pins configured this way are said to be in a high-impedance state. Input pins make extremely small demands on the circuit that they are sampling, equivalent to a series resistor of 100 megaohm in front of the pin.
- This means that it takes very little current to switch the input pin from one state to another. This makes the pins useful for such tasks as implementing a capacitive touch sensor or reading an LED as a photodiode.
- Pins configured as pinMode(pin, INPUT) with nothing connected to them, or with wires connected to them that are not connected to other circuits, report seemingly random changes in pin state, picking up electrical noise from the environment, or capacitively coupling the state of a nearby pin.

7.RESULT

7.1 GENERAL

- IoT based college attendance and transportation monitoring system in this project output details given below.

7.2 OUTPUT

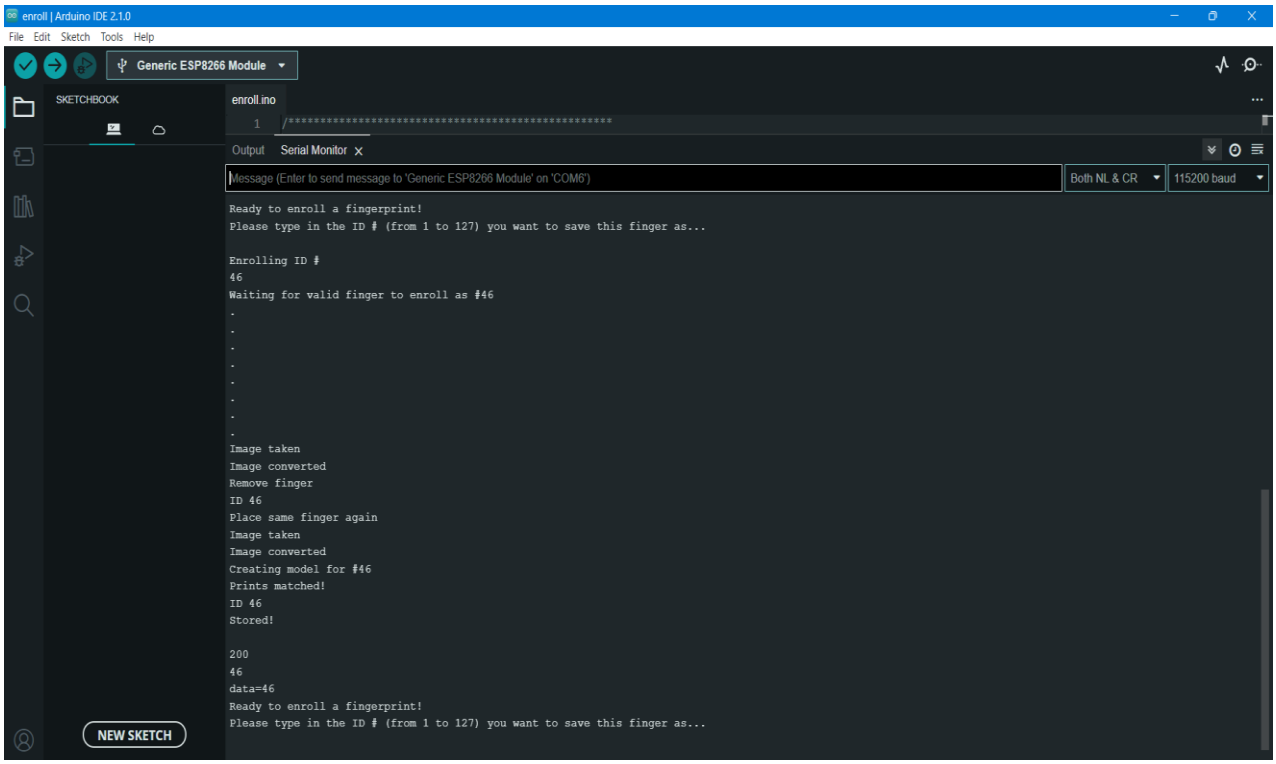

Figure 7.1 Serial Monitor Based Fingerprint Enrollment

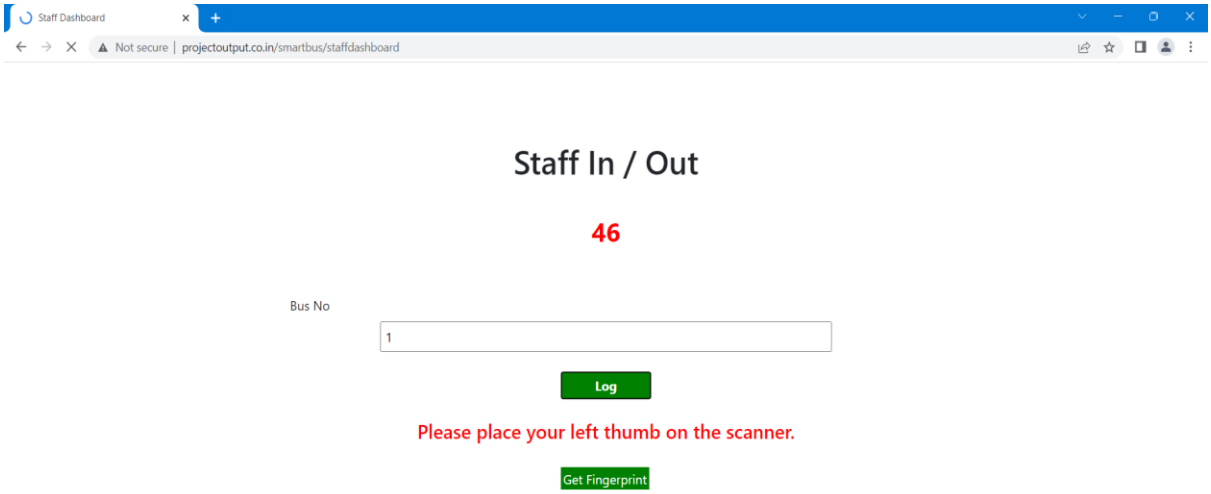

Figure 7.2 Output For Staffs and Students In Bus Enroll

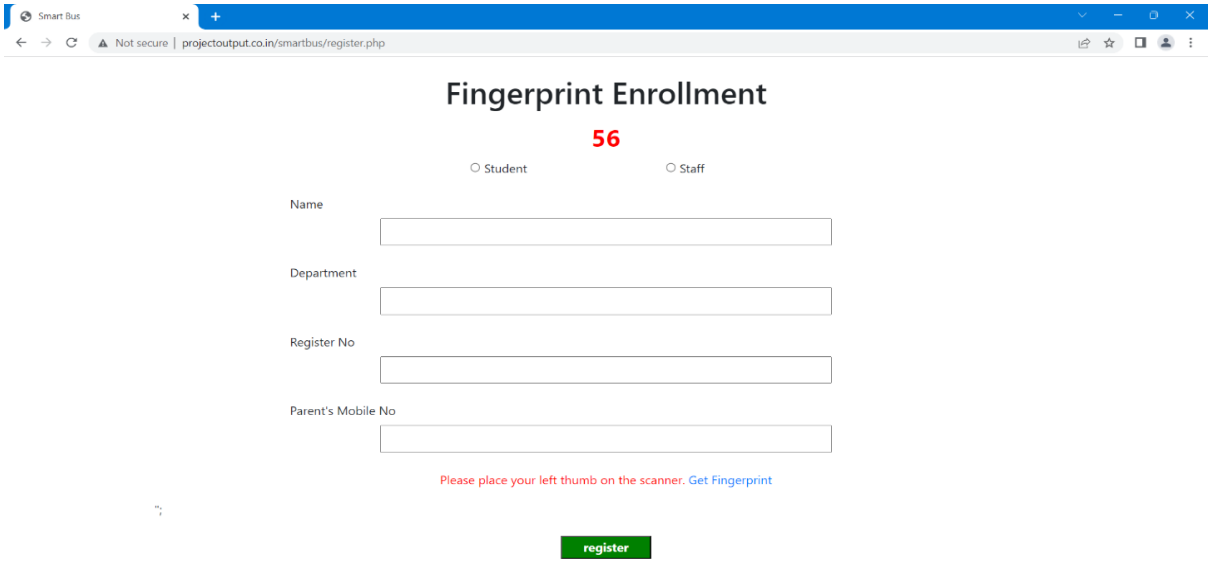

Figure 7.3 Output For Staffs and Students Fingerprint Enrollment

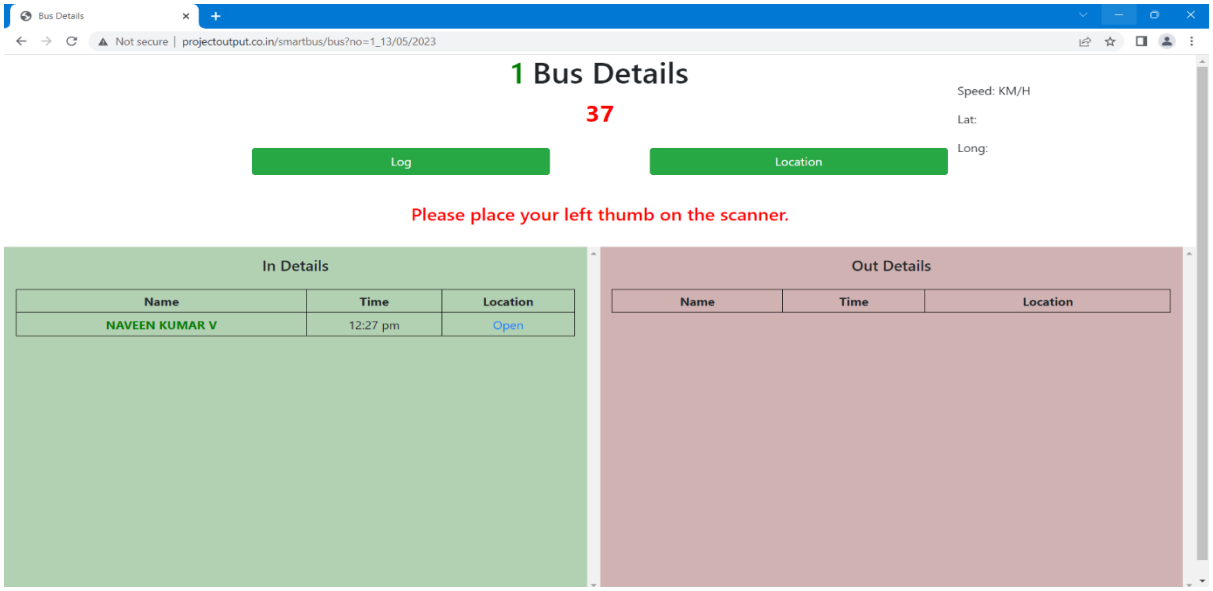

Figure 7.4 Staffs and Student In Out Details with Time and Location

8.CONCLUSION

- This system is designed to monitor college attendance and transportation using fingerprint recognition. It is used an IoT-based system to track the attendance of students and faculty in the college.
- The system uses a fingerprint scanner to identify the user and records the time of entry and exit. This data is then stored in a database which can be accessed by the college administration.
- The system also tracks the transportation of students and faculty by using GPS-enabled devices. This data is also stored in the database and can be used to track the movement of people in the college.
- If student want to step down from bus they should place the finger print again in attendance machine for bus door open. We place the camera Infront of door to detect the person who is placing finger print for exit from bus. We will develop the Android application for user friendly.

8.1REFERENCE

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APPENDIX I

9.1 CODING

9.1.1 ARDUINO UNO BUZZER

```
#include <LiquidCrystal.h>
#define CMDBUFFER_SIZE 32
const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2;
LiquidCrystallcd(rs, en, d4, d5, d6, d7);
const int buzzer = 9;
void setup() {
// Open serial communications and wait for port to open:
Serial.begin(115200);
pinMode(buzzer, OUTPUT);
lcd.begin(16, 2);
lcd.print(" Finger Print");
lcd.setCursor(0,1);
lcd.print("  Attendance");
while (!Serial) {
; // wait for serial port to connect. Needed for native USB port only
}
}
void loop() { // run over and over


serialEvent();


}
```

```
void serialEvent()
{
  static char cmdBuffer[CMDBUFFER_SIZE] = "";
  char c;
while(Serial.available())
  {
    c = processCharInput(cmdBuffer, Serial.read());
Serial.print(c);
    if (c == '\n')
    {
Serial.println();
      //Full command received. Do your stuff here!
      if (strcmp("No finger detected", cmdBuffer) == 0)
      {
lcd.begin(16, 2);
lcd.print(" Waiting For");
lcd.setCursor(0,1);
lcd.print("  Finger...");
}else if (strcmp("Adafruit Fingerprint sensor enrollment", cmdBuffer) == 0)
      {
lcd.begin(16, 2);
lcd.print("Fingerprint sensor");
lcd.setCursor(0,1);
lcd.print("  enrollment");
}else if (strcmp("Found fingerprint sensor", cmdBuffer) == 0)
      {
```

```
lcd.begin(16, 2);
lcd.print("Found Fingerprint");
lcd.setCursor(0,1);
lcd.print("  sensor");
}else if (strcmp("Did not find fingerprint sensor", cmdBuffer) == 0)
    {
lcd.begin(16, 2);
lcd.print("Did not find");
lcd.setCursor(0,1);
lcd.print("fingerprint sensor");
}else if (strcmp("Please type in the ID # (from 1 to 127) you want to save this finger as...",
cmdBuffer) == 0)
    {
lcd.begin(16, 2);
lcd.print("Type in");
lcd.setCursor(0,1);
lcd.print("  ID");
}else if (strcmp("Enrolling ID #", cmdBuffer) == 0)
    {
lcd.begin(16, 2);
lcd.print("Enrolling");
lcd.setCursor(0,1);
lcd.print("  ID");
}else if (strcmp("Stored!", cmdBuffer) == 0)
    {
tone(buzzer, 1000); // Send 1KHz sound signal...
delay(1000);        // ...for 1 sec
```

```
noTone(buzzer);     // Stop sound...
delay(1000);
lcd.begin(16, 2);
lcd.print("Stored");
lcd.setCursor(0,1);
lcd.print("  ID");
}else if (strcmp("Connecting", cmdBuffer) == 0)
     {
lcd.begin(16, 2);
lcd.print("  Connecting");
lcd.setCursor(0,1);
lcd.print("  to WiFi");
}else if (strcmp("Connected", cmdBuffer) == 0)
     {
lcd.begin(16, 2);
lcd.print("  Connected");
lcd.setCursor(0,1);
lcd.print("    to WiFi");
}else if (strcmp("Found a print match!", cmdBuffer) == 0)
     {
tone(buzzer, 1000); // Send 1KHz sound signal...
delay(1000);        // ...for 1 sec
noTone(buzzer);     // Stop sound...
delay(1000);
lcd.begin(16, 2);
lcd.print("  Logged");
```

```
lcd.setCursor(0,1);
lcd.print("    In");//Found a print match!
     }
cmdBuffer[0] = 0;
   }
  }
delay(1);
}
char processCharInput(char* cmdBuffer, const char c)
{
  //Store the character in the input buffer
  if (c >= 32 && c <= 126) //Ignore control characters and special ascii characters
  {
    if (strlen(cmdBuffer) < CMDBUFFER_SIZE)
    {
strncat(cmdBuffer, &c, 1);   //Add it to the buffer
    else
    {
      return '\n';
    }
  }
  else if ((c == 8 || c == 127) &&cmdBuffer[0] != 0) //Backspace
  {
cmdBuffer[strlen(cmdBuffer)-1] = 0;
  }
 return c;
```

9.1.2 NODE MCU ENROLL CODE

```
#include <Adafruit_Fingerprint.h>

#include <SPI.h>

#include <Wire.h>

#include <WiFiClient.h>

#include <ESP8266WiFi.h>

#include <SoftwareSerial.h>

#include <ESP8266WebServer.h>

#include <ESP8266HTTPClient.h>

//#include <Adafruit_GFX.h>          //https://github.com/adafruit/Adafruit-GFX-Library

//#include <Adafruit_SSD1306.h>      //https://github.com/adafruit/Adafruit_SSD1306

//Fingerprint scanner Pins

#define Finger_Rx 14 //D1

#define Finger_Tx 12 //D2

// Declaration for SSD1306 display connected using software I2C

//#define SCREEN_WIDTH 128 // OLED display width, in pixels

//#define SCREEN_HEIGHT 64 // OLED display height, in pixels

//#define OLED_RESET     0 // Reset pin # (or -1 if sharing Arduino reset pin)

//Adafruit_SSD1306 display(SCREEN_WIDTH, SCREEN_HEIGHT, &Wire,
OLED_RESET);

SoftwareSerialmySerial(Finger_Rx, Finger_Tx);
```

```
//#if (defined(__AVR__) || defined(ESP8266)) && !defined(__AVR_ATmega2560__)
// For UNO and others without hardware serial, we must use software serial...
// pin #2 is IN from sensor (GREEN wire)
// pin #3 is OUT from arduino  (WHITE wire)
// Set up the serial port to use softwareserial..
//SoftwareSerialmySerial(2, 3);


//#else
// On Leonardo/M0/etc, others with hardware serial, use hardware serial!
// #0 is green wire, #1 is white
//#define mySerial Serial1
//
//#endif
Adafruit_Fingerprint finger = Adafruit_Fingerprint(&mySerial);
uint8_t id;
/* Set these to your desired credentials. */
const char *ssid = "VIVO V27"; //ENTER YOUR WIFI SETTINGS
const char *password = "Magesh@2002";
WiFiClientwifiClient;
String postData ; // post array that will be send to the website
String link = "http://projectoutput.co.in/smartbus/ajax.php"; //computer IP or the server domain
#define Wifi_start_width 54
```

```
#define Wifi_start_height 49
const uint8_t PROGMEM Wifi_start_bits[] = {
#define FinPr_valid_height 64
const uint8_t PROGMEM FinPr_valid_bits[] = {
  0x00,0x00,0x03,0xfe,0x00,0x00,0x00,0x00
,0x00,0x00,0x1f,0xff,0xe0,0x00,0x00,0x00
,0x00,0x00,0x7f,0xff,0xf8,0x00,0x00,0x00
,0x00,0x00,0xfc,0x00,0xfe,0x00,0x00,0x00
,
,0x00,0x00,0x01,0xff,0x8f,0xff,0xf8,0x00
,0x00,0x00,0x03,0xe0,0xe3,0xff,0xe0,0x00
,0x00,0x00,0x01,0x80,0x00,0x7f,0x00,0x00
};
#define FinPr_invalid_width 64
#define FinPr_invalid_height 64
const uint8_t PROGMEM FinPr_invalid_bits[] = {
  0x00,0x00,0x03,0xfe,0x00,0x00,0x00,0x00
,0x00,0x00,0x01,0xff,0x8f,0xff,0xf8,0x00
,0x00,0x00,0x03,0xe0,0xe3,0xff,0xe0,0x00
,0x00,0x00,0x01,0x80,0x00,0x7f,0x00,0x00
};
//---------------------------------------------------------------
```

```
#define FinPr_failed_width 64

#define FinPr_failed_height 64

const uint8_t PROGMEM FinPr_failed_bits[] = {

delay(100);

Serial.println("Adafruit Fingerprint sensor enrollment\n");

  // set the data rate for the sensor serial port

finger.begin(57600);

  if (finger.verifyPassword()) {

Serial.println("Found fingerprint sensor\n");

  } else {

Serial.println("Did not find fingerprint sensor\n");

    while (1) { delay(1); }

  }

Serial.println(F("Reading sensor parameters"));

finger.getParameters();

Serial.print(F("Status: 0x")); Serial.println(finger.status_reg, HEX);

Serial.print(F("Sys ID: 0x")); Serial.println(finger.system_id, HEX);

Serial.print(F("Capacity: ")); Serial.println(finger.capacity);

Serial.print(F("Security level: ")); Serial.println(finger.security_level);

Serial.print(F("Device address: ")); Serial.println(finger.device_addr, HEX);

Serial.print(F("Packet len: ")); Serial.println(finger.packet_len);

Serial.print(F("Baud rate: ")); Serial.println(finger.baud_rate);
```

```
}
uint8_t readnumber(void) {
  uint8_t num = 0;
  while (num == 0) {
    while (! Serial.available());
    num = Serial.parseInt();
  }
  return num;
}
void loop()
{
Serial.println("Ready to enroll a fingerprint!");
Serial.println("Please type in the ID # (from 1 to 127) you want to save this finger as...\n");
  id = readnumber();
  if (id == 0) {// ID #0 not allowed, try again!
     return;
  }
Serial.print("Enrolling ID #\n");
Serial.println(id);
  while (!  getFingerprintEnroll() );
}
uint8_t getFingerprintEnroll() {
```

```
  int p = -1;
Serial.print("Waiting for valid finger to enroll as #"); Serial.println(id);
  while (p != FINGERPRINT_OK) {
    p = finger.getImage();
    switch (p) {
    case FINGERPRINT_OK:
Serial.println("Image taken");
      break;
    case FINGERPRINT_NOFINGER:
Serial.println(".");
      break;
    case FINGERPRINT_PACKETRECIEVEERR:
Serial.println("Communication error");
      break;
    case FINGERPRINT_IMAGEFAIL:
Serial.println("Imaging error");
      break;
    default:
Serial.println("Unknown error");
      break;
    }
  }
```

```
  // OK success!
  p = finger.image2Tz(1);
  switch (p) {
    case FINGERPRINT_OK:
Serial.println("Image converted");
      break;
    case FINGERPRINT_IMAGEMESS:
Serial.println("Image too messy");
      return p;
    case FINGERPRINT_PACKETRECIEVEERR:
Serial.println("Communication error");
      return p;
    case FINGERPRINT_FEATUREFAIL:
Serial.println("Could not find fingerprint features");
      return p;
    case FINGERPRINT_INVALIDIMAGE:
Serial.println("Could not find fingerprint features");
      return p;
    default:
Serial.println("Unknown error");
      return p;
  }
```

```
Serial.println("Remove finger");
delay(2000);
  p = 0;
  while (p != FINGERPRINT_NOFINGER) {
    p = finger.getImage();
  }
Serial.print("ID "); Serial.println(id);
  p = -1;
Serial.println("Place same finger again");
  while (p != FINGERPRINT_OK) {
    p = finger.getImage();
    switch (p) {
    case FINGERPRINT_OK:
Serial.println("Image taken");
      return p;
    case FINGERPRINT_PACKETRECIEVEERR:
Serial.println("Communication error");
      return p;
    case FINGERPRINT_FEATUREFAIL:
Serial.println("Could not find fingerprint features");
      return p;
Serial.print("Creating model for #");  Serial.println(id);
```

```
  p = finger.createModel();
  if (p == FINGERPRINT_OK) {
Serial.println("Prints matched!");
  } else if (p == FINGERPRINT_PACKETRECIEVEERR) {
Serial.println("Communication error");
    return p;
  } else if (p == FINGERPRINT_ENROLLMISMATCH) {
    return p;
  }
postData = "data=" + String(id); // Add the Fingerprint ID to the Post array in order to send it
http.begin(wifiClient, link);
http.addHeader("Content-Type", "application/x-www-form-urlencoded");
  int httpCode = http.POST(postData);   //Send the request
  String payload = http.getString();    //Get the response payload
Serial.println(httpCode);   //Print HTTP return code
Serial.println(payload);    //Print request response payload
Serial.println(postData);   //Post Data
delay(1000);
postData = "";
http.end();  //Close connection
}
```

9.1.3NODE MCU FINGERPRINT AUTHENTICATION CODE

```
#include <Adafruit_Fingerprint.h>

#include <SPI.h>

#include <Wire.h>

};

#define FinPr_start_width 64

#define FinPr_start_height 64

const uint8_t PROGMEM FinPr_start_bits[] = {

  0x00,0x00,0x00,0x1f,0xe0,0x00,0x00,0x00

,0x00,0x00,0x1f,0x00,0x01,0xf8,0x00,0x00

,0x00,0x0f,0xf8,0x1f,0x00,0xf0,0x00,0x00

};

#define FinPr_valid_width 64

#define FinPr_valid_height 64

const uint8_t PROGMEM FinPr_valid_bits[] = {

  0x00,0x00,0x03,0xfe,0x00,0x00,0x00,0x00

,0x00,0x00,0x1f,0xff,0xe0,0x00,0x00,0x00

,0x00,0x00,0x01,0x80,0x00,0x7f,0x00,0x00

};

#define FinPr_invalid_width 64

#define FinPr_invalid_height 64

const uint8_t PROGMEM FinPr_invalid_bits[] = {
```

```
#define FinPr_scan_width 64

#define FinPr_scan_height 64

const uint8_t PROGMEM FinPr_scan_bits[] = {

,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00

,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00

,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00

};

void setup()

{

Serial.begin(115200);

Serial.println("");

Serial.println("Connected\n");

digitalWrite(buzzer, HIGH);

delay(200);

digitalWrite(buzzer, LOW);

delay(200);

Serial.print("IP address: ");

Serial.println(WiFi.localIP());  //IP address assigned to your ESP

}

void SendFingerprintID(){

HTTPClienthttp;    //Declare object of class HTTPClient

postData = "data=" + String(finger.fingerID);
```

```
http.begin(wifiClient, link); //initiate HTTP request, put your Website URL or Your
Computer IP

http.addHeader("Content-Type", "application/x-www-form-urlencoded  int httpCode =
http.POST(postData);   //Send the request

  String payload = http.getString();    //Get the response payload

http.begin(wifiClient, link2http.addHeader("Content-Type", "application/x-www-form-
urlencoded");    //Specify content-type header

    int httpCode = http.POST(postData);   //Send the request

  String payload = http.getString();    //Get the response payload

delay(1000);

postData = "";

http.end();  //Close connection

}

 void gpsData(){

int count = 0;

while(Serial.available() && count < 3)

  {

    String gpsData = Serial.readString();

Serial.print(gpsData);

SendGPSData(String(gpsData));

    count++;

    break;

   }

}
```

APPENDIX II

PROJECT SETUP IoT BASED COLLEGE ATTENDANCE AND TRANPORTATION MONITORING SYSTEM

Figure:10.1 Hardware Setup

APPENDIX III

CERTIFICATION

CERTIFICATE
OF PARTICIPATION

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Opposite to Hyundai Motors, Chennai-Bangalore Highway,
Irungattukottai, Sriperumbudur 602117
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Accredited by NAAC

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from
KINGS ENGINEERING COLLEGE
for presenting the paper titled
IOT BASED COLLEGE ATTENDANCE AND TRANSPORTATION MONITORING SYSTEM
in the *International Conference on Innovation and Challenges in Engineering and Technology* (ICICET'23), organized by Kings Engineering College on 26th April 2023.

Dr.D. C. JULLIE JOSEPHINE
Prof & Head(CSE), Convenor - ICICET'23

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