“EV AUTOMATION VECHICLE TRACKING AND ANTI –THEFT SYSTEM”

A Project Report submitted
in partial Fulfillment of the Requirements
for Under Graduate Degree Course

in
Electrical Engineering

By

Mr.Nikhil Ghorpade **B190532537**

Under the Guidance of

Prof. Bhagyashri Sherkhane

(Department of Electrical Engineering)

DEPARTMENT OF ELECTRICAL ENGINEERING
ZEAL EDUCATION SOCIETY’S
ZEAL COLLEGE OF ENGINEERING AND RESEARCH,
NARHE, PUNE-411041
Academic Year: 2022-2023

DEPARTMENT OF ELECTRICAL ENGINEERING

Zeal College of Engineering & Research, Pune
Narhe. Pune-411041

CERTIFICATE

This is to certify that the project report entitled ***"Ev Automation Vechicle Tracking And Anti-theft System"*** *submitted by* ***Mr.Nikhil Ghorpade*** *is the bonified record of work done by him under my supervision, in partial fulfillment of the requirement for Graduate degree course in Electrical Engineering from Zeal College of Engineering & Research, Narhe, Pune for the academic year of 2022-23.*

Prof. Bhagyashri Sherkhane	Prof. Pooja shastri	Prof. Prashant Kumar
Guide	Project Coordinator	Head of Department
Electrical Engineering	Electrical Engineering	Electrical Engineering
Z.E.S. ZCOER, Pune	Z.E.S. ZCOER, Pune	Z.E.S. ZCOER, Pune

Place: Pune
Date:

DEPARTMENT OF ELECTRICAL ENGINEERING

Zeal College of Engineering & Research, Pune
Narhe. Pune-411041

CERTIFICATE FOR CONDUCTION OF EXAM

This is to certify that the project presentation of ***Mr.Nikhil Ghorpade*** *with project title* ***"Ev Automation Vechicle Tracking And Anti-theft System"*** *has been held on at Department of Electrical Engineering, Zeal College of Engineering & Research, Narhe, Pune-411041.*

Prof. Bhagyashri Sherkhane	Prof.
Guide	Examiner
Electrical Engineering	
Z.E.S. ZCOER, Pune	

ACKNOWLEDGMENTS

I would like to express my deepest sense of gratitude to my guide **Prof.Bhagyashri Sherkhane,** who offered her continuous advice and encouragement throughout the course of thisproject work. I thank her for the systematic guidance and providing all the assistance needed to complete the work. She inspired me greatly to work in this area. Her willingness to motivate me contributed tremendously to my project. Her guidance and discussions with me are invaluable in realization of this report.

I also thank our H.O.D. **Prof. Prashant Kumar** for their helpful suggestions which led to improvement in my project. It is my pleasure to express great thanks to our Founder Director Hon**.Shri S.M. Katkar sir**, and Principal **Dr. Ajit M. Kate** for their support and encouragement.

.

Mr.Nikhil Ghorpade (B190532537)

Electrical Engineering
Z.E.S. ZCOER, Pune

ABSTRACT

The use of vehicle is a must for everyone. In the same way, safeguarding the vehicle against theftis also very essential and it is done by vehicle tracking system and so on . The roots of Vehicle Tracking Systems lie in shipping industry. They required some sort of system to determine where each vehicle was at any given time and for how long it travelled. Modern vehicle tracking uses the active vehicle tracking and GPS technology. This technology provides with a split screen view when reviewing your driver's route. Stop and transit times, as well as speed information, are displayed in the bottom pane. It can easily toggle between stops by clicking the stop number on the track detail pane and the system can save the information about the engine that it is in workingcondition or stop by ignition ON/OFF detection. Fingerprint sensor captures the fingerprint images, matches the uniqueness of each print read by the sensor and compares it to the one storedin its module or local system database. A vehicle tracking system that works using GPS and GSMtechnology, which would be the cheapest source of vehicle tracking and it would work as anti- theft system. It is an embedded system which is used for tracking and positioning of any vehicle by using Global Positioning System (GPS) and Global system for mobile communication (GSM). With the increasing demand for improved road safety and enhanced driving experiences, automotive manufacturers have been focusing on integrating advanced technologies into their vehicles. One such innovation is adaptive headlights, a system that dynamically adjusts the direction and intensity of vehicle headlights in response to changing driving conditions.

Keywords: Vehicle tracking, GPS technology, fingerprint sensor, GSM technology, anti-theft system

CONTENT

List Of Figures

NOMENCLATURE

UART – Universal Asynchronous receiver/ Transmitter

Wi-Fi – Wireless Fidelity

GPS – Global Positioning system

GPRS – General Pocket Radio Service

GSM – Global System for Mobile Communication

MMC – Main Memory Module

MCU – Main Control unit

LED – Light Emitting Diode

IDE – Integrated Development Environment

1. INTRODUCTION

The main aim of this project is to prevent the vehicle from probable theft. To achieve this, we are incorporating security by including biometrics, i.e a fingerprint. In thebeginning the owner of the vehicle must store his/her own fingerprint in the finger print module. The GSM modem is used to send and receive messages to and from the owner. The owner's mobile number has to be set fixed during the coding. To start the ignition of the four-wheeler one should enter the authorized fingerprint. If anyone enters an unregistered fingerprint, the owner will immediately receive a message and the local alarmsystem will be turned on. For theft prevention, we can also trace the four-wheeler by givinga call to the GSM modem which is embedded on the system. Then real time tracking beginsand the GPS location of the vehicle is sent to the owner by SMS. The ignition of the vehiclecan also be controller through notifications to the system. In this proposed project we are using GPS module to find the current latitude and longitude of the present location, the GPS module is UART (Universal Asynchronous Reciever/Transmitter) with a baud rate of 9600 bps. We are using two serial ports. One, for the GSM modem and another one for the GPS modem. The coding is written in embedded c language and Arduino IDE was used toprogram it. It is a fitted device on the automobile. The whole monitoring of entire device is done by the mobile phone which delivers wireless connection amongst the vehicle tracking system device and the customer. The vehicle tracking device also has a dedicatedsim card slot in which a GSM SIM card is inserted in to receive and send SMS. The user can send an SMS through his mobile phone, know the location of its vehicle and also the facility to safeguard the vehicle. .Adaptive headlights utilize a combination of sensors, cameras, and intelligent control systems to continuously monitor the road ahead and detect various parameters, such as vehicle speed, steering angle, weather conditions, and ambient light levels. This data is then processed in real-time to determine the optimal lighting pattern for the current situation. By dynamically adjusting the direction and intensity of the headlight beams, adaptive headlights improve visibility for the driver while minimizing glare for oncoming traffic, pedestrians, and nearby vehicles.

The primary goal of adaptive headlights is to enhance safety by providing optimal illumination in various driving scenarios. For example, when navigating curved roads, the headlights automatically swivel in the direction of the turn, allowing the driver to see obstacles and potential hazards earlier. Moreover, when driving on poorly lit roads, the system increases the intensity and range of the headlight beams to improve visibility. Additionally, adaptive headlights can detect and adjust the beam pattern to avoid dazzling other drivers, mitigating potential accidents caused by glare.

Driving at night is very different than driving during the day. Without access to natural light, the field of Naturally, the human eyes will become smaller. During nighttime driving, the driver is less at ease with the illumination circumstances. Up until the vehicle reaches its destination, the headlight systems are in charge of delivering lighting.its final position. Contrarily, car front illumination systems are a primary cause of nighttime accidents, which is a serious issue for drivers. Conventional headlights illuminate the road ahead, but they may not be enough while driving around some bends or curves, creating blind spots that can cause accidents. Low visibility and the difficulty of seeing an obstruction at a bend or corner of the road are the main causes of accidents at night. The implementation of adaptive headlights has several advantages, including increased driver comfort, reduced driver fatigue, and improved response time to potential hazards. By providing better visibility, these headlights enable drivers to react more effectively to unexpected situations, such as sudden obstacles or pedestrians on the road. Furthermore, their ability to adapt to different road and weather conditions enhances overall driving confidence and reduces the risk of accidents So for the understanding of the whole operation of this vehicle automation system is distributed in three parts:

1. Tracking the position of vehicle.
2. To provide security to vehicle.
3.Adaptive Headlights

2. LITERATURE SURVEY

This gives a detailed and thorough review of the literature in the area of EV automation problems on safety and security. The literature includes technical papers from IEEE journals and few other sources.

Preventing car theft using microcontrollers and GSM modules. We are generating the results with better accuracy and proficiency. It can be helpful to those people who want better andmore advanced security in their vehicle[1][7]. In case of theft, this system would provide effectivetracking of vehicle through which owner can track the vehicle easily as it instantly prompts user about theft after very next second of theft. Also, after theft it starts providing location co-ordinatesto user immediately after theft and continues to send these co-ordinates after prescribed time intervals through which owner can easily track the vehicle and get It back by getting help from law enforcing agencies[2]. The GPS, GSM based tracking system is explored by developing the various applications to overcome the problems of surveillance, tracking and monitoring of theft vehicle. This is most reliable, efficient and cost effective system in order to provide the vehicle security and tracking [2][4][6].There is sos button that can be used in the event of emergency. Despite the fact of these excited previously , they were not used in conjunction with an accident detection system [3] . we have proposed an open source GPS tracking system, Goo-Tracking system, using commodity hardware and open source software. The Goo-tracking system has shown the feasibility of using it for fleet management[5].

To properly address this issue and help those in need, several individuals are investigating anti-theft measures for automobiles. However, even with these present important improvements may constantly be made in the field of locating and managing stolen vehicles.A contemporary tool called GPS provides precise position information in the form of latitude and longitude coordinates. A microcontroller could help with the entire process and connect GPS and GSM so they could recognise the person.A GPS, RFID, and GSM-based security system is also a powerful vehicle security system that

can be created by connecting all three modules to a microcontroller. Using this method, the car is secured.

This technology uses an area location service to secure the car. A business can employ this method by providing each of its drivers with a unique RFID card. Anytime a driver presents this card to a computer with a unique identification, the machine will get the driver's information from a database, if any. If the driver's information matches that in the system, an SMS with the driver's information, the vehicle the driver is using, and the vehicle's position coordinates will be sent to the system. Any user with a valid login can access this data at any time on the web. Although this technique is efficient, it lacks effectiveness and was rejected for deployment because of its latency.

According to previously conducted study, a significant number of car theft incidents are currently reported. Numerous researchers and other individuals have offered numerous solutions to this issue. There are numerous products on the market that have been developed with user identification and real-time monitoring, such as door locking systems, anti-theft alarm systems, steering locking equipment, network tracking systems, and electronic alarms. These products could prevent car robberies. [1]

Global System for Mobile Communication (GSM) and Global Positioning System (GPS) ideas were used to design software and hardware. The suggested system is composed of two primary components: a mobile or mobile unit and a constant or controlled component. The system's ideas are all functioning correctly. Every interaction between the moveable and constant parts, including connections, data transfers, and interfaces, is in good working order. The outcomes are all compatible with GPS technology. [2]

Another research claims that a created system is an electronic gadget that can be fitted in a car to enable the owner properly track the vehicle. A comprehensive vehicle tracking system that was developed employing the principles of cutting-edge technologies like GPS and GSM has been offered by this research. The foundation of this system is an embedded system that uses the Global Positioning System (GPS) and the Global System for Mobile Communications (GSM) to effectively track and precisely position a vehicle.

The adaptive headlight systems were also designed system with the help of a stepper motor that provides stepwise turns of the headlamps [13][14] .The stepper motor, which enables sequential rotations of the headlights on each side, was also used in the creation of the adaptive headlight systems. The maximum turn that may be made with the left headlight is 20 degrees, whereas the greatest turn with the right headlamp is 30 degrees [12]. The glare that causes pain

Many pedestrian accidents resulted from the lack of a method to reduce these uncomfortable glares, according to reviews of various adaptive driving headlamp systems [15]. An effort is made in this work to design and construct an adaptive headlamp system that is more cost-effective than the current systems. The planned AHS offers adequate lighting over all surfaces to help the driver when driving at night. The range of lighting methods that are accessible.

3.THEORETICAL CONCEPT

3.1.Vehicle tracking, locking system & Adaptive Headlights

The vehicle tracking system is designed and Implemented for tracking the movement of any equipped vehicle from any location at any time. The designed in-vehicle device works using global positioning system and global system for mobile (GSM) communication/general packet radio service (GSM/GPRS) technology .the device is embedded inside a vehicle whose position is to bedetermined and tracked in real time. A microcontroller is used to control the GSM and GSM/GPRSmodules . GPS modules get geographic coordinates at regular interval of time and GSM/GPRS module is used to transmit and update the vehicle location to the database.

A GPS tracking unit is a device that uses the Global Positioning System to determine the precise location of a vehicle, person, or other asset to which it is attached and to record the position of theasset at regular intervals. The recorded location data can be stored within the tracking unit, or it may be transmitted to a central location data base, or internet-connected computer, using a cellular(GPRS).This allows the asset's location to be displayed against a map backdrop either in real-timeor when analysing the track later, using customized software. The prevention of the vehicle from probable theft is the main aim of the project. To achieve this, we are incorporating security by including biometrics, i.e., a fingerprint. In the beginning the owner of the vehicle must store his/her own fingerprint in the finger print module. The GSM modem is used to send and receive messagesto and from the owner. The owner's mobile number has to be set fixed during the coding. To startthe ignition of the four-wheeler one should enter the authorized fingerprint. If anyone enters an unregistered fingerprint, the owner will immediately receive a message and the local alarm systemwill be turned on. For theft prevention, we can also trace the four-wheeler by giving a call to the GSM modem which is embedded on the system. Then real time tracking begins and the GPS location of the vehicle is sent to the owner by SMS. The ignition of the vehicle can also be controller through notifications to the system. The vehicle tracking system consists of a GPS receiver which provides real time position of the automobile. This real time data is deposited in

MMC(Main Memory Module) after a set time of intermission by the MCU(Main Control Unit). GSM module is undoubtedly associated with the MCU which is then used to propel and receive the SMS. GSM module takes the information fromthe MMC and sends this information to the registered user's mobile cell phone. This data consistsof longitude, latitude, altitude, the speed

over ground, and the course over ground, the real time and date. By using Google maps, we can then locate the exact location of vehicle. The vehicle tracking system also has another singular feature which tells not only the whereabouts of vehicle but also securing the automobile. To know the location of the automobile, it is necessary to stop the automobile as soon as possible. For repossessing the automobile, we are using to convey the message in such a way they are allied to the buzzer and other is associated to the power supply ofthe engine of automobile. User can simply deactivate the engine of automobile by sending a message from his cell phone and we can get the automobile back very soon.

Passwords are the weakest component of many important security systems, so there is aninterrelated push from various directions towards passwords with less friable security measures. The main emphasis while developing these vehicles anti-theft system was to assimilate the above features equally. The most significant feature is the vehicle security from theft and it has been guaranteed by providing certain layers of anti-theft protection.

The adaptive headlight system utilizes the processed data to control the movement of the headlights. For example, when the vehicle is approaching a curve, the steering angle sensor detects the intended direction of the turn, and the adaptive headlight system adjusts the headlight beams to swivel in that direction. This allows the driver to have better visibility of the upcoming road and any potential hazards.

Similarly, when driving on poorly lit roads or in adverse weather conditions, the system increases the intensity and range of the headlight beams to improve visibility. This adjustment can be based on input from ambient light sensors and rain sensors, which detect low light levels or precipitation. The system can also dynamically modify the

light pattern to avoid dazzling oncoming drivers by utilizing sensors that detect the presence and position of other vehicles.

The theoretical concept of adaptive headlights aims to enhance safety by providing drivers with optimal visibility and reducing the risk of accidents caused by poor lighting conditions or glare. By adapting the headlights to match the driving situation, these systems improve the driver's ability to identify obstacles, pedestrians, and potential hazards in advance, enabling quicker reaction times and reducing the likelihood of collisions.

Overall, the theoretical concept of adaptive headlights combines sensor technology, data processing algorithms, and intelligent control systems to dynamically adjust the direction and intensity of vehicle headlights. By optimizing visibility and minimizing glare, adaptive headlights enhance safety and contribute to a more comfortable and confident driving experience.

3.2 Hardware

3.2.1.Arduino Mega 2560 Microcontroller

3.2.2.Tracking

i. GSM (900A)

ii. GPS Module Neo 6M

3.2.3.Locking

i. Fingerprint Sensor R-307X

ii.Keypad

iii.LCD Display

iv.Relay

3.2.4.Adaptive Headlights

i.Servo motor SG(90)

ii.LED

iii.Potentiometer

3.1.1 Arduino MEGA 2560 Microcontroller

In the proposed design we have used Arduino Mega 2560 microcontroller board which is based on a Tmega2560. All the modules are controlled by microcontroller and it acts as a drivingforce in obtaining the desired output It has 54 digital input/output pins out of which 14 can be usedas PWM outputs, 16 are analog inputs, 4 are UART's (hardware serial ports), a 16 MHz crystal oscillator, USB connection, power jack, an ICSP header and a reset button. We need to connect itto a computer with a USB cable or power it with an AC-to-DC adapter or battery to get it started. The Mega is compatible with most of the shield designed for the Arduino Duemil anove or Decimal. The Arduino Mega2560 microcontroller can be powered through the USB connection orwith an external power supply. The power supply is selected automatically. External (non-USB)

power can be either from an AC-to-DC adapter or a battery. The adapter can be the connected byplugging the plug into the microcontroller board's power jack. Leads from any battery can then beinserted in the pins Gnd and Vin pin headers of the POWER connector of the board. The board can also operate on an external supply voltage of 6 to 20 volts. If it is supplied with less than 7V,the 5V pin may supply less than five volts and then the board may become unstable. If we are using more than 12V of voltage, the voltage regulator may get overheated and then damage the board. The recommended range is therefore 7 to 12 volts.

The SCL & SDA pins of Mega 2560 R3 board connects to beside the AREF pin. Additionally, there are two latest pins located near the RST pin. One pin is the IOREF that permitthe shields to adjust the voltage offered from the Arduino board. Another pin is not associated & it is kept for upcoming purposes. These boards work with every existing shield although can adjustto latest shields which utilize these extra pins

Arduino-mega 2560-board

A

- **Arduino Mega Specifications**

- The specifications of Arduino Mega include the following.
- The ATmega2560 is a Microcontroller
- The operating voltage of this microcontroller is 5volts
- The recommended Input Voltage will range from 7volts to 12volts
- The input voltage will range from 6volts to 20volts
- The digital input/output pins are 54 where 15 of these pins will supply PWM o/p.
- Analog Input Pins are 16
- DC Current for each input/output pin is 40 mA
- DC Current used for 3.3V Pin is 50 mA
- Flash Memory like 256 KB where 8 KB of flash memory is used with the help of boot loader
- The static random access memory (SRAM) is 8 KB
- The electrically erasable programmable read-only memory (EEPROM) is 4 KB
- The clock (CLK) speed is 16 MHz
- The USB host chip used in this is MAX3421E

- The length of this board is 101.52 mm
- The width of this board is 53.3 mm
- The weight of this board is 36 g

➢ Arduino Mega Pin Configuration

The pin configuration of this Arduino mega 2560 board is shown below. Every pin of thisboard comes by a particular function which is allied with it. All analog pins of this board can be used as digital I/O pins. By using this board, the Arduino mega projected can be designed. These boards offer flexible work memory space is the more & processing powerthat permits to work with different types of sensors without delay

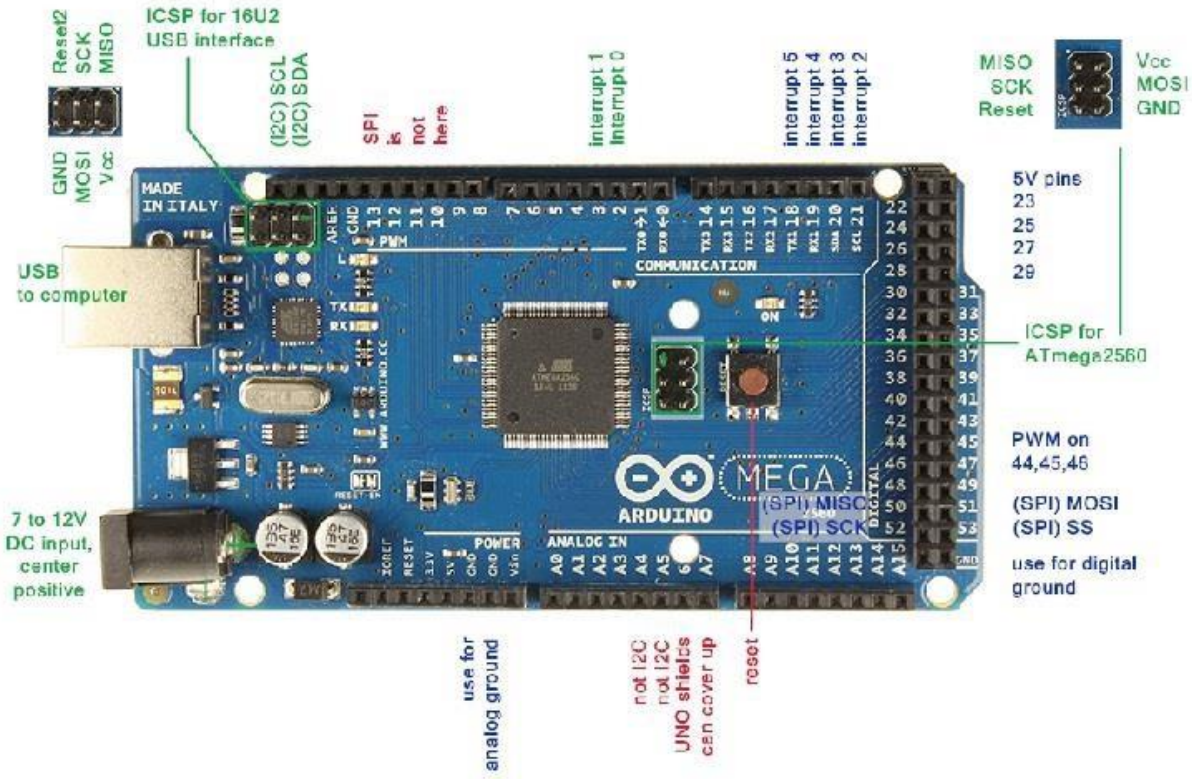

Fig.2: Arduino-mega pin configuration

- **Pin 3.3V & 5V**

These pins are used for providing o/p regulated voltage approximately 5V. This RPS (regulated power supply) provides the power to the microcontroller as well as other components which are used over the Arduino mega board. It can be attained from Vin-pin of the board or one more regulated voltage supply-5V otherwise USB cable, whereas another voltage regulation can be offered by 3.3V0-pin. The max power can be drawn by this is 50mA.

- **GND Pin**

The Arduino mega board includes 5-GND pins where one of these pins can be used whenever theproject requires.

- **Reset (RST) Pin**

The RST pin of this board can be used for rearranging the board. The board can be rearranged bysetting this pin to low.

- **Vin Pin**

The range of supplied input voltage to the board ranges from 7volts to 20volts. The voltage provided by the power jack can be accessed through this pin. However, the output voltage throughthis pin to the board will be automatically set up to 5V.

- **Serial Communication**

The serial pins of this board like TXD and RXD are used to transmit & receive the serial data. Txindicates the transmission of information whereas the RX indicates receive data.

The serial pins ofthis board have four combinations. For serial 0, it includes Tx (1) and Rx (0), for serial 1, it includesTx (18) & Rx(19), for serial 2 it includes Tx(16) & Rx(17), and finally for serial 3, it includes Tx
(14) & Rx(15)

- **LED**

This Arduino board includes a LED and that is allied to pin-13 which is named as digital pin 13. This LED can be operated based on the high and low values of the pin. This will give you to modifythe programming skills in real time.

- **AREF**

The term AREF stands for Analog Reference Voltage which is a reference voltage for analog inputs

- **Analog Pins**

There are 16-analog pins included on the board which is marked as A0-A15. It is very important to know that all the analog pins on this board can be utilized like digital I/O pins. Every analog pinis accessible with the 10-bit resolution which can gauge from GND to 5 volts. But the higher valuecan be altered using AREF pin as well as the function of analog Reference .

- **I2C**

The I2C communication can be supported by two pins namely 20 & 21 where 20-pin signifies Serial Data Line (SDA) which is used for holding the data & 21-pin signifies Serial Clock Line (SCL) mostly utilized for offering data synchronization among the devices

- **SPI Communication**

The term SPI is a serial peripheral interface which is used to transmit the data among the controller& other components. Four pins like MISO (50), MOSI (51), SCK (52), and SS (53) are utilized for the communication of SPI.

3.2.2. Tracking

i. GSM Module SIM900A

A GSM modem or GSM module is a device that uses GSM mobile telephone technology to provide a wireless data link to a network. GSM modems are used in mobile telephones and otherequipment that communicates with mobile telephone networks. They use SIMs to identify their device to the network.

The GSM shield by Arduino is used to send or receive messages and make or receive calls just like a mobile-phone by using a SIM card of any network provider. We can do this by plugging the GSM shield into the given Arduino board and then plugging in a SIM card from any operator that offers the GPRS coverage. The shield employs the use of a radio modem by thecompany, SIM Comm. We can communicate easily with the shield using the available commands. The GSM library contains the various methods of communication with the shield. This GSM Modem can then work with any GSM network operator SIM card just like an ordinary mobile phone with its own 10 digit unique phone number. The advantage of using this modem is that its RS232 port can be used to interconnect and develop various embedded applications.

Applications like the SMS Control, the data transfer, remote control and logging can be developed easily using this module. The modem can either be connected to the PC serial port directly or to any microcontroller with the help of MAX232. It is used extensively to send/ or receive SMS and make or receive voice calls. It can also be used in the GPRS mode to connect tothe internet and then run various applications for data logging and control. In GPRS mode you can also connect to any the remote FTP server and then upload files for the purpose of data logging. It is a highly malleable plug and play quad band SIM900A GSM modem for direct and

easy amalgamation to RS232 applications. It Supports various features like Voice, SMS, Data/Fax, GPRS and integrated TCP/IP stack. To be connected to any cellular network, the shield primarily requires a SIM card that is provided by a network provider. Most recent revisionof the available board makes the connections of the such shield with the Arduino board by connecting its TX to pin 0 of Arduino and pin 1 of Arduino to RX of shield.

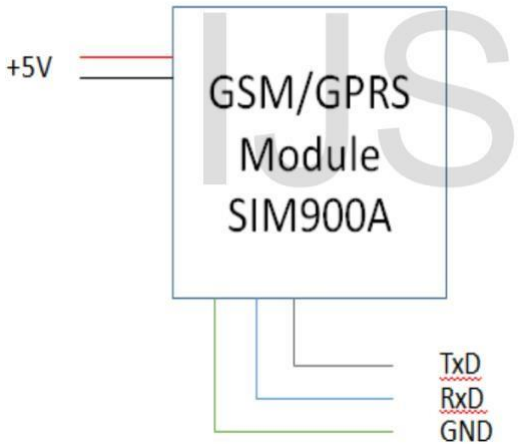

Fig 3: GSM Shield

ii.GPS

GPS is an acronym of Global Positioning System and it is used as a navigation system to find the locality of a device or a place accurately. GPS helps us to the find the exact locationof the device and thereby theft of the device is minimized. GPS uses the satellite data to calculatean accurate position on the planet earth. The calculations made by GPS can help relate the user'slocation to almost any map projection within a few milli-seconds. All GPS modules work in ananalogous manner but they often look very diverse and have different software. The most noteworthy difference between GPS receivers is the given number of available satellites they can instantaneously communicate with. Most receivers are designated as 12 channel i.e they can interconnect with 12 satellites. Older representations may be 8 or even 5 channels with more modern receivers proficient of communicating with 14 – 20

Fig.4.GPS_Neo_6M

3.2.3.Locking

i. Fingerprint Sensor R-307

In this design a fingerprint sensor module is interfaced and powered through Arduino board. The user can use the Arduino IDE to enroll his fingerprint into the ATmega2560 microcontroller .Fingerprint processing includes two major parts: fingerprint enrolment andfingerprint matching (the matching can be 1:1 or 1:N).While enrolling, the user needs to enter his/her finger two times. The system will process the finger images and then generate a template of the finger based on the processing results and store the corresponding template. While matching,the user enters the finger again through the optical sensor and the system will generate a templateof the finger and compare it with available templates of the available finger library. For 1:1 matching, the system will then compare the live finger with the specific template designated in thegiven Module; for 1:N matching, or searching, the system will then search the whole finger libraryfor the available matching finger. In both such circumstances, the system will then return the matching result, as either success or failure.

Fig.5. Fingerprint Sensor R-307

ii.Keypad

A 4 by 3 keypad, also known as a matrix keypad, is a type of input device commonly used in various electronic devices, such as calculators, remote controls, security systems, and industrial control panels. It consists of a grid of 12 keys arranged in four rows and three columns.

Each key on the 4 by 3 keypad represents a specific input, typically a numeric digit (0-9) or a set of control functions. The keys are usually made of plastic and have a tactile response when pressed. The arrangement of the keys follows a matrix configuration, where each key is uniquely identified by its row and column position.

To determine which key has been pressed, the keypad uses a scanning technique. When a key is pressed, it creates an electrical connection between the corresponding row and column. The keypad controller then scans the rows and columns sequentially to detect this connection and identify the pressed key.

Fig.6. Keypad

iii.LCD Display

A 16 by 2 LCD (Liquid Crystal Display) is a type of alphanumeric display commonly used in electronic devices, such as digital clocks, calculators, consumer electronics, and embedded systems. It consists of a grid of 16 columns and 2 rows, allowing for the display of up to 32 characters at a time.

The LCD display is based on liquid crystal technology, which utilizes the properties of liquid crystals to control the passage of light through the display's pixels. The display is divided into multiple character spaces, with each space capable of displaying a single character. Each character space is further divided into a matrix of pixels, typically 5 pixels wide and 8 pixels tall, which form the individual characters.

The LCD display is controlled by a dedicated LCD controller or a microcontroller with built-in LCD driver capabilities. The controller communicates with the display using a standard interface protocol such as the HD44780 protocol, which provides commands and data signals to control the display.

The 16 by 2 LCD display typically supports a character set that includes alphanumeric characters, symbols, and special characters. The characters are predefined and stored in the display's memory, and they can be individually addressed and displayed on the screen.

The display also includes additional features such as cursor control and backlighting. The cursor control allows the positioning of a blinking cursor at a specific character space, enabling text entry or highlighting specific information. The backlighting feature provides illumination for better visibility in low-light conditions and can be controlled to adjust the brightness level.

To use a 16 by 2 LCD display, a microcontroller or other controlling device sends commands and data to the display via the interface pins. The commands can control

functions such as clearing the display, positioning the cursor, and selecting display options. The data sent to the display is interpreted as characters and displayed on the screen accordingly.

Overall, the 16 by 2 LCD display provides a compact and versatile visual output solution for displaying alphanumeric characters and symbols in electronic devices. Its grid of 16 columns and 2 rows allows for the presentation of up to 32 characters simultaneously, making it suitable for various applications that require text-based information display.

Fig.7.LCD Display

iv.Relay

A relay is a type of electronic switching device that operates using solid-state components, such as transistors, thyristors, or integrated circuits, instead of traditional electromechanical relays. It offers several advantages over electromechanical relays, including faster switching speeds, higher reliability, and reduced noise. In the context of your question, a "5V static relay" refers to a static relay that operates with a control signal voltage of 5 volts. This voltage is commonly used in many electronic systems and is often derived from a stable power supply or a microcontroller output. The specific characteristics and functionality of a 5V static relay can vary depending on its design and purpose. However, here are some general aspects to consider:

1.Input Signal: The 5V static relay typically requires a 5V control signal to activate the switching action. This control signal can be a digital voltage level provided by a microcontroller or other control circuitry.

2.Output Switching: The relay switches the output circuit based on the input control signal. It can provide either an on/off switching function or control the current or voltage level in the output circuit.

3.Solid-State Components: A 5V static relay utilizes solid-state components, such as transistors or thyristors, to perform the switching operation. These components offer advantages such as high reliability, long operational life, and faster response times compared to mechanical relays.

4.Protection Features: Some static relays incorporate protection features to safeguard the circuitry and connected devices. These features may include overcurrent protection, overvoltage protection, and short-circuit protection to prevent damage or failure.

5.Application Specifics: The specific application of a 5V static relay can vary widely. It can be used in various electronic systems, including automation, robotics, power control, motor control, and industrial equipment, among others.

When working with a 5V static relay, it is essential to follow the manufacturer's specifications and guidelines regarding input voltage, current ratings, and other operating parameters. Additionally, appropriate circuitry and safety measures should be implemented to ensure proper functioning and protection of the relay and connected devices. It is important to note that for detailed information about a specific 5V static relay, it is recommended to refer to the product datasheet or consult the manufacturer's documentation, as the specifications and features can vary based on the particular **model or brand.**

Fig.8.Relay

3.2.4. Adaptive Headlights

i.**Servo Motor**

A servo motor is a type of electromechanical device that is widely used in various applications, including robotics, automation, RC vehicles, and industrial control systems. It is designed to provide precise control over angular or linear position, velocity, and acceleration. A "5V servo motor" refers to a servo motor that operates using a 5-volt power supply. The 5-volt power supply is a common voltage level provided by many electronic systems and can be derived from a stable power source or a microcontroller output.

Here are some general aspects to consider regarding a 5V servo motor:

1.Power Supply: A 5V servo motor requires a stable 5-volt power supply for its operation. This voltage level is typically provided by a dedicated power source or regulated power supply. It is important to ensure that the power supply can provide sufficient current to meet the motor's requirements.

2.Control Signals: Servo motors are typically controlled using pulse width modulation (PWM) signals. The control signal determines the desired position or movement of the motor. In the case of a 5V servo motor, the control signals should be compatible with a 5V logic level.

3.Wiring: Servo motors have three wires: power supply (usually red), ground (usually black or brown), and control signal (usually white, yellow, or orange). The power and ground wires are connected to the 5V power supply and ground, respectively. The control signal wire is connected to a suitable control circuit, such as a microcontroller or servo motor driver.

5.Torque and Speed: The torque and speed characteristics of a servo motor depend on its specific model and size. Different servo motors have different torque ratings, which

indicate their ability to exert rotational force. Similarly, the speed of a servo motor is specified in terms of the time it takes to rotate a certain number of degrees.

6.Feedback Mechanism: Servo motors typically incorporate a feedback mechanism, such as a potentiometer or an encoder, to provide positional feedback. This feedback allows the control system to accurately monitor and adjust the motor's position, ensuring precise control.

When working with a 5V servo motor, it is important to consider the motor's specifications, including voltage range, current requirements, torque ratings, and control signal compatibility. Always refer to the manufacturer's documentation or datasheet for detailed information and guidelines specific to the particular servo motor model you are using. Additionally, it is recommended to use appropriate motor drivers or servo control circuits that can handle the voltage and current requirements of the servo motor, and ensure proper control signals are provided for desired motor operation.

3.3. Software

The Software requirement is as follows:

3.3.1 Arduino IDE

Arduino IDE is a GUI based Software that supports all the Arduino based microcontrollers. It is across platform application written in the programming language Java. It is an open-sourceSoftware (IDE) that makes it very easy to write code and also upload it to the board. It runs on various operating systems Windows, Mac OS X and Linux. It originated from the IDE for the languages such as Processing and Wiring. A program written with the IDE for Arduino is called a"sketch". The Arduino IDE supports the languages such as C and C++ using special rules to organize the code. The Arduino IDE supplies a software library called Wiring from the Wiring project, which provides a lot of common input and output procedures.

- **PROTEUS**

  Software use for simulation and virtualization of component and circuit.

4.Block Diagram For Tracking ,Locking and Adaptive Headlights :

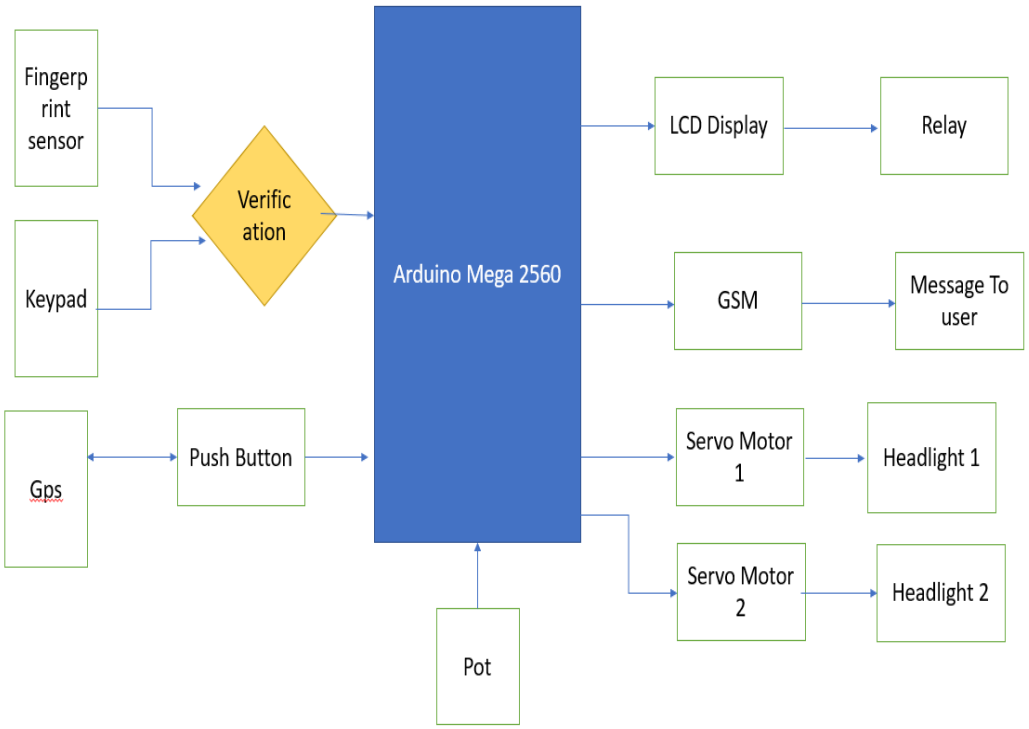

Fig.9. Block Diagram For Tracking ,Locking and Adaptive Headlights

Explaination of Connection

To connect the components in the provided code to an Arduino Mega 2560, we need to make the following connections:

1.Fingerprint Sensor:

- Connect the fingerprint sensor's TX pin to the Arduino Mega's pin 19.
- Connect the fingerprint sensor's RX pin to the Arduino Mega's pin 18.

2.Keypad:

- Connect the keypad's row pins (9, 8, 7, 6) to the Arduino Mega's pins 9, 8, 7, and 6.
- Connect the keypad's column pins (5, 4, 3) to the Arduino Mega's pins 5, 4, and 3.

3.LCD Display:

- Connect the LCD's RS pin to the Arduino Mega's pin 12.
- Connect the LCD's EN pin to the Arduino Mega's pin 11.
- Connect the LCD's D4, D5, D6, and D7 pins to the Arduino Mega's pins 25, 22, 23, and 24, respectively.

4.Servo Motors:

- Connect the first servo motor's signal pin to the Arduino Mega's pin 52.
- Connect the second servo motor's signal pin to the Arduino Mega's pin 53.

5.Relay:

- Connect the relay's control pin to the Arduino Mega's pin 26.

6.GSM Module:

- Connect the GSM module's RX pin to the Arduino Mega's pin 17.
- Connect the GSM module's TX pin to the Arduino Mega's pin 16.

7.Push Button:

- Connect the push button to the Arduino Mega's pin 40.

Please note that the Arduino Mega 2560 has multiple hardware serial ports, so you don't need to use Software Serial for the fingerprint sensor and GSM module. You can directly use the hardware serial ports (Serial1, Serial2, Serial3) by connecting the respective RX and TX pins.

Additionally, make sure to power the components appropriately and follow any additional requirements specified by the component datasheets. Once the connections are made, you can upload the code to your Arduino Mega 2560 and it should work as expected.

5.Program

5.1.Simulation Program

```
#include <SoftwareSerial.h>
#include <TinyGPS.h>
TinyGPSgps; //Creates a new instance of the TinyGPS object floatlat = -1.6848579,lon
= 37.1690756; SoftwareSerialmySerial(9, 10); //RX and TX pins respectively.void
setup()
{
```

```
mySerial.begin(9600); // Setting the baud rate of GSM Module Serial.begin(9600);
                      // Setting the baud rate of Serial Monitor (Arduino)
Serial.println("Welcome.");
Serial.println("..... ");

Serial.println();delay(100);
}
void loop()

{

if (Serial.available()>0)switch(Serial.read())
{

case 's':

case 'S':

mySerial.println("AT+CMGF=1"); //Sets the GSM Module in Text Mode
delay(1000);  // Delay of 1 second mySerial.println("AT+CMGS=\"+2547****\"\r");
/ / mobile number to send a text todelay(1000);
Serial.println(); Serial.println("Nikhil Gorpade");Serial.println("   ");
Serial.println("Your location.          ");

Serial.println(gps_connect()); Serial.println("         ");
delay(100);
```

```
mySerial.println((char)26);// ASCII code of CTRL+Z for saying the end of sms to  the
moduledelay(1000);
break; case 'r':
case 'R':

mySerial.println("AT+CNMI=2,2,0,0,0"); // AT Command to receive a live SMS
delay(1000);
break;

}

if (mySerial.available()>0) Serial.write(mySerial.read());
}

floatgps_connect() {

while (Serial.available()) { // check for gps data

if (gps.encode(Serial.read())) // encode gps data
{

gps.f_get_position(&lat, &lon); // get latitude and longitude

// display position

}
```

5.2.Hardware Program Code:

```
#include <Adafruit_Fingerprint.h>
#include <Keypad.h>
#include <LiquidCrystal.h>
#include <SoftwareSerial.h>
#include <SoftwareSerial.h>
#include <TinyGPS.h>


#include <Servo.h>

// Constants for potentiometer
#define POT_PIN A0
#define POT_MIN_VALUE 0
#define POT_MAX_VALUE 1023

// Constants for servo motors
#define SERVO1_PIN 52
#define SERVO2_PIN 53
#define SERVO_MIN_ANGLE 0
#define SERVO_MAX_ANGLE 180

Servo servo1;  // Create an instance of the first servo motor
Servo servo2;  // Create an instance of the second servo motor

#if (defined(__AVR__) || defined(ESP8266)) && !defined(__AVR_ATmega2560__)

SoftwareSerial mySerial(19 , 18);
#else
```

```
#define mySerial Serial1

#endif


Adafruit_Fingerprint finger = Adafruit_Fingerprint(&mySerial);

// Define keypad pins and size
const byte ROWS = 4;
const byte COLS = 3;
char keys[ROWS][COLS] = {
  {'1', '2', '3'},
  {'4', '5', '6'},
  {'7', '8', '9'},
  {'*', '0', '#'}
};
byte rowPins[ROWS] = {9, 8, 7, 6};
byte colPins[COLS] = {5, 4, 3};
Keypad = Keypad(makeKeymap(keys), rowPins, colPins, ROWS, COLS);

// Define LCD pins and initialize
Liquid Crystal lcd(12, 11, 25, 22, 23, 24);

// Define relay pin
const int r = 26;

// Define password
const char password[] = "4444";
SoftwareSerial gsmSerial(17, 16); // RX, TX
const int buttonPin = 40; // Pin connected to the push button
boolean buttonPressed = false; // Flag to indicate if the button is pressed
```

```
#define GPS_RX_PIN 4
#define GPS_TX_PIN 3

SoftwareSerial gpsSerial(GPS_RX_PIN, GPS_TX_PIN);  // Create a software serial port for GPS module
TinyGPS gps;                                       // Create a TinyGPS object

void setup()

{

 servo1.attach(SERVO1_PIN);  // Attach the first servo motor to the corresponding pin
  servo2.attach(SERVO2_PIN);  // Attach the second servo motor to the corresponding pin

Serial.begin(9600);        // Initialize the hardware serial port
  gpsSerial.begin(9600);     // Initialize the software serial port for GPS module

  Serial.println("GPS Tracking Started");

  finger.begin(57600);
    while (!Serial);  // For Yun/Leo/Micro/Zero/...
  delay(100);

  delay(5);

  if (finger.verifyPassword())

  {

  }
```

```
  else

  {

    while (1) { delay(1); }

  }

  pinMode(r, OUTPUT);
  digitalWrite(r, HIGH);

   lcd.begin(16, 2);
  lcd.print("Enter password:");
    Serial.begin(9600);
  gsmSerial.begin(9600);
  pinMode(buttonPin, INPUT_PULLUP); // Set button pin as input with internal pull-
up resistor
  delay(1000);

  // Configure GSM module
  gsmSerial.println("AT");
  delay(1000);
  gsmSerial.println("AT+CMGF=1"); // Set SMS mode to text
  delay(1000);
  gsmSerial.println("AT+CNMI=2,2,0,0,0"); // New message notification to Arduino
  delay(1000);
}
void loop() {

  if (gsmSerial.available()) {
    Serial.write(gsmSerial.read());
```

```
}

if (digitalRead(buttonPin) == LOW && !buttonPressed) {
  buttonPressed = true;
  sendSMS();
}

if (digitalRead(buttonPin) == HIGH && buttonPressed) {
  buttonPressed = false;
}
static char enteredPassword[5]; // Store entered password (4 digits + null terminator)
static int passwordIndex = 0; // Index for entering password

char key = keypad.getKey(); // Read keypad input

if (key != NO_KEY) {
  // A key was pressed
  lcd.print('*'); // Print asterisk instead of entered digit
  enteredPassword[passwordIndex++] = key; // Store entered digit in password
  if (passwordIndex == 4) {
    // Entered full password, compare to correct password
    if (strcmp(enteredPassword, password) == 0) {
      // Correct password entered
      lcd.clear();
      lcd.print("UNLOCK");
      digitalWrite(r, LOW); // Activate relay

    }
    else {
      // Incorrect password entered
      lcd.clear();
      lcd.print("LOCK");
```

```
      }
      // Reset password index and clear entered password
      passwordIndex = 0;
      enteredPassword[0] = '\0';
    }
  }

    if  ( getFingerPrint() != -1)

  {
 lcd.clear();
       lcd.print("UNLOCK");
       digitalWrite(r, LOW); // Activate relay
  }
   int potValue = analogRead(POT_PIN);

  // Map the potentiometer value to the servo angle range
  int angle = map(potValue, POT_MIN_VALUE, POT_MAX_VALUE,
SERVO_MIN_ANGLE, SERVO_MAX_ANGLE);

  // Move the first servo to the calculated angle
  servo1.write(angle);

  // Move the second servo to the calculated angle (can be adjusted based on your
setup)
  servo2.write(angle);

  // Wait for a brief moment before taking the next reading
  delay(100);
}
int getFingerPrint()
```

```
{

  int p = finger.getImage();

  if (p != FINGERPRINT_OK)  return -1;
  p = finger.image2Tz();

  if (p != FINGERPRINT_OK)  return -1;

  p = finger.fingerFastSearch();

  if (p != FINGERPRINT_OK)  return -1;

  return finger.fingerID;

}
void sendSMS() {
  gsmSerial.println("AT+CMGS=\"+919970868079\"");
  delay(1000);
  gsmSerial.write(26);
while (gpsSerial.available() > 0) {
    if (gps.encode(gpsSerial.read())) {
      double latitude, longitude;
      unsigned long fixAge;

      gps.f_get_position(&latitude, &longitude, &fixAge);  // Get latitude, longitude,
and fix age

      Serial.print("Latitude: ");
      Serial.println(latitude, 6);

      Serial.print("Longitude: ");
```

```
      Serial.println(longitude, 6);

      Serial.print("Fix Age: ");
      Serial.println(fixAge);

      // Add your code here to send the data to a server or perform any other desired
actions

      delay(1000);  // Delay between GPS readings
    }
  }
}
}

String latitude = String(lat, 6); String longitude = String(lon, 6);
Serial.println("Latitude: " + latitude + "," "Longitude: " + longitude);delay(1000)
```

SIMULATION

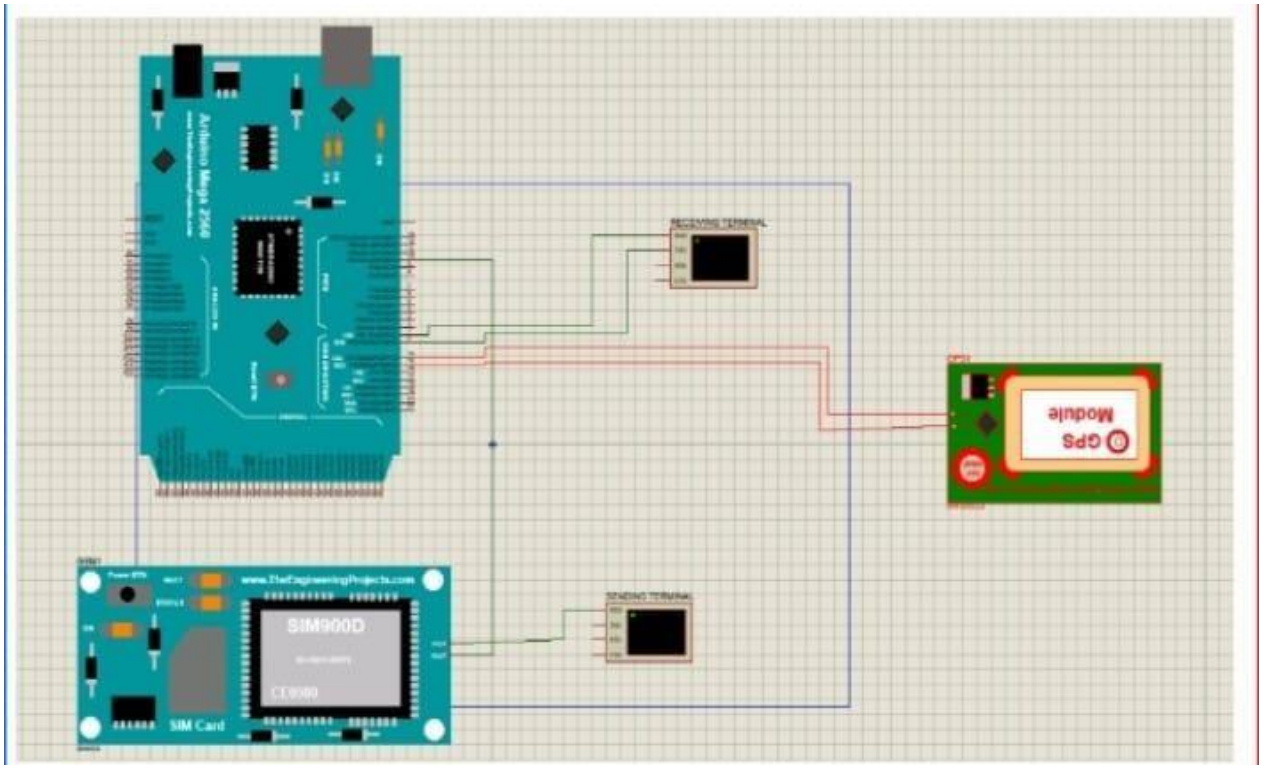

Fig 10: Simulation

Output:

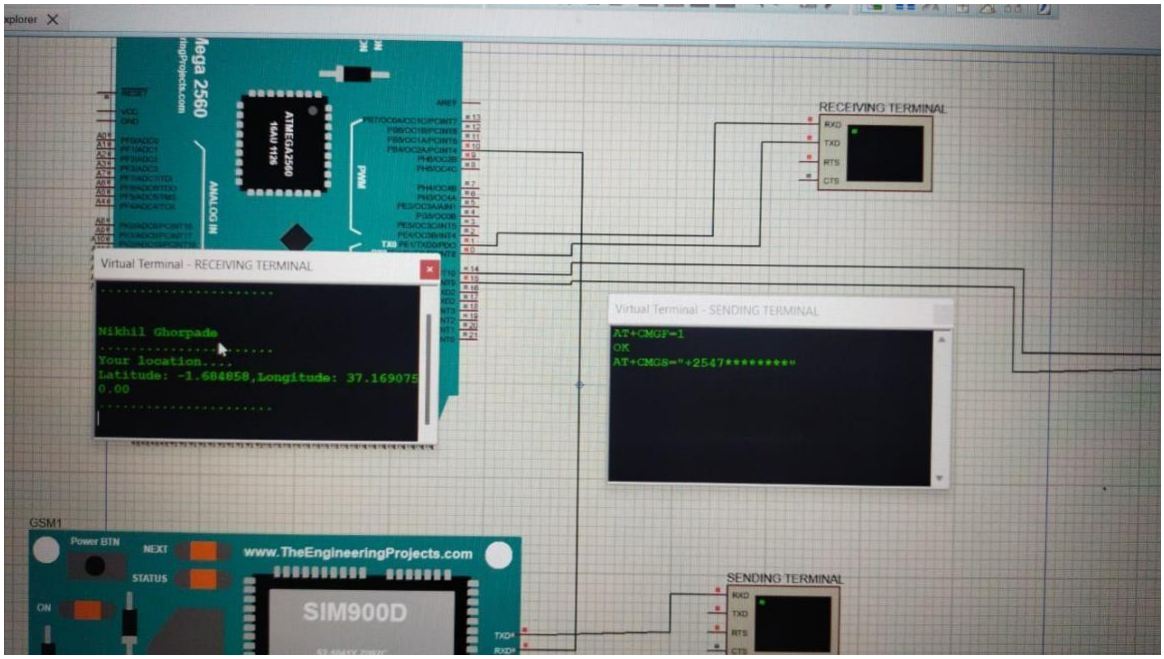

Fig 11: Output of Simulation

SMS FROM GSM AND GPS :

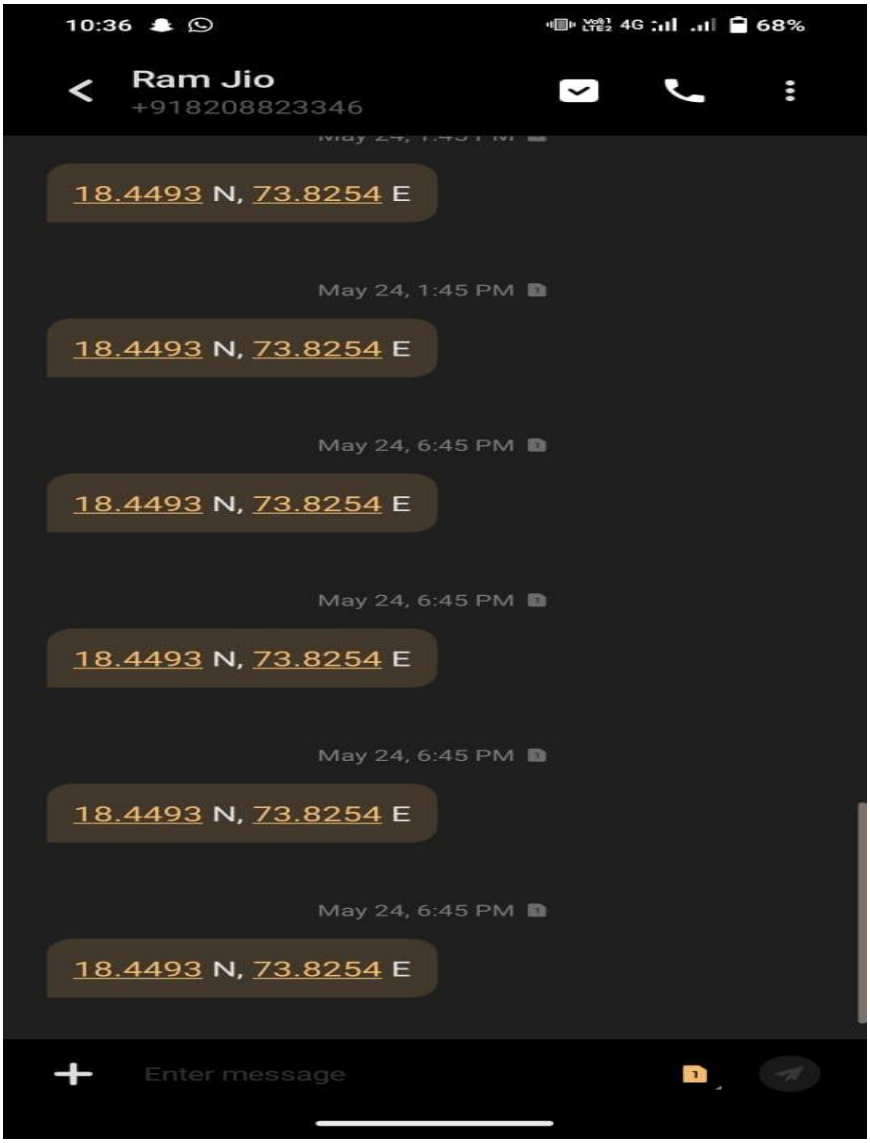

Fig 12: Location by GPS

Circuit Connection :

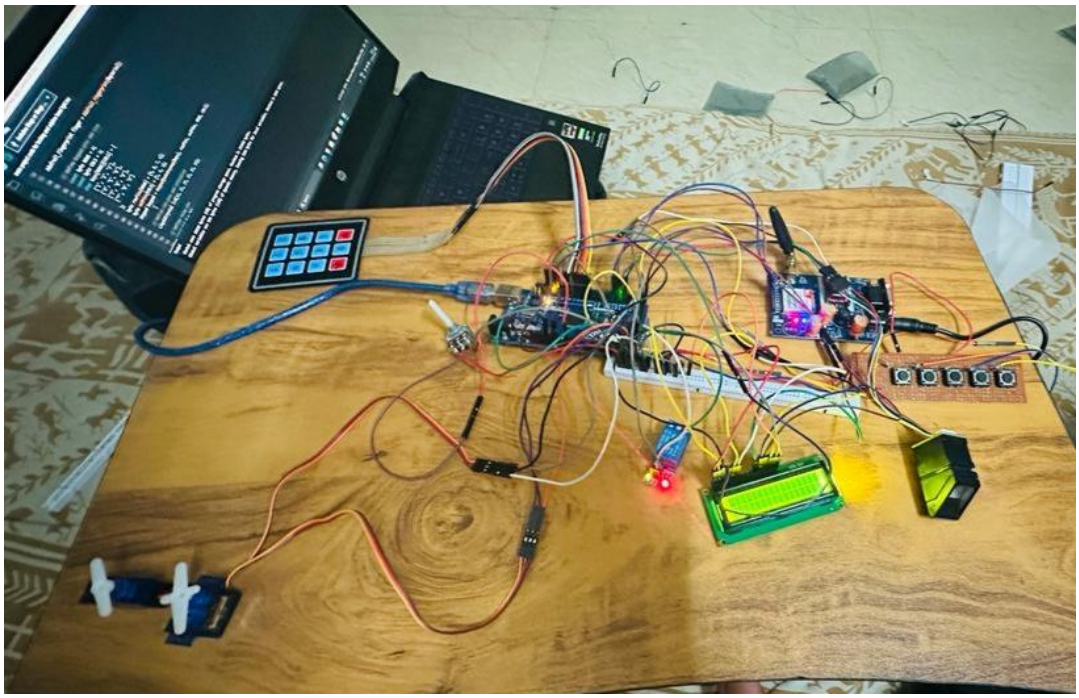

Fig .13. Project Execution

5.ADVANTAGES AND LIMITATIONS

- **Advantages :**

- This project provides security.
- Power consumption is less.
- Used commonly available component.
- Circuit diagram is simple and easy.
- Easy to use and setup.
- Vehicle tracking becomes easy

- **Limitations:**

- Different biometric technologies need the use of different devicesthat have a range of cost.
- Entry and delete fingerprints need to operate multiple steps, theprogram is too much trouble, convenience is not enough.
- Performance can be fluctuated to dry, wet, dirty fingers.
- Population coverage may be a problem with old age people orpeople with skin disease.

CONCLUSION

In this report an alternative approach for device switching which combines fingerprint identification technique with GSM and GPS functionalities has been proposed.This approach allows more than one person to control the device functionality and the authentication facility provided by thefingerprint sensor helps to reduce the fault correction time. The Arduino board used in this model is least expensive and can be implemented in various applications. The application of device switching is not limited to control device from a long distance, but it can alsobe used in automobile applications. The proposed design not only provides switching functionality,but also provides the exact location of the device. Hence theft of the device can easily be detected.Itgives complete knowledge of designing microcontroller based system and developing embedded software.In the future work cloud computing can be included to this project so that every activityperformed on the device can be closely monitored. This reduces the need for storing all the log-ininformation in the computer storage

In conclusion, adaptive headlights represent a significant advancement in automotive safety technology. By dynamically adjusting the direction of the headlight beams, these systems provide improved visibility, reduce glare for oncoming traffic, and enhance overall driving experiences. With their ability to adapt to changing driving conditions, adaptive headlights contribute to reducing accidents, enhancing road safety, and making driving safer and more enjoyable for all road users.

BIBLIOGRAPHY

1. JoelSachin, KiranRana Gill International Journal Of Scientific & Engineering Research, Volume 7, Issue 7, July-2016 1436 ISSN 2229-5518 IJSER © 2016 http://www.ijser.org Anti-Theft System For Vehicles Using Fingerprint Sensor.

2. BinduNagendra, B Bhargavi, Ramyashree K, Sukanya K, Nagashree R Nanti-theft-protection-of-vehicles-by-using-fingerprint

3. Madhumala R B https://www.researchgate.net/publication/361276842 Smart ReminderSOS & Emergency Detection Device Article · June 2022

4. SudhanshuJanwadkarl ,Dipak Bhavar2 and M.T. Kolte3 “Design and implementation of aGPS based personal tracking system Conference Paper ·” July 2016

5. L.Valliammal, S.kayathri1 ,S.Meena2 , K.Nethra3 International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (An ISO 3297: 2007 Certified Organization) Website: www.ijareeie.com Vol. 6, Issue 3, March 2017 Copyright to IJAREEIE DOI:10.15662/IJAREEIE.2017.0603146 2027 Tracking System And Accident Detection

6. PhongsakKeeratiwintakorn King Mongkut'sReal-time tracking management system usingGPS, GPRS and Google earth Muhammad Awais ,website: https://www.researchgate.net/publication/358768079

Admin ,Website: https://techatronic.com/call-and-message-using-arduino-and-gsm-module/Call And Message Using Arduino And Gsm Module

7. Jetlab , website : www.instructables.com/Arduino-Fingerprint-Door-Lock-with- Keypad-and- Arduino Fingerprint Door Lock (with Keypad and LCD)

8. Opfermann A Bertram T Baum D and Karas P T 2008 Proc. Int. Conf. on 17th World Congress the International Federation of Automatic Control (Seoul: Korea)

9. Meftah Hrairi and Anwar B Abu Bakar 2010 Proc. Int. Conf. on Computer and Communication Engineering (Kuala Lumpur: Malaysia)

10. Shreyas S and Kirthanaa Raghuraman 2014 et.al Int. Conf. on Recent Trends in Information Technology

11. Raj Kumar Mahadevan1 and Muralimohan Gurusamy2 , https://iopscience.iop.org/article/10.1088/1742-6596/1969/1/012059/pdf

12. Venugopal M ,website :https://www.engineersgarage.com/adaptive-headlights-for-cars-part-21-23/

13. Ian J Reagan and Matthew L Brumbelow 2015 et.al Int. Conf. on Applied Human Factors and Ergonomics (USA: Arlington/ American Elsevier) p 3214-3221