

VEHICLE ANTI THEFT DETECTION AND PROTECTION WITH SHOCK USING FACIAL RECOGNITION

A PROJECT REPORT

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for the award of the degree of*

BACHELOR OF TECHNOLOGY

in

ELECTRONICS AND COMMUNICATION ENGINEERING

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APRIL - 2024

CERTIFICATE

This is to certify that this project report entitled “**VEHICLE ANTI THEFT DETECTION AND PROTECTION WITH SHOCK USING FACIAL RECONGNITION**” submitted by **U.HYMAREDDY(20JR1A04E9), S.JAHNAVI(20JR1A04E6),V.THANYA(20JR1A04F2, P.VANDANA(20JR1A04D6)** , to Jawaharlal Nehru Technological University Kakinada, through KKR & KSR Institute of Technology and Sciences (Autonomous) for the award of the Degree of Bachelor of Technology in Electronics and Communication Engineering is a bonafide record of project work carried out by **Sd.Vaheeda** under my supervision during the year 202324.

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EXTERNAL EXAMINER

DECLARATION

We here by declare that the project “**VEHICLE ANTI THEFT DETECTION AND PROTECTION WITH SHOCK USING FACIAL RECOGNITION**” has been carried out by me and this work has been submitted to KKR & KSR Institute of Technology and Sciences (A), Vinjanampadu, affiliated to Jawaharlal Nehru Technological University, Kakinada in partial fulfilment of the requirements for the award of degree of Bachelor of Technology in **Electronics and Communication Engineering**. We further declare that this project work has not been submitted in full or part for the award of any other degree in any other educational institutions.

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- 1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and engineering specializations to the solution of complex engineering problems.
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- 5. Modern tool usage:** Create, Select and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
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- 7. Environmental and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
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- 10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give receive clear instructions.

11.Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12.Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadcast context of technological change.

COURSE OUTCOMES

CO421.1: Perform a system of examinations to identify problems.

CO421.2: Review the literature/Related work.

CO421.3: Defining the problem & its area of domain.

CO421.4: Proposal of solution for the selected area/methodology.

CO421.5: Analysis of the proposed work & documentation.

CO421.6: Acquire collaborative learning, leadership qualities & presentation skills

COURSE OUTCOMES – PROGRAM OUTCOMES MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO421.1	2	2		3		2				2			3			3
CO421.2			3				2		2						2	
CO421.3					3					2		2			1	
CO421.4			2					2			2		3		2	
CO421.5		2							2			2		2		2
CO421.6	1			3		2					2			3		

3: High 2: Medium 1: Low

**Program Educational Objectives – Program Specific Outcomes
correlation**

	PSO1	PSO2	PSO3	PSO4
PEO1	2	1	3	2
PEO2		3	2	2
PEO3	1	2	3	3
PEO4	3		2	2
PEO5	1	3	2	

3: High 2: Medium 1: Low

CO-PO's MAPPING WITH REASONS

1. **CO421.1** is mapped with PO1, PO2, PO4, PO6 and PO10 as basic knowledge of Engineering and problem Analysis activities are highly essential to conduct examinations on existing systems which have been using in industries as a part of and to define the problem of the proposed system.
2. **CO421.2** is mapped with PO3, PO7 and PO9 for identification, gathering analysis, and classification of requirements for the proposed system, basic knowledge of engineering and Analysis steps along with complex problem analysis through the efforts of teamwork in order to meet the specific needs of the customer.
3. **CO421.3** is mapped with PO5, PO10 and PO12 as to conduct the literature review and to examine the relevant systems to understand and identify the merits and demerits of each to enhance and develop the proposed as per the need.
4. **CO421.4** is mapped with PO3, PO8 and PO11 because modularization and design of the project are needed after requirements elicitation. For modularization and design of the project, Basic knowledge of Engineering, Analysis capabilities, Design skills, and communication is needed between team members as different modules are designed individually before integration.
5. **CO421.5** is mapped with PO2, PO9, and PO12 as to construct the project latest technologies are needed. The development of the project is done individually and in groups with well-defined communication by using engineering and management principles.
6. **CO421.6** is mapped with PO1, PO4, PO6, and PO11 because during and after completion of the project, documentation is needed along with proper methods of presentation through understanding and application of engineering and management principles, which in turn needs well-defined communication between the team members with all the ethical values. Even the project development team defines future enhancements as a part of the project development after identifying the scope of the project.

CO-PSO's Mapping with Reasons

1. **CO421.1** is mapped with PSO1 and PSO4 as examining existing systems and identification of the problem is a part of Application Development activity and identification of evolutionary changes in the latest technologies.
2. **CO421.2** is mapped with PSO3 as identifying and classifying the requirements is a part of Application development and evolutionary computing changes and also follows ethical principles. 3. **CO421.3** is mapped with PSO3 as a review of literature is a part of application development activity by recognizing the computing technologies and their evolutionary changes.
4. **CO421.4** is mapped with PSO1 and PSO3 because modularization and logical design is also a part of Application development and follows computing changes using Deep learning technology.
5. **CO421.5** is mapped with PSO2 and PSO4 as Testing, Development, and Integration of project activities are part of Application development and follow ethical principles
6. **CO421.6** is mapped with PSO2 for project documentation and presentation the project team members apply the professional and leadership skills.

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ABSTRACT

Vehicle Anti-Theft Detection and Protection with Shock employs a robust security system integrating facial recognition technology and shock protection mechanisms. A camera, connected to a Python-installed PC, facilitates facial recognition to identify authorized users. In the event of an unrecognized face, the system triggers an immediate response by sending an alert email to the registered user. This aspect adds an extra layer of security to deter potential thefts.

In addition to the facial recognition feature, the project incorporates a shock protection mechanism inspired by a mosquito bat. This innovative approach involves integrating a shock mechanism that can be activated remotely. If unauthorized access or tampering is detected, the shock mechanism provides an additional deterrent, enhancing the security of the vehicle. The combination of facial recognition and shock protection contributes to a comprehensive anti-theft system, ensuring both user authentication and a swift response to potential threats. The shock protection mechanism is designed to deliver a non-lethal electric shock upon unauthorized access or tampering, similar to the mechanism used in mosquito bats. This shock is intended to startle and deter intruders without causing lasting harm, serving as a powerful deterrent against theft or vandalism. Moreover, the Pythonbased software running on the PC enables extensive customization and integration with other security systems or smart home devices. This flexibility allows users to tailor the system to

their specific needs and preferences, ensuring seamless integration into their existing security infrastructure.

1.INTRODUCTION

Vehicle Anti-Theft Detection and Protection with Shock Using Facial Recognition is an innovative project designed to enhance the security measures for vehicles. With the rising incidents of vehicle theft globally, there is a growing need for advanced security systems to safeguard automobiles. This project integrates cutting-edge technologies like facial recognition and shock mechanisms to create a robust anti-theft system.

The project utilizes facial recognition technology to authenticate the vehicle owner. A camera is installed within the vehicle, which captures the driver's face upon entry. The captured image is processed using facial recognition algorithms implemented with the help of Python programming. If the detected face matches the authorized user's profile stored in the system, the vehicle remains accessible. However, if an unauthorized individual attempts to gain access, the system triggers an alert.

In addition to facial recognition, the project incorporates a shock mechanism as a deterrent against theft. Upon unauthorized access or tampering, the system activates a shock mechanism installed within the vehicle. This shock mechanism is designed to deliver a nonlethal electric shock to the perpetrator, effectively immobilizing them and preventing further intrusion. The shock mechanism serves as a powerful deterrent, discouraging potential thieves from attempting to steal the vehicle.

Furthermore, the project employs Arduino microcontrollers to integrate various components and manage the system's functionalities. Arduino facilitates the communication between different modules, such as the facial recognition system, shock mechanism, and vehicle's locking mechanism. By leveraging Arduino's versatility and programmability, the system can execute complex security protocols seamlessly.

Moreover, the project aims to provide real-time notifications to the vehicle owner and authorities in case of unauthorized access or theft attempts. Upon detecting suspicious activity, the system sends instant alerts to the owner's smartphone or connected device via SMS or email. Additionally, the system can be configured to notify law enforcement agencies, enabling prompt action to recover the stolen vehicle.

In summary, the Vehicle Anti-Theft Detection and Protection with Shock Using Facial Recognition project offer an advanced and comprehensive solution to combat vehicle theft. By integrating facial recognition technology, shock mechanisms, and real-time notifications, the system provides enhanced security measures, ensuring peace of mind for vehicle owners and effectively deterring potential thieves.

In addition to facial recognition, this innovative project incorporates a shock mechanism inspired by mosquito bat technology. This mechanism serves as a formidable deterrent against theft or unauthorized access. Upon detecting suspicious activity, such as tampering with the vehicle or attempting to bypass the security system, the shock mechanism can be remotely activated.

The shock delivered by the mechanism is non-lethal and designed to startle and deter intruders without causing harm. It acts as a powerful deterrent, effectively preventing theft or vandalism. Moreover, the system can be configured to provide real-time alerts to the owner's smartphone or other connected devices, allowing for immediate action in the event of a security breach.

Furthermore, the project's use of Python programming facilitates seamless integration and customization. The software running on the vehicle's system enables extensive customization options, allowing users to tailor the security settings according to their preferences and requirements. This flexibility ensures that the system can adapt to evolving security threats and user needs.

By combining facial recognition technology with a shock protection mechanism, this project offers a comprehensive and effective solution to vehicle theft and unauthorized access.

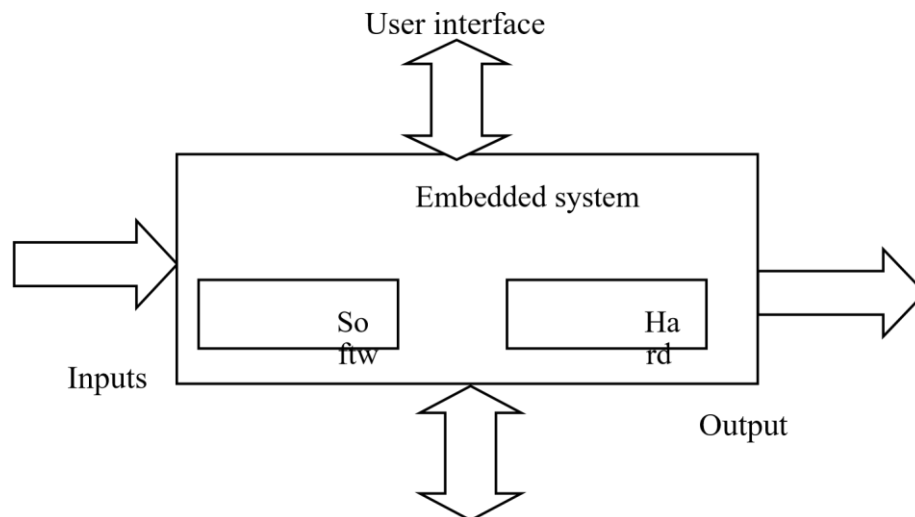
2.Literature Survey

2.1Embedded system implementation

2.1.1. Introduction:

An embedded system is one kind of a computer system mainly designed to perform several tasks like to access, process, and store and also control the data in various electronics-based

systems. Embedded systems are a combination of hardware and software where software is usually known as firmware that is embedded into the hardware. One of its most important characteristics of these systems is, it gives the o/p within the time limits. Embedded systems support to make the work more perfect and convenient. So, we frequently use embedded systems in simple and complex devices too. The applications of embedded systems mainly involve in our real life for several devices like microwave, calculators, TV remote control, home security and neighbourhood traffic control systems, etc.



Link to other systems

Fig:2.1 Overview of embedded syste

2.1.2 Embedded system:

Embedded system includes mainly two sections, they are

1. Hardware
2. Software

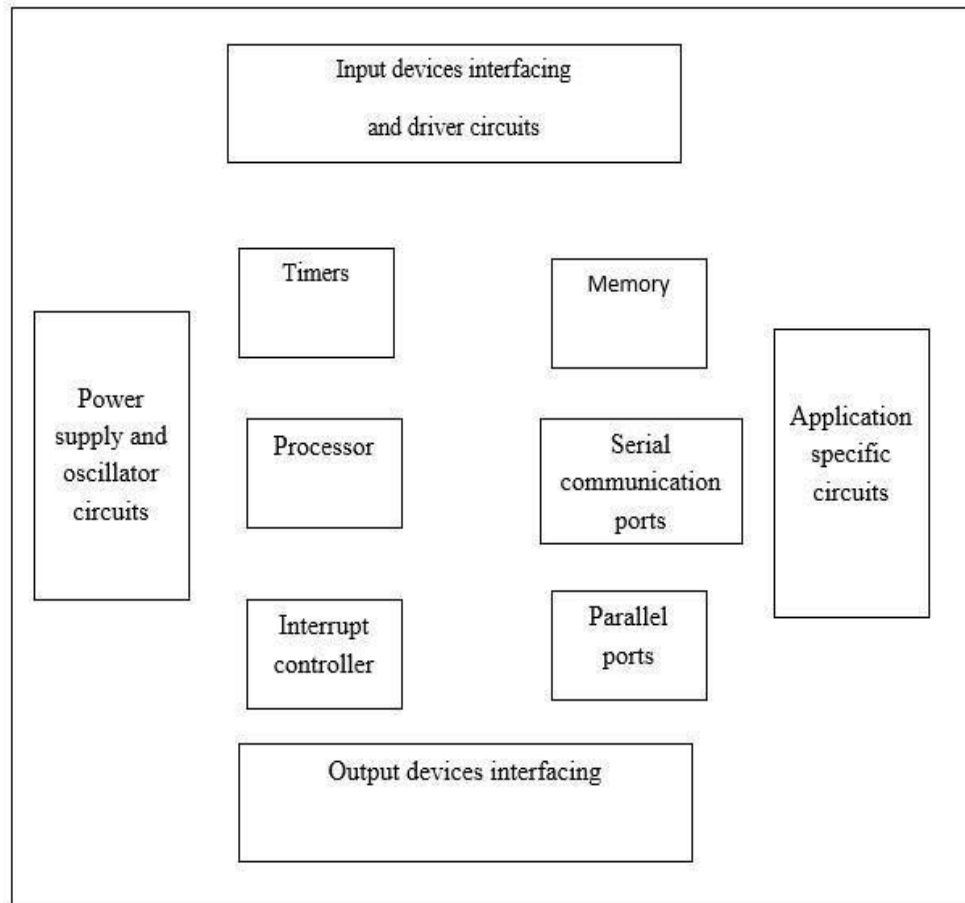


Fig 2.1.2.1 Embedded Block Dia

2.2 Embedded System Hardware:

As with any electronic system, an embedded system requires a hardware platform on which it performs the operation. Embedded system hardware is built with a microprocessor or microcontroller. The embedded system hardware has elements like input output (I/O) interfaces, user interface, memory and the display. Usually, an embedded system consists of:

- Power Supply
- Processor
- Memory
- Timers
- Serial communication ports
- Output/Output circuits
- System application specific circuits

Embedded systems use different processors for its desired operation. Some of the processors used are

1. Microprocessor
2. Microcontroller
3. Digital signal processor

Microprocessor vs. Microcontroller

Microprocessor

- **CPU** on a chip.
- We can attach required amount of ROM, RAM and I/O ports.
- Expensive due to external peripherals.
- Large in size
- general-purpose **Microcontroller**
- **Computer** on a chip
- fixed amount of on-chip ROM, RAM, I/O ports
- Low cost.
- Compact in size.
- Specific –purpose

Embedded System Software:

The embedded system software is written to perform a specific function. It is typically written in a high level format and then compiled down to provide code that can be lodged within a non-volatile memory within the hardware. An embedded system software is designed to keep in view of the three limits:

- Availability of system memory
- Availability of processor's speed
- When the system runs continuously, there is a need to limit power dissipation for events like stop, run and wake up.

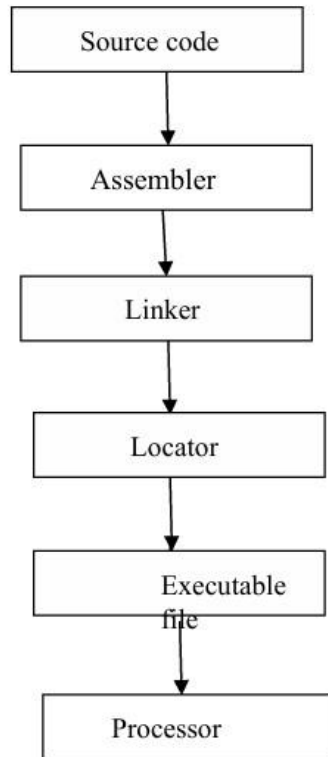
Bringing software and hardware together for embedded system:

To make software to work with embedded systems we need to bring software and hardware together .for this purpose we need to burn our source code into microprocessor or microcontroller which is a hardware component and which takes care of all operations to be done by embedded system according to our code.

Generally we write source codes for embedded systems in assembly language, but the processors run only executable files.The process of converting the source code representation of your embedded software into an executable binary image involves three distinct steps:

1. Each of the source files must be compiled or assembled into an object file.
2. All of the object files that result from the first step must be linked together to produce a single object file, called the re-locatable program.
3. Physical memory addresses must be assigned to the relative offsets within the relocatable program in a process called relocation.

The result of the final step is a file containing an executable binary image that is ready to run on the embedded system.



Flow of burning source code to processor

2.3 Applications:

Embedded systems have different applications. A few select applications of embedded systems are smart cards, telecommunications, satellites, missiles, digital consumer electronics, computer networking, etc.

Embedded Systems in Automobiles

- Motor Control System
- Engine or Body Safety
- Robotics in Assembly Line
- Mobile and E-Com Access

Embedded systems in Telecommunications

- Mobile computing

- Networking
- Wireless Communications

Embedded Systems in Smart Cards

- Banking
- Telephone
- Security Systems

Implementation flow:

Stage 1:

Considering the problems of existing methods and giving solution to that problem by

considering the basic requirements for our proposed system **Stage 2:**

Considering the hardware requirement for the proposed system For this we

need to select the below components:

1. Microcontroller
2. Inputs for the proposed system (ex: sensors, drivers etc...)
3. Outputs (ex: relays, loads) **Stage 3:**

After considering hardware requirements, now we need to check out the software requirements.

Based on the microcontroller we select there exists different software for coding, compiling, debugging. we need to write source code for that proposed system based on our requirements and compile, debug the code in that software .

After completing all the requirements of software and hardware we need to bring both together to work our system. For this we need to burn our source code into microcontroller, after burning our source code to microcontroller then connect all input and output modules as per our requirement.

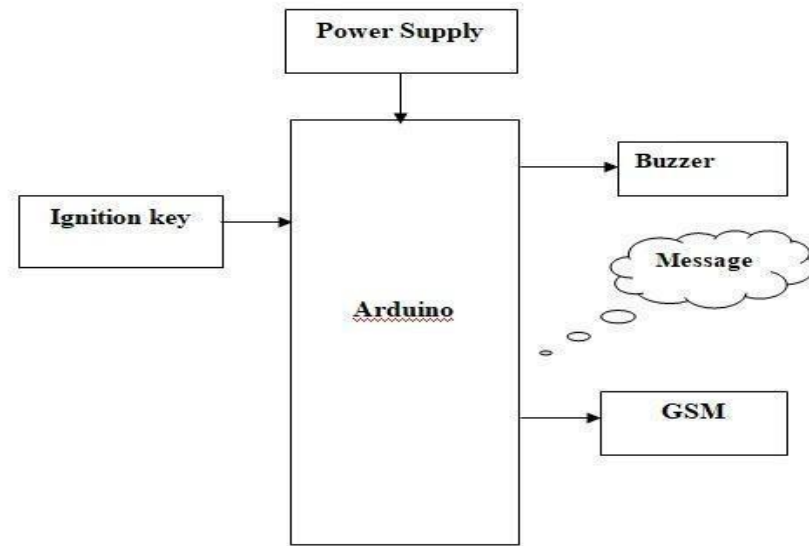
3.EXISTING SYSTEM

3.1Introduction

The existing method of the Vehicle Anti-Theft Detection and Protection with Shock project typically involves conventional vehicle security systems such as alarms or immobilizers. These systems often rely on key-based access or remote control mechanisms to secure the vehicle. However, they lack the advanced features of facial recognition and shock protection. In traditional methods, unauthorized access or theft attempts are generally detected through sensors triggering alarms. While alarms serve as a warning, they may not be sufficient to prevent theft. Additionally, conventional methods lack the personalized and proactive approach offered by facial recognition and the physical deterrent effect provided by the shock mechanism in the proposed project

The existing vehicle anti theft system are alarm, flashing light automation which makes apply of different kind of sensors which can be force, slope & door sensors, but the shortcomings are cost and it only blocks the vehicles from the robbery but can't be used to trace the thief. Traditional vehicle security system hangs on many sensors and fetch is also towering.

3.1Block Diagram:



3.2 RELATED WORK:

The latest car anti theft system are Car alarm, flashing light manners which makes use of different kind of sensors which can be pressure, tilt and shock & door sensors, but the shortcomings are cost and it only averts the vehicles from theft but can't be used to trace the thief. Customary car security systems rely on many sensors. When firstly 'Car Alarm System' is initiated, this system consists of mostly electromechanical devices. As automation advanced they unfolding into fully integrated microprocessor positioned system using diversified electronics sensors. In , the hardware and software of the GPS and GSM grid were advanced.[1] In, a vehicle tracing system is an electronic device, installed in a vehicle to authorise the owner or a third party to track the vehicle's place. This advanced to Design a vehicle tracing system that works using GPS and GSM technology. This process is set up based on embedded system, used for tracking and positioning of any vehicle by using Global Positioning System (GPS) and Global system for mobile communication (GSM). This pattern will continuously watch a Motion Vehicle and rank the status of the Vehicle on request.[3]

Rashed et al. paper describes a GPS based tracking system that keeps track of the locus of a vehicle and its pace based on a mobile phone text messaging system. The system is able to give real-time text alerts for pace and locus. The current location can be latched and the system

will alert the owner if the vehicle is moved from its present locked location.[6] Pethakar et al. paper on RFID, GPS and GSM based Vehicle Tracking and Employee Security System consolidate the establishment of an electronic gadget in a vehicle, with reason planned machine programming to empower the organization to track the vehicle's area. At the point when the vehicle picks the worker; he/she needs to swap the RFID card. The micro controller matches the RFID card no. with its database records and sends the representative's id, taxi id & the taxicab position co-ordinates to the organization unit by means of GSM module. The GSM Modem will get the message through GSM in the organization unit. On the off chance that worker ends up/herself in an issue, he/she will press the catch. Microcontroller will distinguish the activity and sends a sign to the GSM which will arrange with to the organization unit and police.[4]

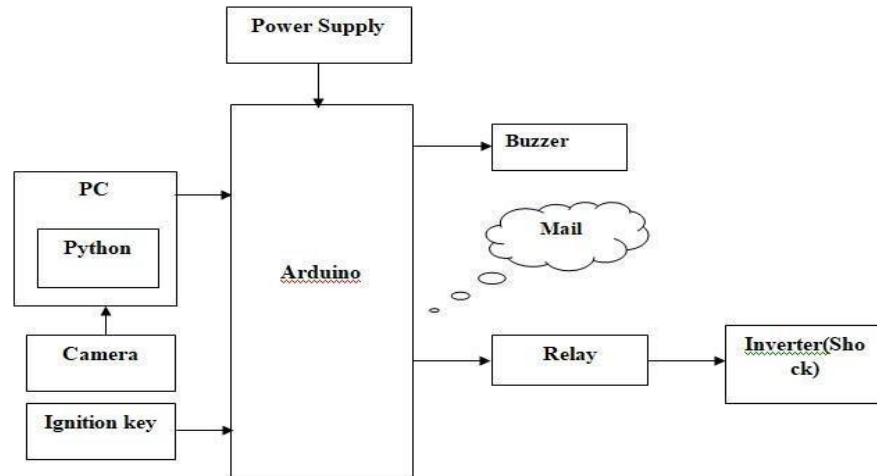
4.PROPOSED SYSTEM

In the proposed method of the project "Smart Vehicle Theft Protection Using Face Recognition, Shock Mechanism, and Alerting Through Mail," an integrated system is designed to prevent vehicle theft. The system utilizes facial recognition technology to authenticate the identity of individuals attempting to access the vehicle. A camera connected to a microcontroller captures the face of the person approaching the vehicle. The image data is processed using machine learning algorithms to recognize registered faces. If an unknown face is detected, the system triggers an alarm to alert the owner and initiates preventive measures to thwart theft attempts.

Additionally, a shock mechanism is integrated into the system to deter unauthorized access further. Upon detecting an unknown face attempting to access the vehicle, the system activates the shock mechanism, delivering a non-lethal electric shock to the individual. This shock serves as a deterrent, discouraging theft attempts and protecting the vehicle from

potential intruders. Combined with facial recognition technology, the shock mechanism enhances the security of the vehicle, providing an effective defense mechanism against theft.

Block Diagram:



Internal Block Diagram

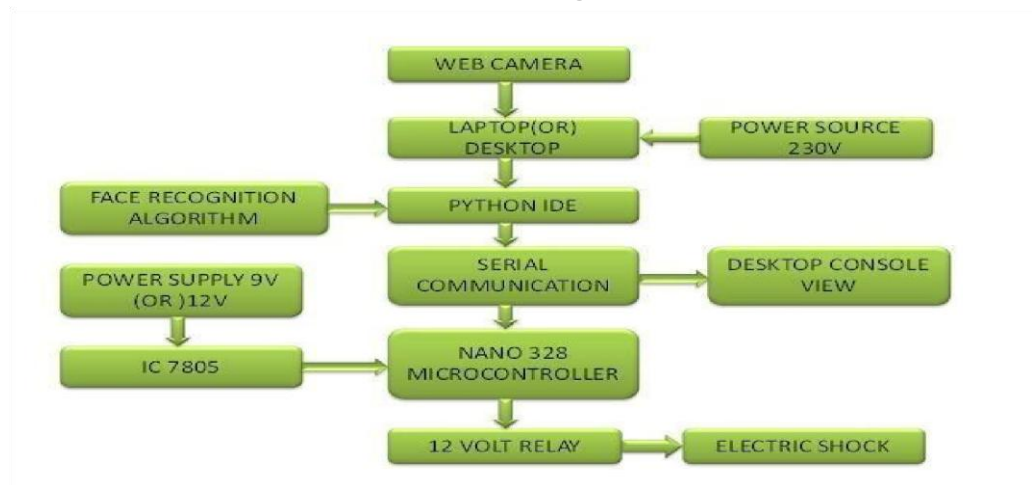


Fig4.2 Internal Block Diagram

4.1HARDWARE REQUIREMENTS Arduino:

Arduino Uno is a very valuable addition in the electronics that consists of USB interface, 14 digital I/O pins, 6 analog pins, and Atmega328 microcontroller. It also supports serial communication using Tx and Rx pins.

There are many versions of Arduino boards introduced in the market like Arduino Uno, Arduino Due, Arduino Leonardo, Arduino Mega, however, most common versions are Arduino Uno and Arduino Mega. If you are planning to create a project relating to digital electronics, embedded system, robotics, or IoT, then using Arduino Uno would be the best, easy and most economical option.



Fig 4.1.1 Arduino family

It is an open-source platform, means the boards and software are readily available and anyone can modify and optimize the boards for better functionality.

The software used for Arduino devices is called IDE (Integrated Development Environment) which is free to use and required some basic skills to learn it. It can be programmed using C and C++ language.

Some people get confused between **Microcontroller and Arduino**. While former is just an on system 40 pin chip that comes with a built-in microprocessor and later is a board that comes with the microcontroller in the base of the board, bootloader and allows easy access to input-output pins and makes uploading or burning of the program very easy.

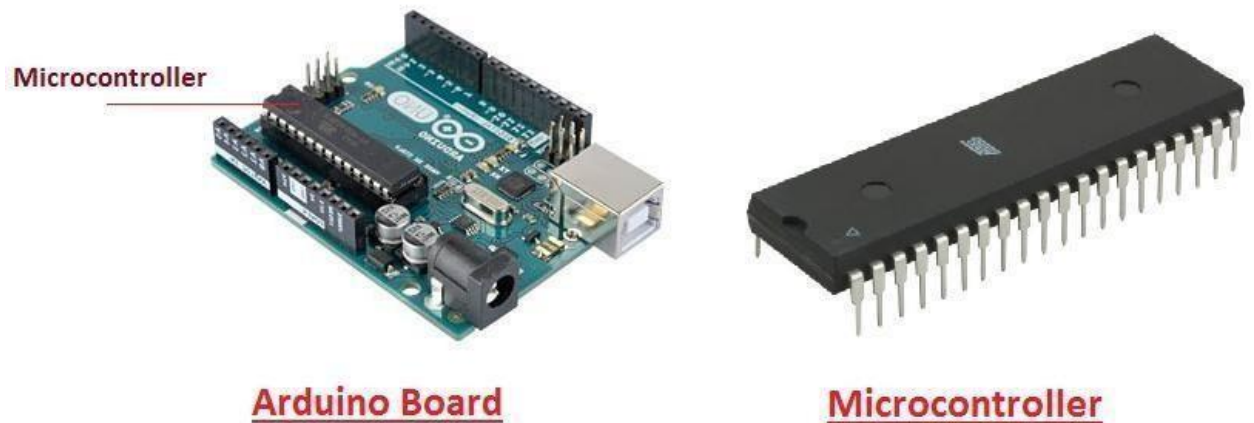


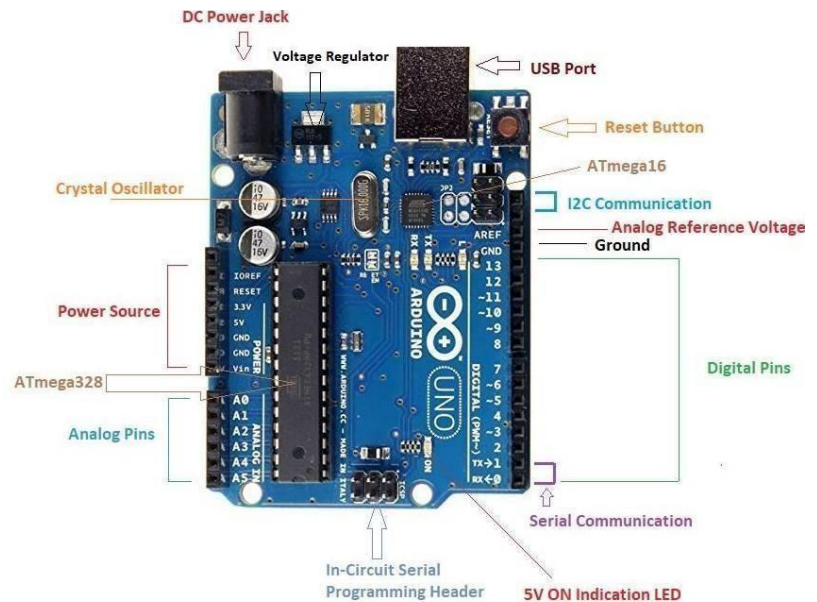
Fig 4.1.2 Arduino Board and microcontroller

While learning microcontroller requires some expertise and skills.

Nevertheless, we can say every Arduino is basically a microcontroller but not every microcontroller is an Arduino.

Introduction to Arduino

- **Arduino Uno** is a microcontroller board developed by Arduino.cc which is an open-source electronics platform mainly based on AVR microcontroller Atmega328.
- First Arduino project was started in Interaction Design Institute Ivrea in 2003 by David Cuartielles and Massimo Banzi with the intention of providing a cheap and flexible way to students and professional for controlling a number of devices in the real world.
- The current version of Arduino Uno comes with USB interface, 6 analog input pins, 14 I/O digital ports that are used to connect with external electronic circuits. Out of 14 I/O ports, 6 pins can be used for PWM output.
- It allows the designers to control and sense the external electronic devices in the real world

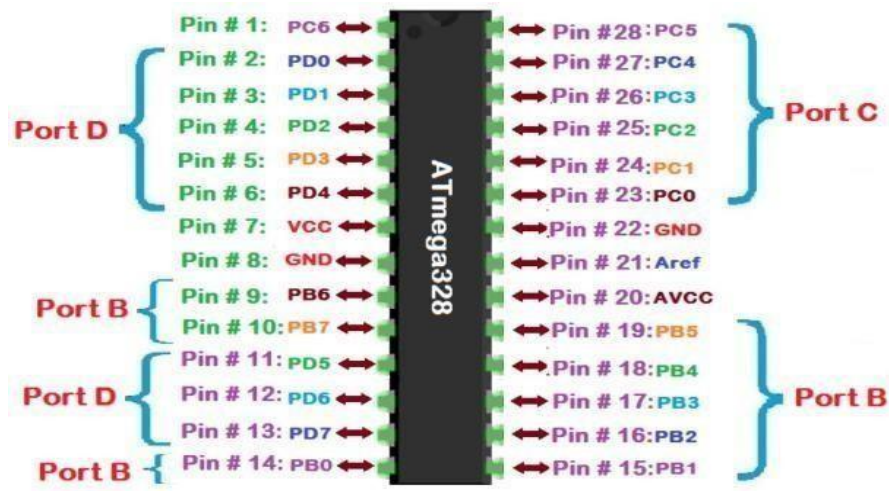


Arduino UNO

Fig.4.1.3 Arduino Uno

- This board comes with all the features required to run the controller and can be directly connected to the computer through USB cable that is used to transfer the code to the controller using IDE (Integrated Development Environment) software, mainly developed to program Arduino. IDE is equally compatible with Windows, MAC or Linux Systems, however, Windows is preferable to use. Programming languages like C and C++ are used in IDE.
- Apart from USB, battery or AC to DC adopter can also be used to power the board.
- Arduino Uno boards are quite similar to other boards in Arduino family in terms of use and functionality, however, Uno boards don't come with FTDI USB to Serial driver chip.
- There are many versions of Uno boards available, however, Arduino Nano V3 and Arduino Uno are the most official versions that come with Atmega328 8-bit AVR Atmel microcontroller where RAM memory is 32KB.
- When nature and functionality of the task go complex, Micro SD card can be added in the boards to make them store more information. **Features of Arduino**

- Arduino Uno comes with USB interface i.e. USB port is added on the board to develop serial communication with the computer.
- Atmega328 microcontroller is placed on the board that comes with a number of features like timers, counters, interrupts, PWM, CPU, I/O pins and based on a 16MHz clock that helps in producing more frequency and number of instructions per cycle.



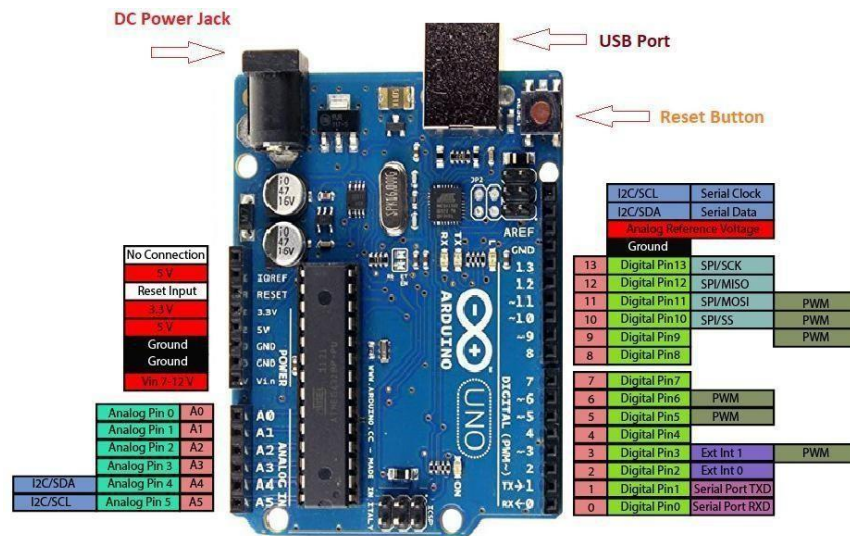
Atmega328 Microcontroller

Fig.4.1.4.Atmega328 Microcontroller Pin description

- It is an open source platform where anyone can modify and optimize the board based on the number of instructions and task they want to achieve.
- This board comes with a built-in regulation feature which keeps the voltage under control when the device is connected to the external device.
- Reset pin is added in the board that reset the whole board and takes the running program in the initial stage. This pin is useful when board hangs up in the middle of the running

program; pushing this pin will clear everything up in the program and starts the program right from the beginning.

- There are 14 I/O digital and 6 analog pins incorporated in the board that allows the external connection with any circuit with the board. These pins provide the flexibility and ease of use to the external devices that can be connected through these pins. There is no hard and fast interface required to connect the devices to the board. Simply plug the external device into the pins of the board that are laid out on the board in the form of the header.
- The 6 analog pins are marked as A0 to A5 and come with a resolution of 10bits. These pins measure from 0 to 5V, however, they can be configured to the high range using `analogReference()` function and AREF pin.
- 13KB of flash memory is used to store the number of instructions in the form of code.
- Only 5 V is required to turn the board on, which can be achieved directly using USB port or external adopter, however, it can support external power source up to 12 V which can be regulated and limit to 5 V or 3.3 V based on the requirement of the project. **Arduino Pinout**
- Arduino Uno is based on AVR microcontroller called Atmega328. This controller comes with 2KB SRAM, 32KB of flash memory, 1KB of EEPROM. Arduino Board comes with 14 digital pins and 6 analog pins. ON-chip ADC is used to sample these pins. A 16 MHz frequency crystal oscillator is equipped on the board. Following figure shows the pinout of the Arduino Uno Board



Arduino Uno Pinout
Fig.4.1.5.Arduino Uno PinOut

Pin Description:

There are several I/O digital and analog pins placed on the board which operates at 5V. These pins come with standard operating ratings ranging between 20mA to 40mA. Internal pull-up resistors are used in the board that limits the current exceeding from the given operating conditions. However, too much increase in current makes these resistors useless and damages the device.

LED. Arduino Uno comes with built-in LED which is connected through pin 13. Providing HIGH value to the pin will turn it ON and LOW will turn it OFF.

Vin. It is the input voltage provided to the Arduino Board. It is different than 5 V supplied through a USB port. This pin is used to supply voltage. If a voltage is provided through power jack, it can be accessed through this pin.

5V. This board comes with the ability to provide voltage regulation. 5V pin is used to provide output regulated voltage. The board is powered up using three ways i.e. USB, Vin pin of the board or DC power jack.

USB supports voltage around 5V while Vin and Power Jack support a voltage ranges between 7V to 20V. It is recommended to operate the board on 5V. It is important to note

that, if a voltage is supplied through 5V or 3.3V pins, they result in bypassing the voltage regulation that can damage the board if voltage surpasses from its limit.

GND. These are ground pins. More than one ground pins are provided on the board which can be used as per requirement.

Reset. This pin is incorporated on the board which resets the program running on the board. Instead of physical reset on the board, IDE comes with a feature of resetting the board through programming.

IOREF. This pin is very useful for providing voltage reference to the board. A shield is used to read the voltage across this pin which then select the proper power source. **PWM.** PWM is provided by 3, 5, 6,9,10, 11pins. These pins are configured to provide 8bit output PWM.

SPI. It is known as Serial Peripheral Interface. Four pins 10(SS), 11(MOSI), 12(MISO), 13(SCK) provide SPI communication with the help of SPI library.

AREF. It is called Analog Reference. This pin is used for providing a reference voltage to the analog inputs.

TWI. It is called Two-wire Interface. TWI communication is accessed through Wire Library. A4 and A5 pins are used for this purpose.

Serial Communication. Serial communication is carried out through two pins called Pin 0 (Rx) and Pin 1 (Tx).

Rx pin is used to receive data while Tx pin is used to transmit data.

External Interrupts. Pin 2 and 3 are used for providing external interrupts. An interrupt is called by providing LOW or changing value.

4.2 Arduino Uno Technical Specifications

Microcontroller	<u>ATmega328P</u> – 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz

Table4.2.1Arduino Technical Specifications

4.2.3.Communication and Programming:

Arduino Uno comes with an ability of interfacing with other other Arduino boards, microcontrollers and computer. The Atmega328 placed on the board provides serial communication using pins like Rx and Tx.

The Atmega16U2 incorporated on the board provides a pathway for serial communication using USB com drivers. Serial monitor is provided on the IDE software which is used to send or receive text data from the board. If LEDs placed on the Rx and Tx pins will flash, they indicate the transmission of data.

Arduino Uno is programmed using Arduino Software which a cross-platform application called IDE is written in Java. The AVR microcontroller Atmega328 laid out on the base comes with built-in boot loader that sets you free from using a separate burner to upload the program on the board.



4.2.4Applications:

Arduino Uno comes with a wide range of applications. A larger number of people are using Arduino boards for developing sensors and instruments that are used in scientific research. Following are some main applications of the board.

- Embedded System
- Security and Defense System
- Digital Electronics and Robotics
- Parking Lot Counter
- Weighing Machines
- Traffic Light Count Down Timer
- Medical Instrument
- Emergency Light for Railways
- Home Automation
- Industrial Automation

There are a lot of other microcontrollers available in the market that are more powerful and cheap as compared to Arduino board. So, why you prefer Arduino Uno?

Actually, Arduino comes with a big community that is developing and sharing the knowledge with a wide range of audience. Quick support is available pertaining to technical aspects of any electronic project. When you decide Arduino board over other controllers, you don't need to arrange extra peripherals and devices as most of the functions are readily available on the board that makes your project economical in nature and free from a lot of technical expertise.

4.3 Hardware Components Description

Buzzer:

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm

devices, timers and confirmation of user input such as a mouse click or keystroke. Buzzer is an integrated structure of electronic transducers, DC power supply, widely used in computers, printers, copiers, alarms, electronic toys, automotive electronic equipment, telephones, timers and other electronic products for sound devices. Active buzzer 5V Rated power can be directly connected to a continuous sound, this section dedicated sensor expansion module and the board in combination, can complete a simple circuit design, to "plug and play.



Fig.4.3.1 Buzzer

Buzzer Pin Configuration

Pin Number	Pin Name	Description
1	Positive	Identified by (+) symbol or longer terminal lead. Can be powered by 5V DC
2	Negative	Identified by short terminal lead. Typically connected to the ground of the circuit

Table 4.3.1.Buzzer Specifications

Buzzer Features and Specifications

- Rated Voltage: 6V DC
- Operating Voltage: 4-8V DC
- Rated current: <30mA
- Sound Type: Continuous Beep
- Resonant Frequency: ~2300 Hz
- Small and neat sealed package
- Breadboard and Perf board friendly

How to use a Buzzer

A **buzzer** is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications.

There are two types are buzzers that are commonly available. The one shown here is a simple buzzer which when powered will make a Continuous Beeeeeeppp.... sound, the other type is called a readymade buzzer which will look bulkier than this and will produce a Beep. Beep. Beep. Sound due to the internal oscillating circuit present inside it. But, the one shown here is most widely used because it can be customized with help of other circuits to fit easily in our application.

This buzzer can be used by simply powering it using a DC power supply ranging from 4V to 9V. A simple 9V battery can also be used, but it is recommended to use a regulated +5V or +6V DC supply. The buzzer is normally associated with a switching circuit to turn ON or turn OFF the buzzer at required time and require interval. **Applications of Buzzer**

- Alarming Circuits, where the user has to be alarmed about something

- Communication equipment's
- Automobile electronics
- Portable equipment's, due to its compact size

Relay:

What is a relay?

A relay is an electromagnetic switch that is used to turn on and turn off a circuit by a low power signal, or where several circuits must be controlled by one signal.

Most of the high end industrial application devices have relays for their effective working. Relays are simple switches which are operated both electrically and mechanically. Relays consist of an electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. There are also other operating principles for its working. But they differ according to their applications. Most of the devices have the application of relays.

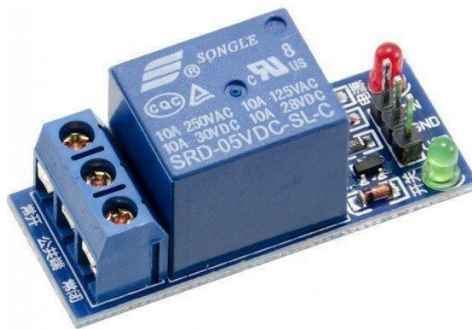


Fig.4.3.2.Relay Pin

Diagram:



Fig.4.3.3.Relay pin diagram **Why**

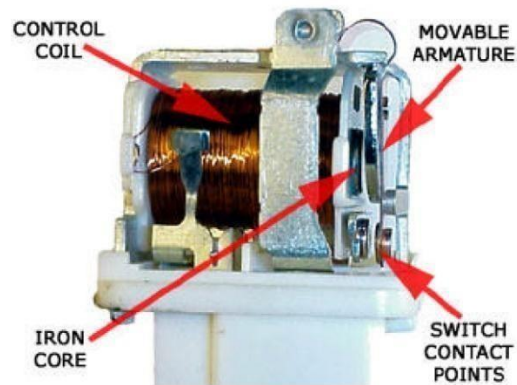
is a relay used?

The main operation of a relay comes in places where only a low-power signal can be used to control a circuit. It is also used in places where only one signal can be used to control a lot of circuits. The application of relays started during the invention of telephones. They played an important role in switching calls in telephone exchanges. They were also used in long distance telegraphy. They were used to switch the signal coming from one source to another destination. After the invention of computers they were also used to perform Boolean and other logical operations. The high end applications of relays require high power to be driven by electric motors and so on. Such relays are called contactors.

Relay Design

- There are only four main parts in a relay. They are
- Electromagnet
- Movable Armature
- Switch point contacts
- Spring

The figures given below show the actual design of a simple relay.



Relay Construction

Fig.4.3.4.Relay construction

It is an electro-magnetic relay with a wire coil, surrounded by an iron core. A path of very low reluctance for the magnetic flux is provided for the movable armature and also the switch point contacts.

The movable armature is connected to the yoke which is mechanically connected to the switch point contacts. These parts are safely held with the help of a spring. The spring is used so as to produce an air gap in the circuit when the relay becomes de-energized.

How relay works?

The relay function can be better understood by explaining the following diagram given below.

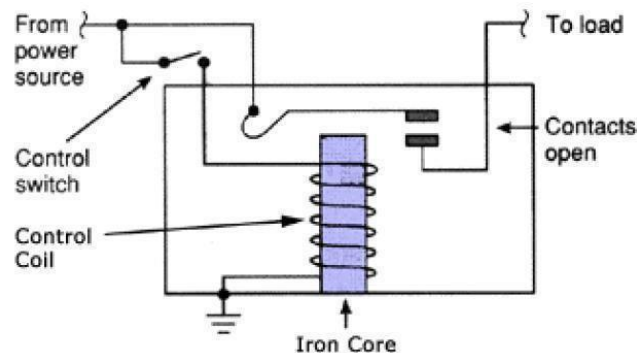


Fig.4.3.5.Relay Design

The diagram shows an inner section diagram of a relay. An iron core is surrounded by a control coil. As shown, the power source is given to the electromagnet through a control switch and through contacts to the load. When current starts flowing through the control

coil, the electromagnet starts energizing and thus intensifies the magnetic field. Thus the upper contact arm starts to be attracted to the lower fixed arm and thus closes the contacts causing a short circuit for the power to the load. On the other hand, if the relay was already de-energized when the contacts were closed, then the contact move oppositely and make an open circuit.

As soon as the coil current is off, the movable armature will be returned by a force back to its initial position. This force will be almost equal to half the strength of the magnetic force. This force is mainly provided by two factors. They are the spring and also gravity.

Relays are mainly made for two basic operations. One is low voltage application and the other is high voltage. For low voltage applications, more preference will be given to reduce the noise of the whole circuit. For high voltage applications, they are mainly designed to reduce a phenomenon called arcing.

Relay Basics

The basics for all the relays are the same. Take a look at a 4 pin relay shown below. There are two colors shown. The green color represents the control circuit and the red color represents the load circuit. A small control coil is connected onto the control circuit. A switch is connected to the load. This switch is controlled by the coil in the control circuit.

Now let us take the different steps that occur in a relay.

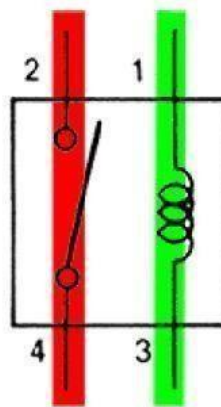


Fig.4.3.6.Relay operation

Energized Relay (ON)

As shown in the circuit, the current flowing through the coils represented by pins 1 and 3 causes a magnetic field to be aroused. This magnetic field causes the closing of the pins 2 and 4. Thus the switch plays an important role in the relay working. As it is a part of the load circuit, it is used to control an electrical circuit that is connected to it. Thus, when the electrical relay in energized the current flow will be through the pins 2 and 4.

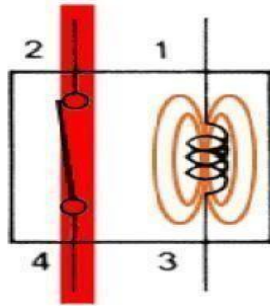


Fig.4.3.7.Energized Relay (ON)

De – Energized Relay (OFF)

As soon as the current flow stops through pins 1 and 3, the relay switch opens and thus the open circuit prevents the current flow through pins 2 and 4. Thus the relay becomes deenergized and thus in off position.

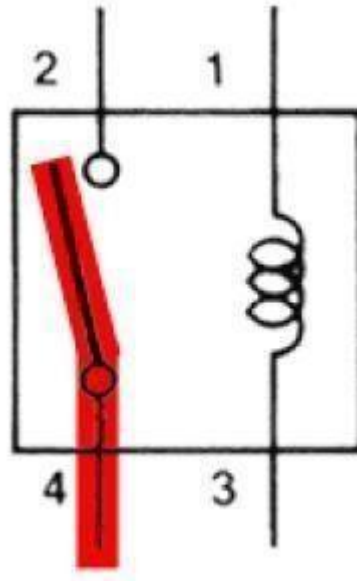


Fig.4.3.8.De-Energized Relay (OFF)

In simple, when a voltage is applied to pin 1, the electromagnet activates, causing a magnetic field to be developed, which goes on to close the pins 2 and 4 causing a closed circuit. When there is no voltage on pin 1, there will be no electromagnetic force and thus no magnetic field. Thus the switches remain open.

Pole and Throw

Relays have the exact working of a switch. So, the same concept is also applied. A relay is said to switch one or more poles. Each pole has contacts that can be thrown in mainly three ways. They are

- **Normally Open Contact (NO):** NO contact is also called a make contact. It closes the circuit when the relay is activated. It disconnects the circuit when the relay is inactive.
- **Normally Closed Contact (NC):** NC contact is also known as break contact. This is opposite to the NO contact. When the relay is activated, the circuit disconnects. When the relay is deactivated, the circuit connects.
- **Change-over (CO) / Double-throw (DT) Contacts:** This type of contacts are used to control two types of circuits. They are used to control a NO contact and also a NC contact

with a common terminal. According to their type they are called by the names **break before make** and **make before break** contacts.

Relays can be used to control several circuits by just one signal. A relay switches one or more poles, each of whose contacts can be thrown by energizing the coil.

Relays are also named with designations like

- **Single Pole Single Throw (SPST):** The SPST relay has a total of four terminals. Out of these two terminals can be connected or disconnected. The other two terminals are needed for the coil to be connected.
- **Single Pole Double Throw (SPDT):** The SPDT relay has a total of five terminals. Out of these two are the coil terminals. A common terminal is also included which connects to either of two others.
- **Double Pole Single Throw (DPST):** The DPST relay has a total of six terminals. These terminals are further divided into two pairs. Thus they can act as two SPST which are actuated by a single coil. Out of the six terminals two of them are coil terminals.
- **Double Pole Double Throw (DPDT):** The DPDT relay is the biggest of all. It has mainly eight relay terminals. Out of these two rows are designed to be change over terminals. They are designed to act as two SPDT relays which are actuated by a single coil.

Relay Applications

- A relay circuit is used to realize logic functions. They play a very important role in providing safety critical logic.
- Relays are used to provide time delay functions. They are used to time the delay open and delay close of contacts.
- Relays are used to control high voltage circuits with the help of low voltage signals.

Similarly they are used to control high current circuits with the help of low current signals.

- They are also used as protective relays. By this function all the faults during transmission and reception can be detected and isolated.

Application of Overload Relay

Overload relay is an electro-mechanical device that is used to safeguard motors from overloads and power failures. Overload relays are installed in motors to safeguard against sudden current spikes that may damage the motor. An overload relay switch works in characteristics with current over time and is different from circuit breakers and fuses, where a sudden trip is made to turn off the motor. The most widely used overload relay is the thermal overload relay where a bimetallic strip is used to turn off the motor. This strip is set to make contact with a contactor by bending itself with rising temperatures due to excess current flow. The contact between the strip and the contactor causes the contactor to deenergize and restricts the power to the motor, and thus turns it off.

Another type of overload motor is the electronic type which continuously watches the motor current, whereas the thermal overload relay shuts off the motor depending on the rise of temperature/heat of the strip.

All overload relays available to buy comes in different specifications, the most important of them being the current ranges and response time. Most of them are designed to automatically reset to work after the motor is turned back on.

Relay Selection

You must note some factors while selecting a particular relay. They are

- Protection Different protections like contact protection and coil protection must be noted. Contact protection helps in reducing arcing in circuits using inductors. A Coil protection helps in reducing surge voltage produced during switching.
- Look for a standard relay with all regulatory approvals.

- Switching time Ask for high speed switching relays if you want one.
- Ratings There are current as well as voltage ratings. The current ratings vary from a few amperes to about 3000 amperes. In case of voltage ratings, they vary from 300 Volt AC to 600 Volt AC. There are also high voltage relays of about 15,000 Volts.
- Type of contact used whether it is a NC or NO or closed contact.
- Select Make before Break or Break before Make contacts wisely.
- Isolation between coil circuit and contacts

Power supply:

A power supply is a component that provides at least one electrical charge with power. It typically converts one type of electrical power to another, but it can also convert a different Energy form in electrical energy, such as solar, mechanical, or chemical.

A power supply provides electrical power to components. Usually, the term refers to devices built into the powered component. Computer power supplies, for example, convert AC current to DC current and are generally located along with at least one fan at the back of the computer case.

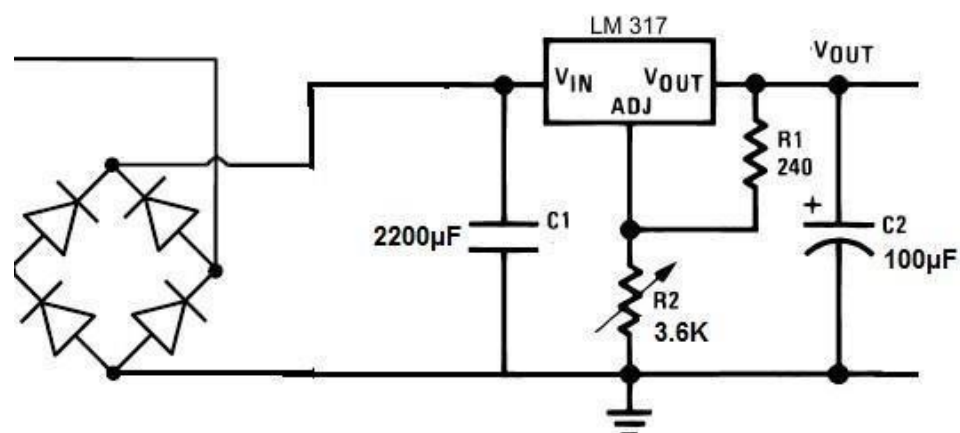


Fig.4.3.9.power supply

Some basic components used in the supply of power:

Rectifier:

A **rectifier** is an electrical device that [converts alternating current](#) (AC), which periodically reverses direction, to [direct current](#) (DC), which flows in only one direction. The process is known as *rectification*, since it "straightens" the direction of current.

Rectifiers have many uses, but are often found to serve as components of DC power supplies and direct power transmission systems with high voltage. Rectification can be used in roles other than direct current generation for use as a power source.

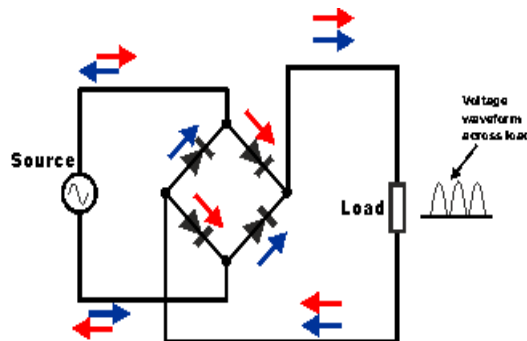


Fig.4.3.10.Circuit of rectifier



Fig.4.3.11.Rectifier

Capacitors:

Capacitors are used to attain from the connector the immaculate and smoothest DC voltage in which the rectifier is used to obtain throbbing DC voltage which is used as part of the light of the present identity. Capacitors are used to acquire square DC from the current AC experience of the current channels so that they can be used as a touch of parallel yield.



Fig.4.3.12.Capacitor

Voltage regulators:

The 78XX voltage controller is mainly used for voltage controllers as a whole. The XX speaks to the voltage delivered to the specific gadget by the voltage controller as the yield. 7805 will supply and control 5v yield voltage and 12v yield voltage will be created by 7812. The voltage controllers are that their yield voltage as information requires no less than 2 volts. For example, 7805 as sources of information will require no less than 7V, and 7812, no less than 14 volts. This voltage is called Dropout Voltage, which should be given to voltage controllers.

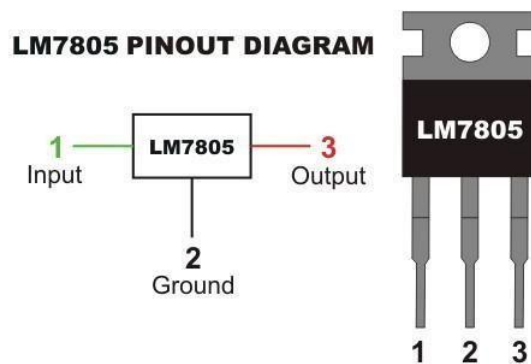


Fig.4.3.13.7805 voltage regulator with pinout

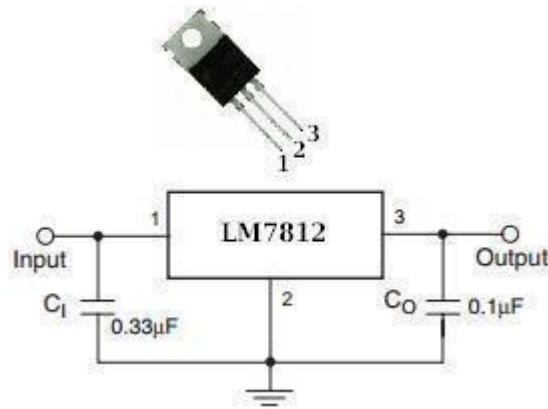


Fig.4.3.14.7812 voltage regulator with pinout

BATTERY:

A rechargeable battery is an energy storage device that can be charged again after being discharged by applying ^{DC}DC current to its terminals.

Rechargeable [batteries](#) allow for multiple usages from a cell, reducing waste and generally providing a better long-term investment in terms of dollars spent for usable device time. This is true even factoring in the higher purchase price of rechargeable and the requirement charger.

A rechargeable battery is generally a more sensible and sustainable replacement to onetime use batteries, which generate current through a chemical reaction in which a reactive anode is consumed. The anode in a rechargeable battery gets consumed as well but at a slower rate, allowing for many charges and discharges.

In use, rechargeable batteries are the same as conventional ones. However, after discharge the batteries are placed in a charger or, in the case of built-in batteries, an [AC](#)/DC adapter is connected.

While rechargeable batteries offer better long term cost and reduce waste, they do have a few cons. Many types of rechargeable cells created for consumer devices, including AA and AAA, C and D batteries, produce a lower voltage of 1.2v in contrast to the 1.5v of alkaline batteries. Though this lower voltage doesn't prevent correct operation in properly designed electronics, it can mean a single charge does not last as long or offer the same power in a session. This is not the case, however, with lithium polymer and [lithium ion batteries](#).

Some types of batteries such as [nickel cadmium](#) and [nickel-metal hydride](#) can develop a [battery memory effect](#) when only partially discharged, reducing performance of subsequent charges and thus [battery life](#) in a given device.

Rechargeable batteries are used in many applications such as cars, all manner of consumer electronics and even off-grid and supplemental facility power storage.

4.4 SOFTWARE REQUIREMENTS

Arduino IDE:

Arduino IDE where IDE stands for Integrated Development Environment – An official software introduced by Arduino.cc, that is mainly used for writing, compiling and uploading the code in the Arduino Device. Almost all Arduino modules are compatible with this software that is an open source and is readily available to install and start compiling the code on the go.

Introduction to Arduino IDE:

- Arduino IDE is an open source software that is mainly used for writing and compiling the code into the Arduino Module.
- It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process.
- It is easily available for operating systems like MAC, Windows, and Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment.
- A range of Arduino modules available including Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro and many more.
- Each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code.
- The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board.
- The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module.
- This environment supports both C and C++ languages.

How to install Arduino IDE:

You can download the Software from Arduino main website. As I said earlier, the software is available for common operating systems like Linux, Windows, and MAX, so make sure you are downloading the correct software version that is easily compatible with your operating system.

- If you aim to download Windows app version, make sure you have Windows 8.1 or Windows 10, as app version is not compatible with Windows 7 or older version of this operating system.

The IDE environment is mainly distributed into three sections

- **1. Menu Bar**
- **2. Text Editor**
- **3. Output Pane**

As you download and open the IDE software, it will appear like an image below.

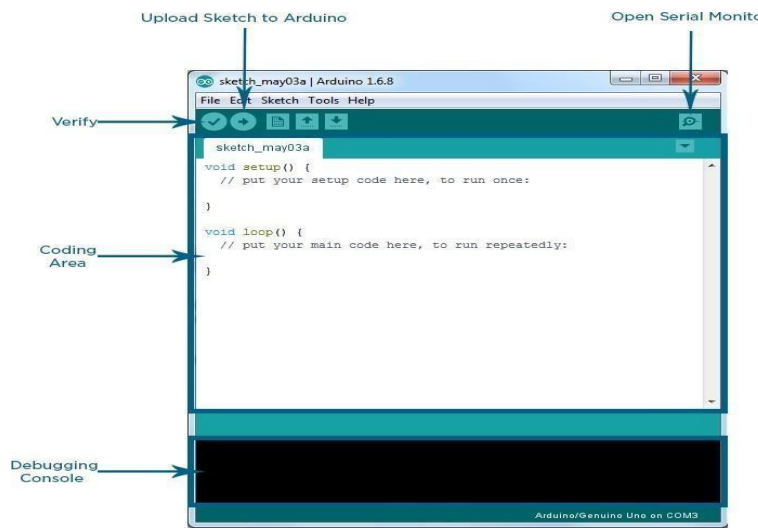


Fig.4.4.1.Menu bar

The bar appearing on the top is called **Menu Bar** that comes with five different options as follow

- **File** – You can open a new window for writing the code or open an existing one. Following table shows the number of further subdivisions the file option is categorized into.

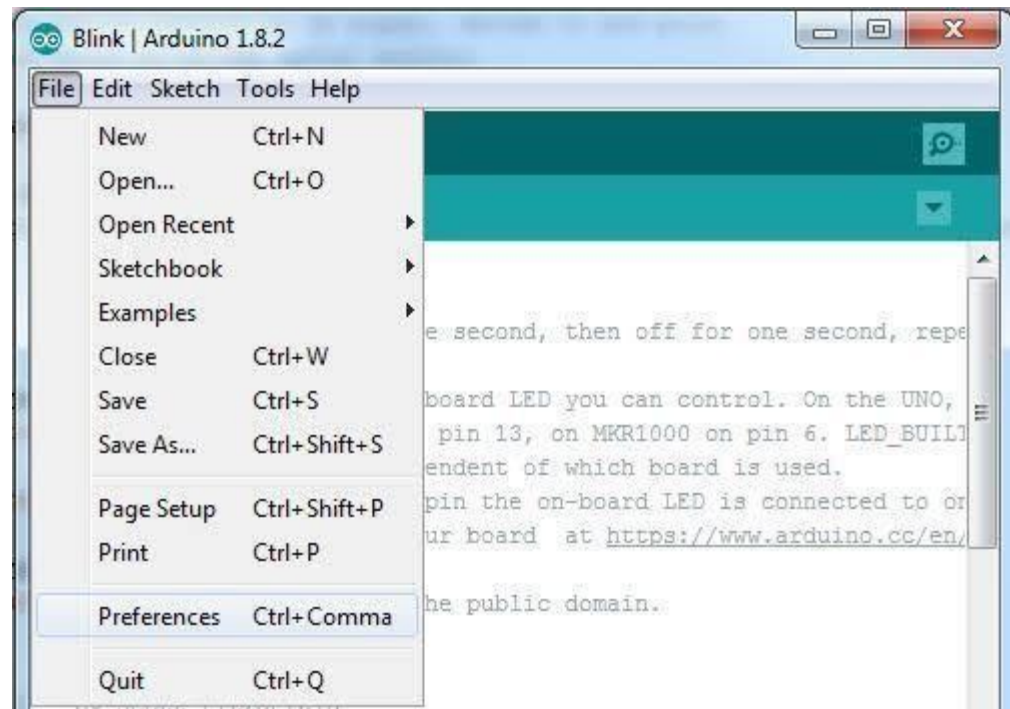


Fig.4.4.2.options

As you go to the preference section and check the compilation section, the Output Pane will show the code compilation as you click the upload button.

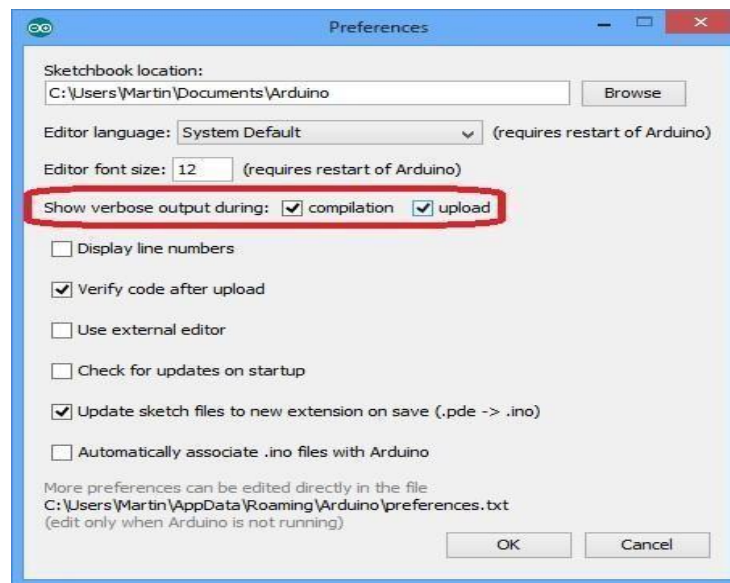


Fig.4.4.3.hex file generation

And at the end of compilation, it will show you the hex file it has generated for the recent sketch that will send to the Arduino Board for the specific task you aim to achieve.

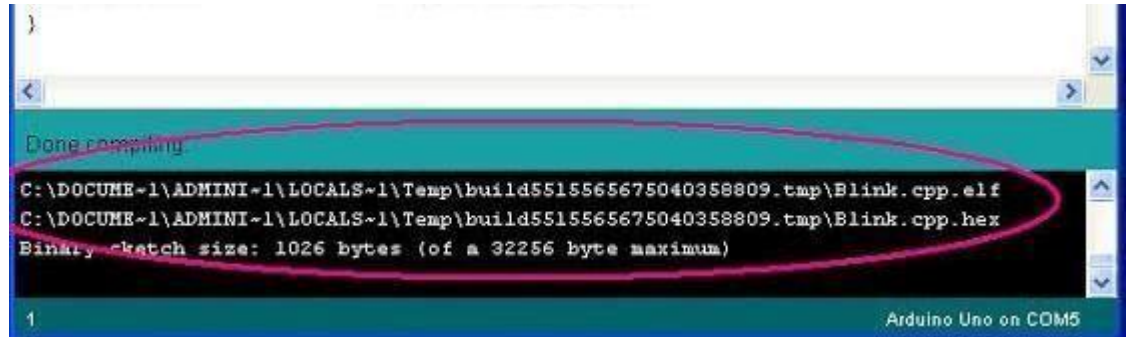


Fig.4.4.5.After compiling

- **Edit** – Used for copying and pasting the code with further modification for font
- **Sketch** – For compiling and programming
- **Tools** – Mainly used for testing projects. The Programmer section in this panel is used for burning a bootloader to the new microcontroller.
- **Help** – In case you are feeling skeptical about software, complete help is available from getting started to troubleshooting.

The **Six Buttons** appearing under the Menu tab are connected with the running program as follow.

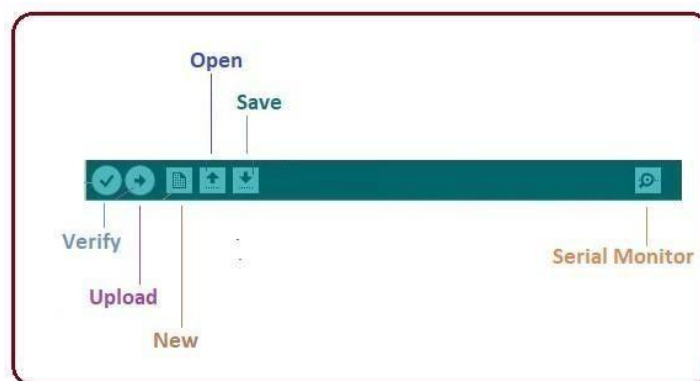


Fig.4.4.6.buttons

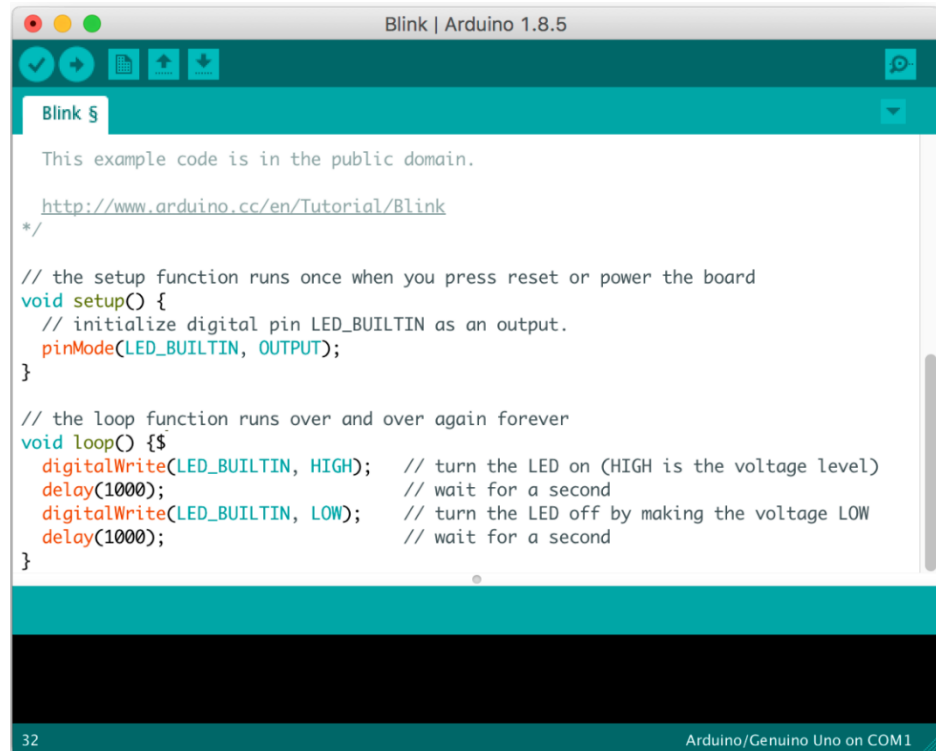
- The check mark appearing in the circular button is used to verify the code. Click this once you have written your code.

- The arrow key will upload and transfer the required code to the Arduino board.
- The dotted paper is used for creating a new file.
- The upward arrow is reserved for opening an existing Arduino project.
- The downward arrow is used to save the current running code.
- The button appearing on the top right corner is a **Serial Monitor** – A separate pop-up window that acts as an independent terminal and plays a vital role for sending and receiving the Serial Data. You can also go to the Tools panel and select Serial Monitor, or pressing Ctrl+Shift+M all at once will open it instantly. The Serial Monitor will actually help to debug the written Sketches where you can get a hold of how your program is operating. Your Arduino Module should be connected to your computer by USB cable in order to activate the Serial Monitor.
- You need to select the baud rate of the Arduino Board you are using right now. For my Arduino Uno Baud Rate is 9600, as you write the following code and click the Serial Monitor, the output will show as the image below.



Fig.4.4.7 blinkcount

The main screen below the Menu bar is known as a simple text editor used for writing the required code.

A screenshot of the Arduino IDE window titled "Blink | Arduino 1.8.5". The window has a teal header bar with icons for file operations and a search icon. Below the header, a tab labeled "Blink \$" is active. The main text area contains the following code:

```
This example code is in the public domain.

http://www.arduino.cc/en/Tutorial/Blink
*/

// the setup function runs once when you press reset or power the board
void setup() {
  // initialize digital pin LED_BUILTIN as an output.
  pinMode(LED_BUILTIN, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {$
  digitalWrite(LED_BUILTIN, HIGH); // turn the LED on (HIGH is the voltage level)
  delay(1000); // wait for a second
  digitalWrite(LED_BUILTIN, LOW); // turn the LED off by making the voltage LOW
  delay(1000); // wait for a second
}
```

The status bar at the bottom shows "32" on the left and "Arduino/Genuino Uno on COM1" on the right.

Fig.4.4.8.blink program

The bottom of the main screen is described as an Output Pane that mainly highlights the compilation status of the running code: the memory used by the code, and errors occurred in the program. You need to fix those errors before you intend to upload the hex file into your Arduino Module.

A screenshot of the Arduino IDE's Output Pane. The pane has a teal header bar with the text "Done compiling". The main area is black with white text showing memory usage statistics:

```
Sketch uses 928 bytes (2%) of program storage space. Maximum is 32256 bytes.
Global variables use 9 bytes (0%) of dynamic memory, leaving 2039 bytes for local variables. Maximum is 2048 bytes.
```

The status bar at the bottom right shows "Arduino/Genuino Uno on COM10".

Fig.4.4.9.Memory space

More or less, Arduino C language works similar to the regular C language used for any embedded system microcontroller, however, there are some dedicated libraries used for calling and executing specific functions on the board.

Libraries:

Libraries are very useful for adding the extra functionality into the Arduino Module. There is a list of libraries you can add by clicking the Sketch button in the menu bar and going to Include Library.

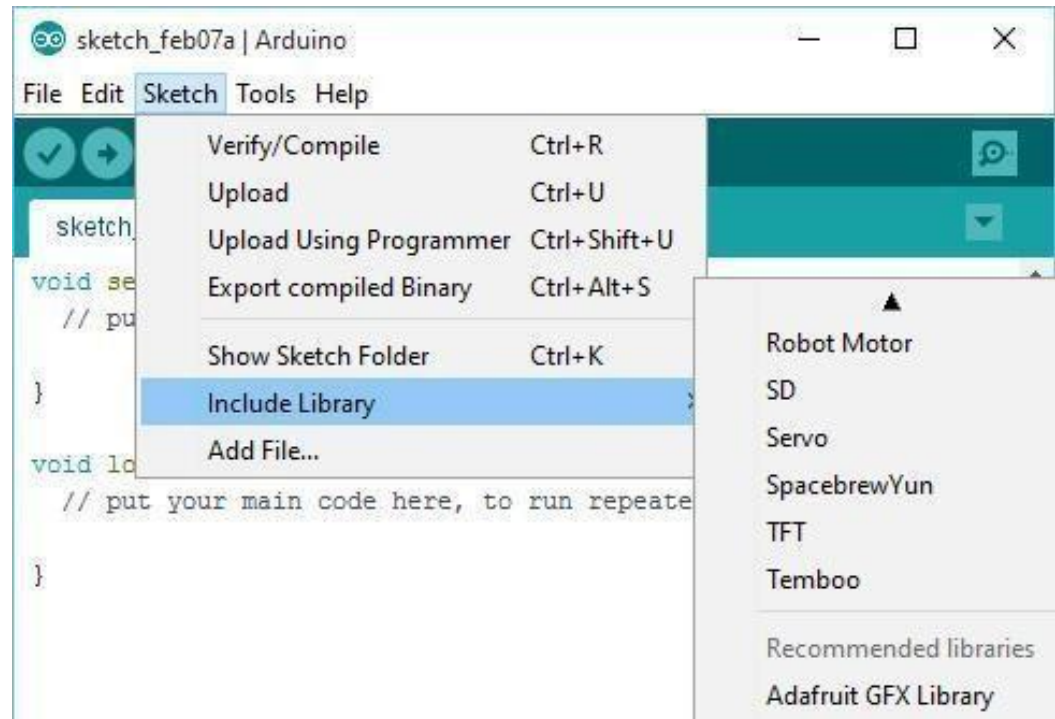


Fig 4.4.9.Sketch

As you click the Include Library and Add the respective library it will on the top of the sketch with a #include sign. Suppose, I Include the EEPROM library, it will appear on the text editor as

```
#include <EEPROM.h>.
```

Most of the libraries are preinstalled and come with the Arduino software. However, you can also download them from the external sources.

Making pins Input and output:

The `digitalRead` and `digitalWrite` commands are used for addressing and making the Arduino pins as an input and output respectively.

These commands are text sensitive i.e. you need to write them down the exact way they are given like `digitalWrite` starting with small “d” and write with capital “W”. Writing it down with `Digitalwrite` or `digitalwrite` won’t be calling or addressing any function.

How to select the board:

In order to upload the sketch, you need to select the relevant board you are using and the ports for that operating system. As you click the Tools on the Menu, it will open like the figure below.

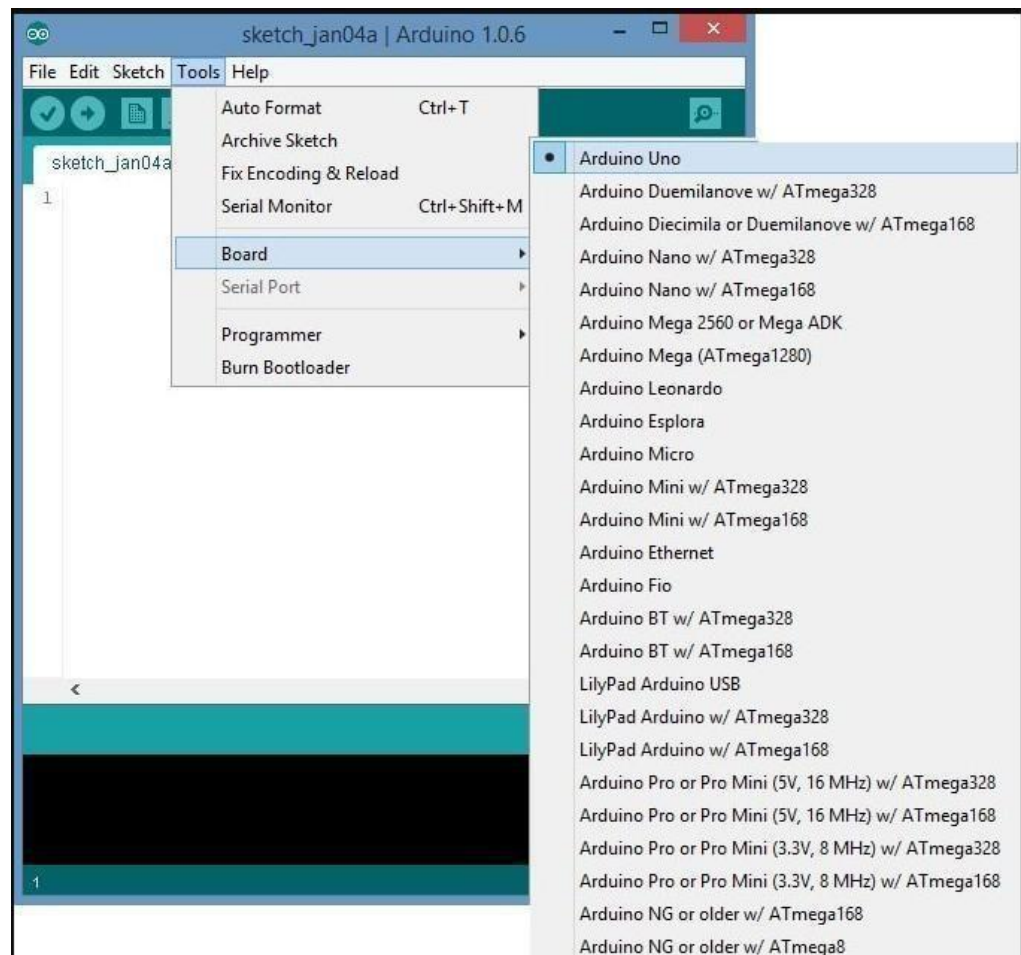


Fig.4.4.10 Tools

- Just go to the “Board” section and select the board you aim to work on. Similarly, COM1, COM2, COM4, COM5, COM7 or higher are reserved for the serial and USB board. You can look for the USB serial device in the ports section of the Windows Device Manager. Following figure shows the COM4 that I have used for my project, indicating the Arduino Uno with COM4 port at the right bottom corner of the screen.

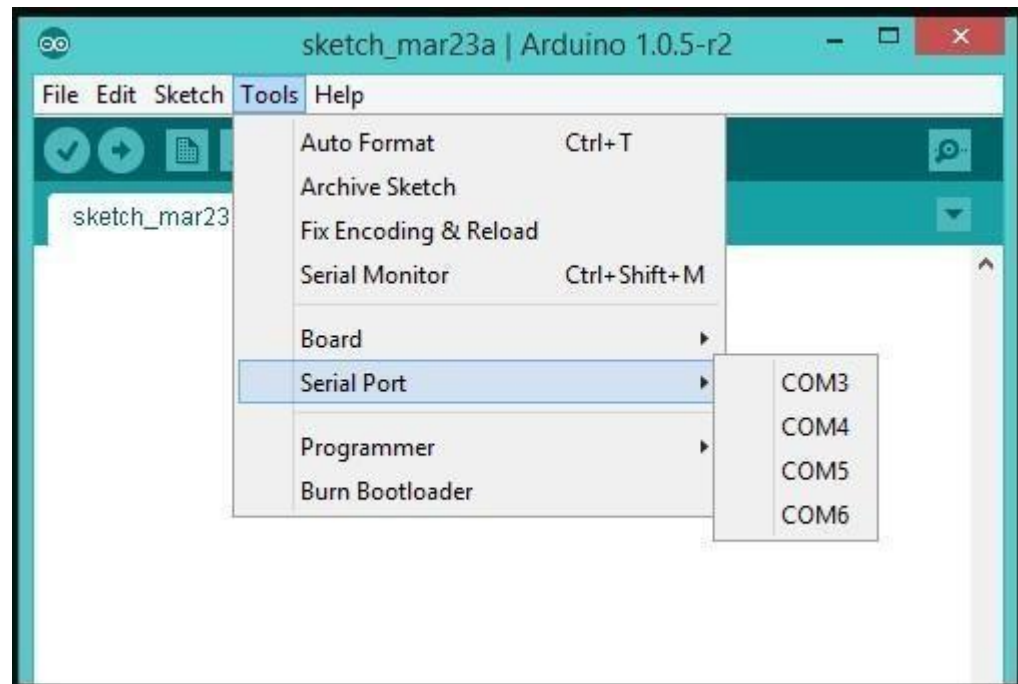


Fig.4.4.11 Serial ports

- After correct selection of both Board and Serial Port, click the verify and then upload button appearing in the upper left corner of the six button section or you can go to the Sketch section and press verify/compile and then upload.
 - The sketch is written in the text editor and is then saved with the file extension .ino.
- It is important to note that the recent Arduino Modules will reset automatically as you compile and press the upload button the IDE software, however, older version may require the physical reset on the board.

- Once you upload the code, TX and RX LEDs will blink on the board, indicating the desired program is running successfully.

Note: The port selection criteria mentioned above is dedicated for Windows operating system only, you can check this [Guide](#) if you are using MAC or Linux.

- The amazing thing about this software is that no prior arrangement or bulk of mess is required to install this software, you will be writing your first program within 2 minutes after the installation of the IDE environment.

BootLoader:

As you go to the Tools section, you will find a bootloader at the end. It is very helpful to burn the code directly into the controller, setting you free from buying the external burner to burn the required code.

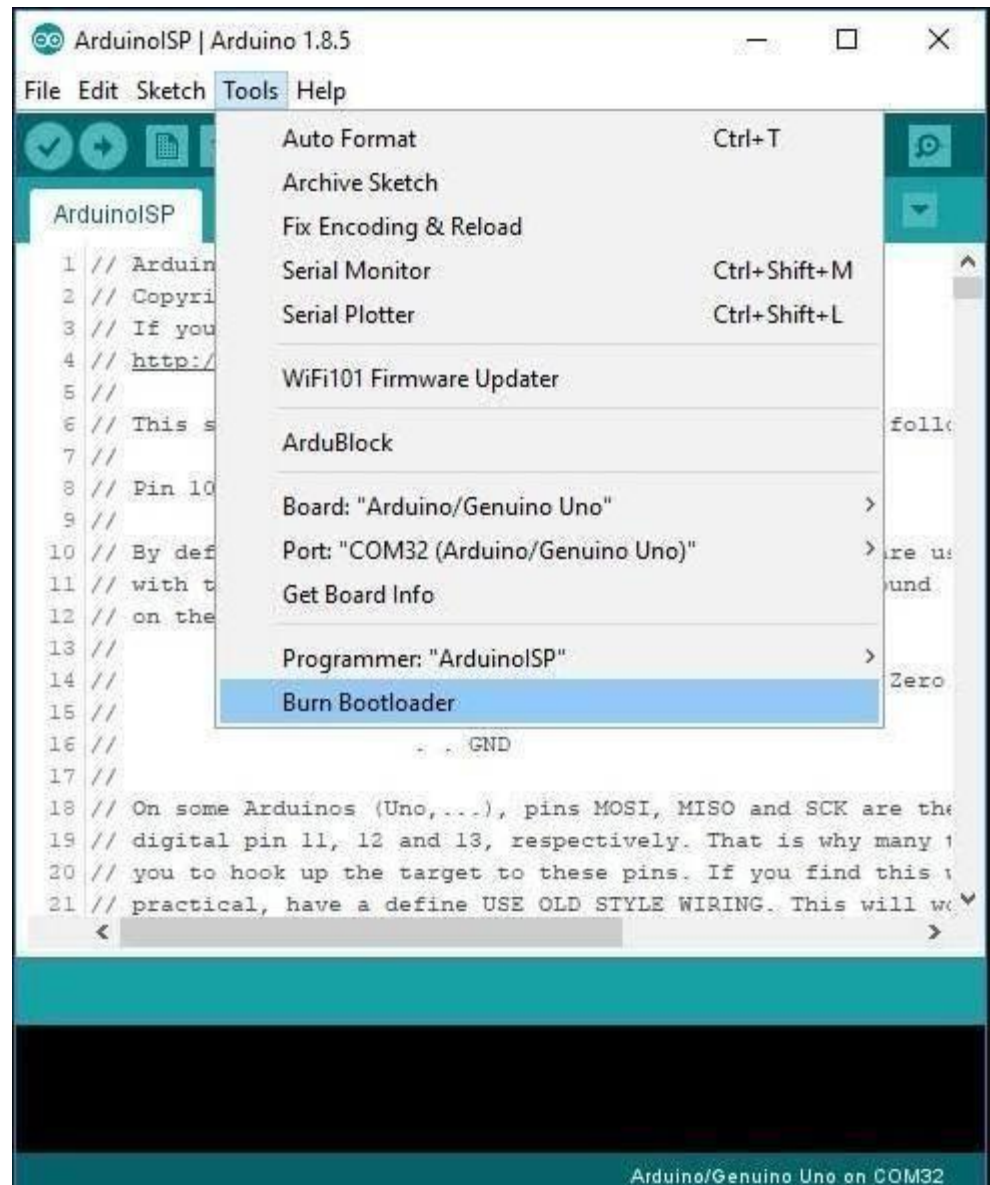


Fig 4.4.12.Burn Bootloader

When you buy the new Arduino Module, the bootloader is already installed inside the controller. However, if you intend to buy a controller and put in the Arduino module, you need to burn the bootloader again inside the controller by going to the Tools section and selecting the burn bootloader.

PYTHON:

Python is a general purpose, dynamic, high level and interpreted programming language. It supports Object Oriented programming approach to develop applications. It is

simple and easy to learn and provides lots of high-level data structures. It is easy to learn yet powerful and versatile scripting language which makes it attractive for Application Development. Its syntax and dynamic typing with its interpreted nature, makes it an ideal language for scripting and rapid application development. It supports multiple programming patterns, including object oriented, imperative and functional or procedural programming styles. It is not intended to work on special area such as web programming. That is why it is known as multipurpose because it can be used with web, enterprise, 3D CAD etc. We don't need to use data types to declare variable because it is dynamically typed so we can write `a=10` to assign an integer value in an integer variable. It makes the development and debugging fast because there is no compilation step included in python development and edit-test-debug cycle is very fast.

Python Features

Python provides lots of features that are listed below.

1) Easy to Learn and Use

Python is easy to learn and use. It is developer-friendly and high level programming language.

2) Expressive Language

Python language is more expressive means that it is more understandable and readable.

3) Interpreted Language

Python is an interpreted language i.e. interpreter executes the code line by line at a time. This makes debugging easy and thus suitable for beginners.

4) Cross-platform Language

Python can run equally on different platforms such as Windows, Linux, Unix and Macintosh etc. So, we can say that Python is a portable language.

5) Free and Open Source

Python language is freely available at address. The source-code is also available. Therefore it is open source.

6) Object-Oriented Language

Python supports object oriented language and concepts of classes and objects come into existence.

7) Extensible

It implies that other languages such as C/C++ can be used to compile the code and thus it can be used further in our python code.

8) Large Standard Library

Python has a large and broad library and provides rich set of module and functions for rapid application development.

9) GUI Programming Support

Graphical user interfaces can be developed using Python.

10) Integrated

It can be easily integrated with languages like C, C++, JAVA etc.

Python History

- Python laid its foundation in the late 1980s.
- The implementation of Python was started in the December 1989 by **Guido Van Rossum** at CWI in Netherland.
- In February 1991, van Rossum published the code (labeled version 0.9.0) to alt.sources.
- In 1994, Python 1.0 was released with new features like: lambda, map, filter, and reduce.
- Python 2.0 added new features like: list comprehensions, garbage collection system.
- On December 3, 2008, Python 3.0 (also called "Py3K") was released. It was designed to rectify fundamental flaw of the language.
- *ABC programming language* is said to be the predecessor of Python language which was capable of Exception Handling and interfacing with Amoeba Operating System.
- Python is influenced by following programming languages: o ABC language. o

Modula-3

Python Version

Python programming language is being updated regularly with new features and supports.

There are lots of updations in python versions, started from 1994 to current release.

A list of python versions with its released date is given below.

Python Version	Released Date
Python 1.0	January 1994
Python 1.5	December 31, 1997
Python 1.6	September 5, 2000
Python 2.0	October 16, 2000

Python 2.1	April 17, 2001
Python 2.2	December 21, 2001
Python 2.3	July 29, 2003
Python 2.4	November 30, 2004
Python 2.5	September 19, 2006
Python 2.6	October 1, 2008
Python 2.7	July 3, 2010
Python 3.0	December 3, 2008
Python 3.1	June 27, 2009
Python 3.2	February 20, 2011
Python 3.3	September 29, 2012
Python 3.4	March 16, 2014
Python 3.5	September 13, 2015
Python 3.6	December 23, 2016
Python 3.6.4	December 19, 2017

Python Applications Area

Python is known for its general purpose nature that makes it applicable in almost each domain of software development. Python as a whole can be used in any sphere of development.

Here, we are specifying applications areas where python can be applied.

1) Web Applications

We can use Python to develop web applications. It provides libraries to handle internet protocols such as HTML and XML, JSON, Email processing, request, BeautifulSoup, Feedparser etc. It also provides Frameworks such as Django, Pyramid, Flask etc to design

and develop web based applications. Some important developments are: PythonWikiEngines, Pocoo, PythonBlogSoftware etc.

2) Desktop GUI Applications

Python provides Tk GUI library to develop user interface in python based application. Some other useful toolkits wxWidgets, Kivy, PyQt that are useable on several platforms. The Kivy is popular for writing multitouch applications.

3) Software Development

Python is helpful for software development process. It works as a support language and can be used for build control and management, testing etc.

4) Scientific and Numeric

Python is popular and widely used in scientific and numeric computing. Some useful library and package are SciPy, Pandas, IPython etc. SciPy is group of packages of engineering, science and mathematics.

5) Business Applications

Python is used to build Business applications like ERP and e-commerce systems. Tryton is a high level application platform.

6) Console Based Application

We can use Python to develop console based applications. For example: **IPython**.

7) Audio or Video based Applications

Python is awesome to perform multiple tasks and can be used to develop multimedia applications. Some of real applications are: TimPlayer, cplay etc.

8)3D CAD Applications

To create CAD application Fandango is a real application which provides full features of CAD.

9) Enterprise Applications

Python can be used to create applications which can be used within an Enterprise or an Organization. Some real time applications are: OpenErp, Tryton, Picalo etc.

10) Applications for Images

Using Python several application can be developed for image. Applications developed are: VPython, Gogh, imgSeek etc. There are several such applications which can be developed using Python.

4.5 APPLICATIONS

1. **Automobile Security Enhancement:** The primary application of this project is to bolster the security of automobiles against theft. By integrating facial recognition and shock mechanisms, the system provides an advanced layer of protection, ensuring that only authorized users can access the vehicle. This feature is especially valuable in high-theft areas or for expensive vehicles where traditional security measures may prove inadequate.
2. **Fleet Management:** In fleet management scenarios, where multiple vehicles are operated by a company or organization, this system can ensure that only authorized drivers have

access to the vehicles. By accurately identifying drivers through facial recognition, it helps in monitoring and controlling vehicle usage, reducing the risk of unauthorized use or theft within the fleet.

3. **Car Rental Services:** Car rental companies can utilize this technology to enhance the security of their rental fleet. By implementing facial recognition, they can streamline the rental process, allowing customers to access rented vehicles seamlessly while ensuring that only registered renters can unlock and drive the vehicles. This not only enhances security but also improves the overall rental experience for customers.
4. **Vehicle Sharing Programs:** For vehicle sharing programs such as car-sharing services or ride-hailing platforms, ensuring the security and safety of vehicles is paramount. With this system in place, vehicle sharing programs can authenticate drivers before granting access to vehicles, reducing the risk of unauthorized use or theft. It instills confidence among users and promotes trust in the sharing economy model.
5. **Personal Vehicle Security:** Individuals can deploy this system to protect their personal vehicles from theft or unauthorized access. Whether parked in public spaces or at home, the system provides an additional layer of security beyond traditional locks and alarms. The facial recognition feature ensures that only authorized individuals, such as family members or designated users, can start the vehicle and operate it.
6. **Commercial Vehicle Protection:** Businesses that rely on commercial vehicles for transportation or logistics can benefit from this system to safeguard their assets. By incorporating facial recognition and shock mechanisms, companies can mitigate the risk of vehicle theft, unauthorized usage, or tampering. This is particularly crucial for industries where vehicle downtime due to theft can lead to significant financial losses.
7. **Security for High-Value Cargo:** Industries involved in transporting high-value cargo, such as precious metals, electronics, or pharmaceuticals, can employ this system to secure their cargo vehicles. By implementing stringent security measures, including facial recognition and shock deterrents, they can minimize the risk of theft or tampering during transit, safeguarding valuable goods and assets.

8. **Parking Lot Security:** Parking lots, especially in urban areas or public spaces, are vulnerable to vehicle theft and vandalism. Installing this system in parking lots can enhance security by restricting unauthorized access to parked vehicles. The facial recognition feature ensures that only vehicle owners or authorized personnel can unlock and retrieve their vehicles, reducing the incidence of theft and unauthorized entry.
9. **Law Enforcement Vehicles:** Law enforcement agencies can integrate this technology into their vehicles to enhance security and prevent unauthorized access. By implementing facial recognition systems and shock mechanisms, police vehicles can be better protected against theft or tampering, ensuring that only authorized officers can access critical equipment and resources stored in the vehicles.
10. **Custom Vehicle Security Solutions:** Vehicle customization shops or security firms can offer tailored security solutions based on this project to meet the specific needs of clients. Whether it's installing facial recognition systems, shock deterrents, or integrated security platforms, these customized solutions can address the unique security challenges faced by vehicle owners, businesses, or organizations.

ADVANTAGES

Advantages:

1. Facial Recognition Security:
2. Immediate Email Alerts:
3. Deterrent Shock Mechanism:
4. Enhanced Theft Prevention:
5. Comprehensive Anti-Theft Solution

5. Testing and Result analysis

5.1 Testing:

HAAR CASCADE CLASSIFIER (ALGORITHM)

Haar Cascade classifiers are an effective way for object detection. This method was proposed by Paul Viola and Michael Jones in their paper Rapid Object Detection using a Boosted Cascade of Simple Features. Haar Cascade is a machine learning based approach where a lot of positive and negative images are used to train the classifier. Positive images – These images contain the images which we want our classifier to identify. Negative Images – Images of everything else, which do not contain the object we want to detect.

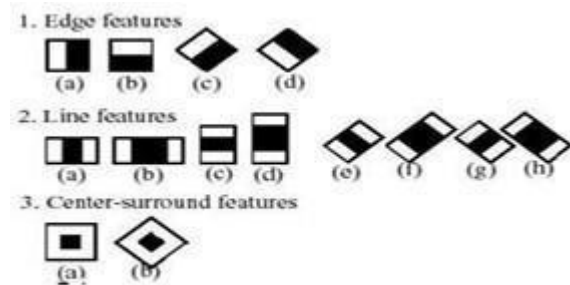
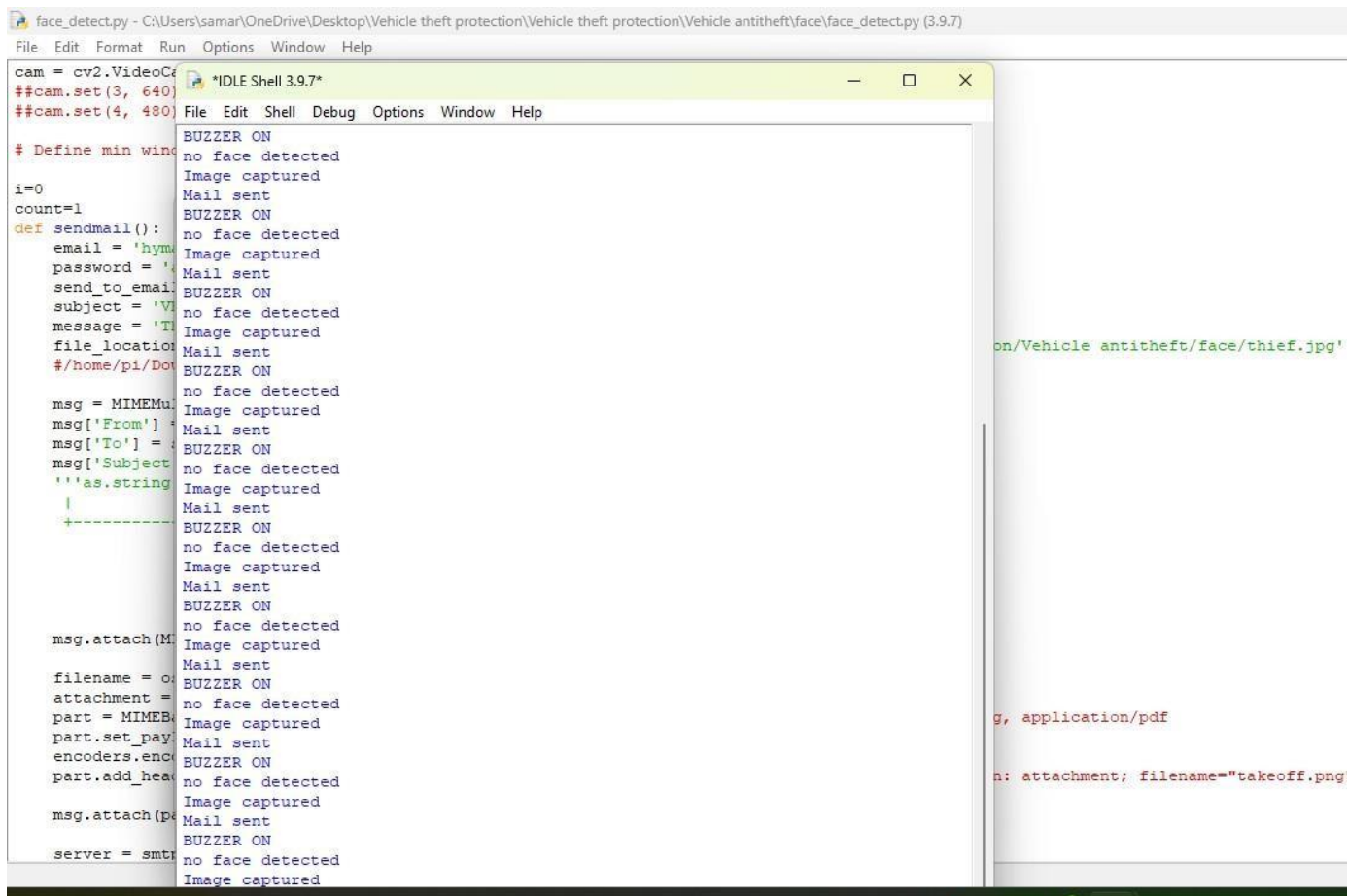


Fig5.1.1. Face angles

FACIAL LANDMARK (ALGORITHM) :

Facial landmarks is a technique which can be applied to applications like face alignment, head pose estimation, face swapping, blink detection, drowsiness detection, etc. In this context of facial landmarks, our vital aim is to detect facial structures on the person's face using a method called shape prediction. Facial Landmarks Detection has 2 steps: 1. To detect the key facial structures on the person's face. 2. It involves localizing the face in the image. User do Face

detection in a number of ways. It's use OpenVMS built-in Haar Cascade XML files or even Tensor Flow or using Keas. Over here especially, We need to apply a HOG (Histogram of Gradients) and Linear SVM (Support Vector Machines) object detector specifically for the task of face detection. It also do it using Deep Learning-based algorithms which are built for face localization. Also, the algorithm will be used for the detection of the faces in the image.

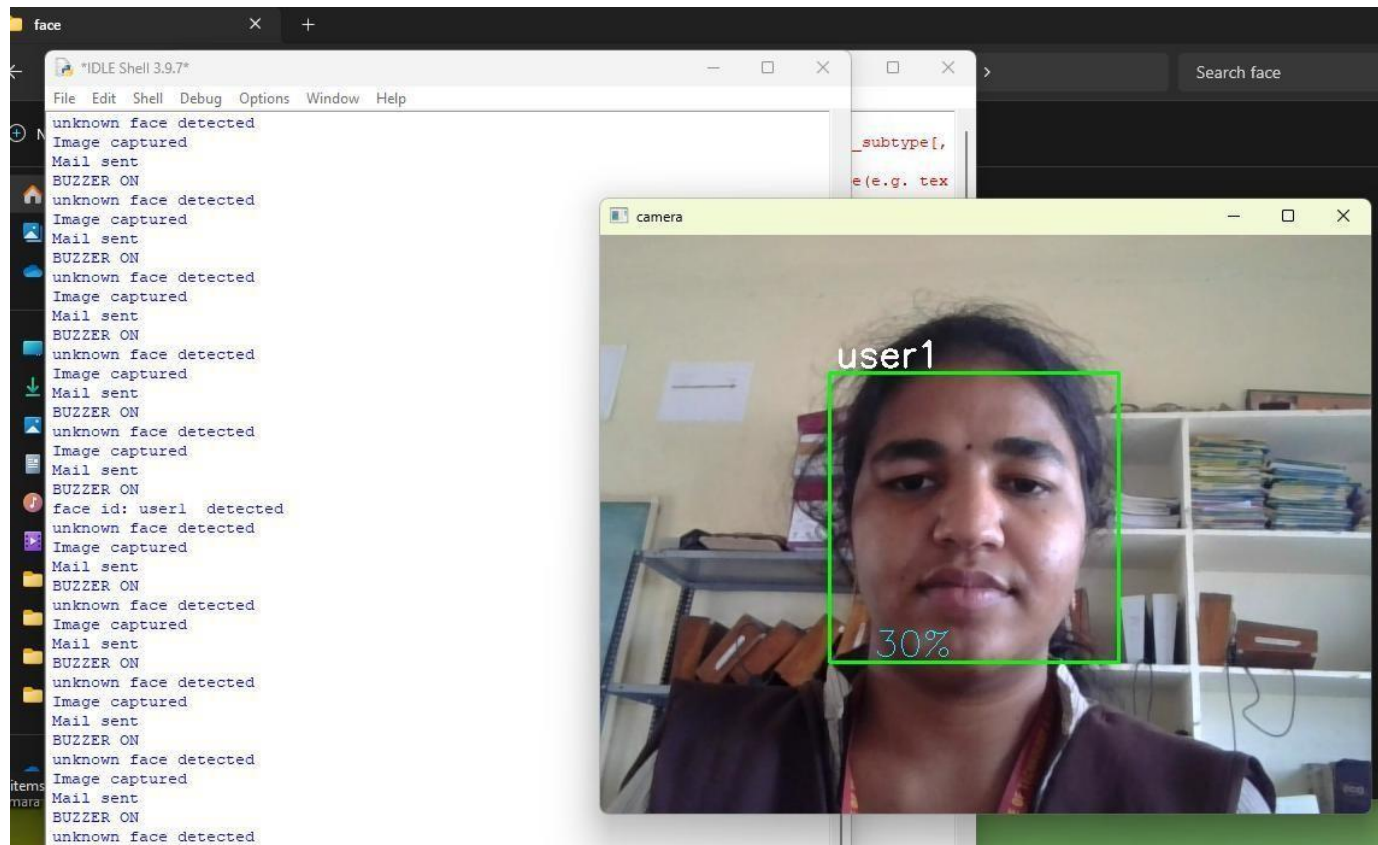


SYSTEM SOFTWARE :

PyCharm is the most popular IDE used for Python scripting language. This chapter will give you an introduction to PyCharm and explains its features. PyCharm offers some of the best features to its users and developers in the following aspects · Code completion and inspection

- Advanced debugging
- Support for web programming and frameworks such as Django and Flask.

Fig 5.1.2. software



5.2 Result Analysis:

This is the result of our Project where the unknown person unlock door of the Vehicle ,it will not open and gives the Electric Shock to that person incase the owner of default person's face detects while opening the door, it will open This will provide Antitheft Detection and also provides the

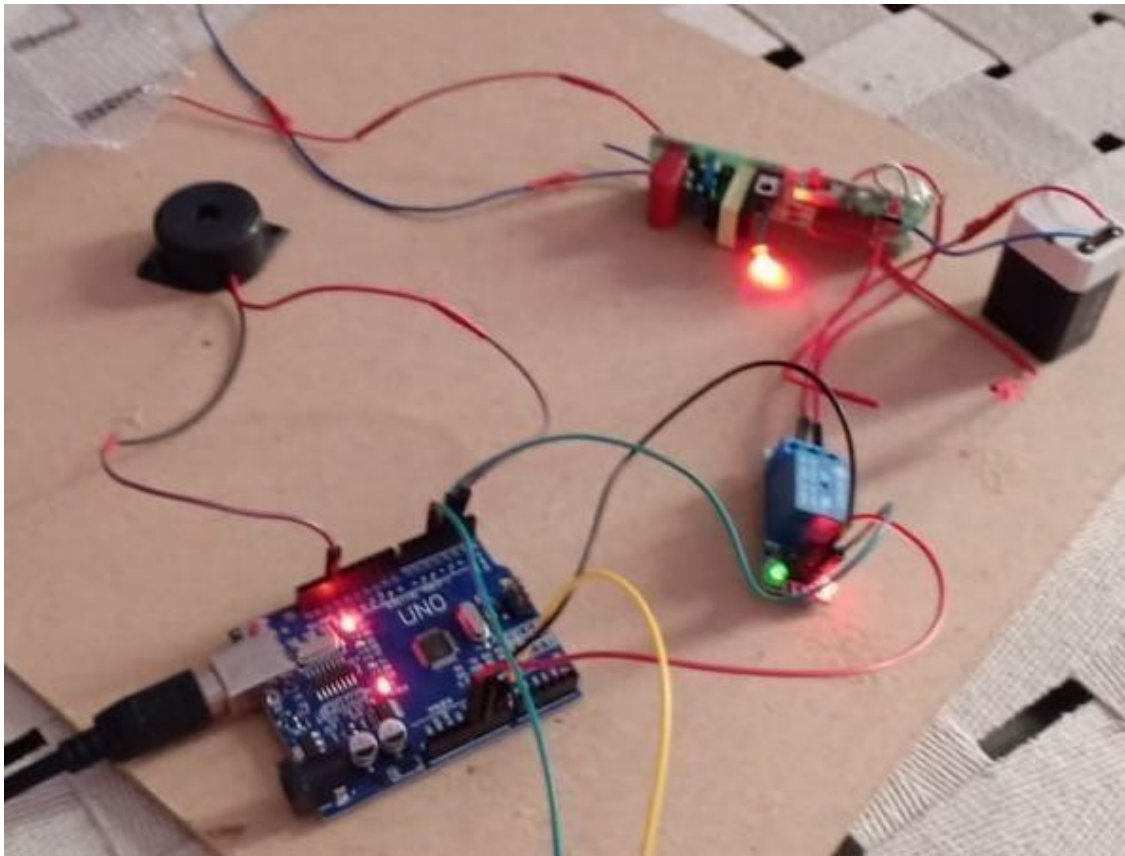
Fig 5.2.1Experimental Setup

solution for the theft kind of Activities in the vehicle with the help of DIP and gives best Security System to authorized person.

The above figure shows the experimental set up of our method wherein a circuit board is present to process the data

(a) By the figure we come to a conclusion that the owner of the vehicle is the true identity person. (b)

By this figure we could form a conclusion that the owner of the vehicle is not the true identity person but someone with the intention of theft.



Fig

5.2.3 project setup

6.CONCLUSION

In conclusion, the project on "Vehicle Anti-Theft Detection and Protection with Shock using Facial Recognition" represents a significant advancement in vehicle security technology. By integrating facial recognition systems and shock mechanisms, the project aims to provide robust protection against vehicle theft and unauthorized access. Throughout the development and implementation phases, several key insights and outcomes have emerged, highlighting the effectiveness and potential of the system.

Firstly, the project underscores the importance of adopting multifaceted security solutions to safeguard vehicles in an increasingly complex threat landscape. Traditional security measures, such as mechanical locks and alarms, have proven vulnerable to sophisticated theft techniques. In contrast, the integration of facial recognition technology adds an additional layer of authentication, ensuring that only authorized individuals can access the vehicle. Moreover, the incorporation of shock mechanisms acts as a deterrent, further enhancing the security posture and dissuading potential thieves.

Secondly, the project demonstrates the feasibility and practicality of leveraging emerging technologies, such as facial recognition and IoT-based systems, for vehicle security applications. By leveraging facial recognition algorithms and machine learning techniques, the system can accurately identify authorized users and detect unauthorized access attempts. Furthermore, the integration of IoT capabilities enables real-time monitoring and remote management, allowing vehicle owners to track security events and respond promptly to security breaches.

Lastly, the project highlights the importance of user acceptance and usability in security Solutions.

6.2 Future Scope

The described vehicle anti-theft system integrating facial recognition technology and shock protection Mechanisms presents a strong foundation for future enhancements and developments. Here are some potential areas for future scope and improvement.

1. ***Enhanced Facial Recognition Algorithms***: Continuously improving the accuracy and speed of facial recognition algorithms can make the system more reliable in identifying authorized users and reducing false positives or negatives. Integration with machine learning techniques can help the system adapt to varying environmental conditions and different facial appearances.
2. ***Multi-factor Authentication***: Implementing additional layers of authentication, such as biometric verification (e.g., fingerprint or iris recognition) or token-based authentication (e.g., RFID cards), can further strengthen the security of the system. Multi-factor authentication adds redundancy and makes it harder for unauthorized individuals to gain access to the vehicle.
3. ***Geolocation Tracking***: Integrating GPS tracking capabilities into the system can provide real-time location data for the vehicle. This feature enhances security by allowing the owner to track the vehicle's movements remotely and receive alerts if it deviates from predefined geofenced areas or enters unauthorized zones.
4. ***Integration with Mobile Applications***: Developing a mobile application that interfaces with the vehicle security system enables users to remotely monitor and control the system from their smartphones or tablets. This includes features such as arming/disarming the shock protection mechanism, receiving push notifications for alerts, and accessing logs of security events.

5. ***Cloud Connectivity and Data Analysis***: Leveraging cloud-based storage and analysis can enhance the scalability and intelligence of the system. Storing security event data in the cloud allows for long-term analysis and pattern recognition, enabling proactive measures to prevent thefts or security breaches. Additionally, cloud connectivity enables seamless integration with other smart devices and services for a more interconnected security ecosystem.
6. ***User-friendly Interface and Customization***: Designing an intuitive and user-friendly interface for configuring and managing the security system ensures accessibility for users of varying technical expertise. Providing options for customization, such as adjustable sensitivity levels for the shock protection mechanism or personalized alert preferences, allows users to tailor the system to their specific needs and preferences.
7. ***Collaboration with Automotive Manufacturers***: Partnering with automotive manufacturers to integrate the anti-theft system directly into vehicle hardware and onboard systems can streamline installation and improve integration. This collaboration can also facilitate the adoption of the technology as a standard feature in new vehicles, further enhancing vehicle security across the industry.

Continued research and development in these areas can contribute to the evolution of the vehicle anti-theft system, making it more effective, user-friendly, and adaptable to emerging security challenges.

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Facial Recognition and Shock Protection: A Comprehensive Anti-Theft System for Vehicles

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edge technologies like facial recognition and shock mechanisms to create a robust anti-theft system.

Abstract - Vehicle Anti-Theft Detection and Protection with Shock employs a robust security system integrating facial recognition technology and shock protection mechanisms. A camera, connected to a Python-installed PC, facilitates facial recognition to identify authorized users. In the event of an unrecognized face, the system triggers an immediate response by sending an alert email to the registered user. This aspect adds an extra layer of security to deter potential thefts.

In addition to the facial recognition feature, the project incorporates a shock protection mechanism inspired by a mosquito bat. This innovative approach involves integrating a shock mechanism that can be activated remotely. If unauthorized access or tampering is detected, the shock mechanism provides an additional deterrent, enhancing the security of the vehicle. The combination of facial recognition and shock protection contributes to a comprehensive anti-theft system, ensuring both user authentication and a swift response to potential threat

Keywords : Arduino, Python installed PC, Vehicle security, Relay, Inverter

I. INTRODUCTION

Vehicle Anti-Theft Detection and Protection with Shock Using Facial Recognition is an innovative project designed to enhance the security measures for vehicles. With the rising incidents of vehicle theft globally, there is a growing need for advanced security systems to safeguard automobiles. This project integrates cutting-

authenticate the vehicle owner. A camera is installed within the vehicle, which captures the driver's face upon entry. The captured image is processed using facial recognition algorithms implemented with the help of Python programming. If the detected face matches the authorized user's profile stored in the system, the vehicle remains accessible. However, if an unauthorized individual attempts to gain access, the system triggers an alert. In addition to facial recognition, the project incorporates a shock mechanism as a deterrent against theft. Upon unauthorized access or tampering, the system activates a shock mechanism installed within the vehicle. This shock mechanism is designed to deliver a non-lethal electric shock to the perpetrator, effectively immobilizing them and preventing further intrusion. The shock mechanism serves as a powerful deterrent, discouraging potential thieves from attempting to steal the vehicle.

Furthermore, the project employs Arduino microcontrollers to integrate various components and manage the system's functionalities. Arduino facilitates the communication between different modules, such as the facial recognition system, shock mechanism, and vehicle's locking mechanism. By leveraging Arduino's versatility and programmability, the system can execute complex security protocols seamlessly.

Moreover, the project aims to provide real-time notifications to the vehicle owner and authorities in case of unauthorized access or theft attempts. Upon detecting suspicious activity, the system sends instant alerts to the owner's smartphone or connected device via SMS or email. Additionally, the system can be configured to notify law enforcement

agencies, enabling prompt action to recover the stolen vehicle.

In summary, the Vehicle Anti-Theft Detection and

Protection with Shock Using Facial Recognition project offer an advanced and comprehensive solution to combat vehicle theft. By integrating facial recognition technology, shock mechanisms, and real-time notifications, the system provides enhanced security measures, ensuring peace of mind for vehicle owners and effectively deterring potential thieves.

III. METHODOLOGY

In our proposed system we are designing our system with ARDUINO UNO and taking ARDUINO UNO as the control unit of our design. However, we use different components for the fulfillment of our design

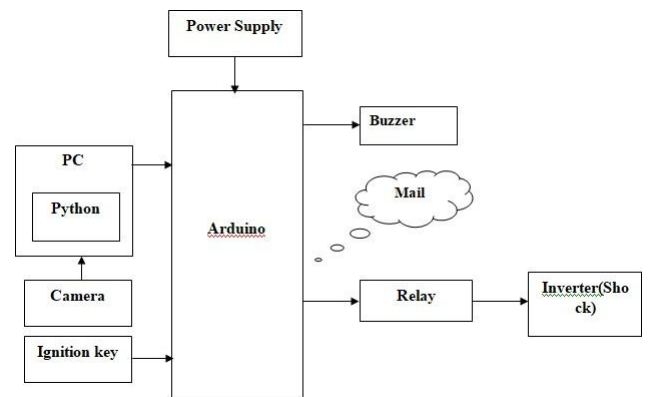
II. OBJECTIVES

comprehensive security solutions that effectively deter theft and unauthorized access while ensuring user convenience and peace of mind.

in-order to achieve accurate and satisfying results to reach our goals and objectives.3.1

BLOCK DIAGRAM AND CONSTRUCTION

3.1 BLOCK DIAGRAM AND CONSTRUCTION



3.2.3

A buzzer of

Fig 3.2.3

Buzzer is

power alarms,

Ignition

connects
Fig 3.2.4

in electricity
Inverters

3.2.2
devices

Operating Voltage

5V

Analog Input Pins

6 (A0 – A5)

Digital I/O Pins

14 (Out of which 6 provide PWM output)

Flash Memory

32 KB

SRAM

2 KB

EEPROM

1 KB

Frequency (Clock Speed)

16 MHz

Buzzer

or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke.

Buzzer is an integrated electronic supply, widely used in computers, electronic toys, electronic telephones, timers



structure of transducers, DC used in printers, copiers, automotive equipment, and others.

3.2.4

Ignition key

key is used in vehicles to turn the ignition switch that

the battery to the ignition system and other electrical devices

3.2.5

Invertor

An inverter is a converting the direct into alternate current are mainly used

Relay as a source of when there are power



device which helps current electricity.

power to run cuts. Most of our home

appliances require only the AC



electricity for proper working.

IV. RESULTS

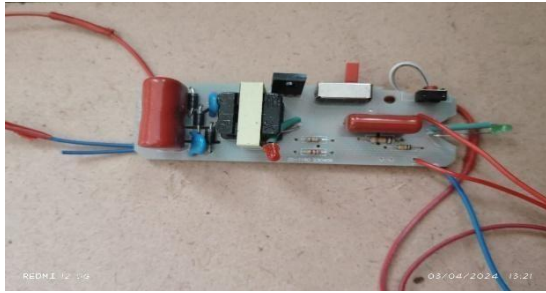


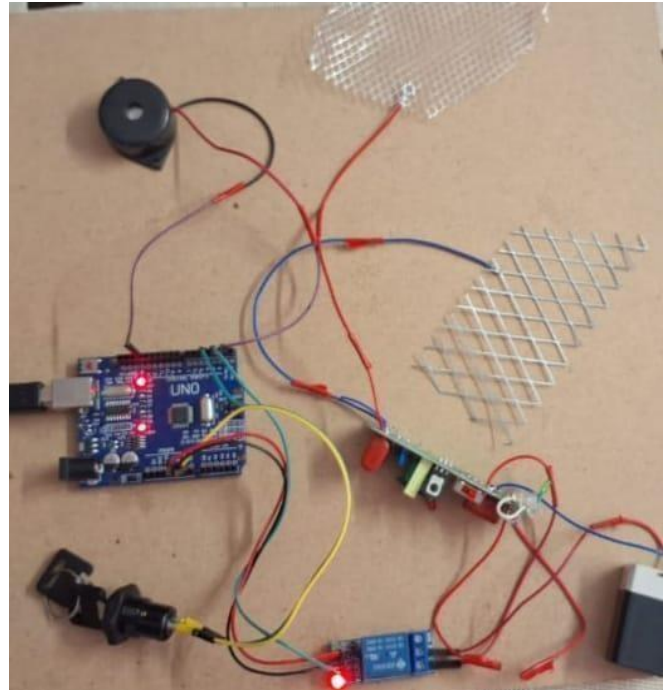
Fig 3.2.5 Inverter

3.3 WORKING

The Vehicle Anti-Theft Detection and Protection system employs facial recognition technology and a

shock protection mechanism to enhance vehicle security. A camera connected to a Python-installed PC facilitates facial recognition to identify authorized users. If an unrecognized face is detected, the system triggers an immediate alert email to the registered user. Additionally, a shock mechanism, inspired by a mosquito bat, is integrated into the system. If unauthorized access or tampering is detected, the shock mechanism can be remotely activated, providing an additional deterrent against theft or vandalism. This combination of facial recognition and shock protection ensures both user authentication and a swift response to potential threats, contributing to a comprehensive anti-theft system. Fig 6.1 Assembled proposed system with all components

This is the result of our Project where the unknown person unlock door of the Vehicle ,it will not open and gives the



Electric



Fig 3.2.6 Working flow chart

Shock to that person incase the owner of default person's face detects while opening the door, it will open This will provide Antitheft Detection and also provides the solution for the theft kind of Activities in the vehicle with the help of DIP and gives best Security System to authorized person.

The below figure shows the experimental set up of our method wherein a circuit board is present to process the data

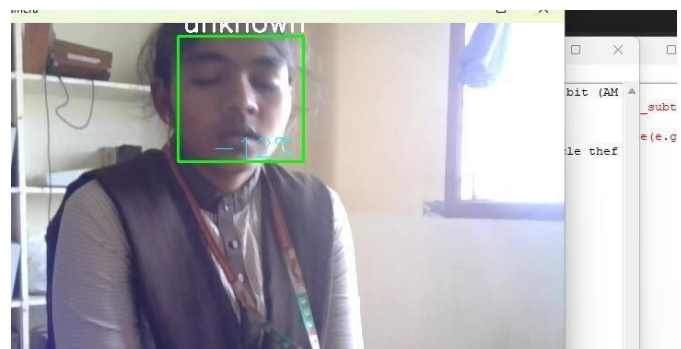


Fig 6.2 Unkown person screenshot

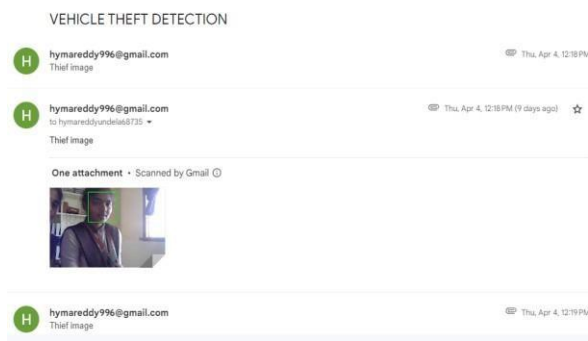
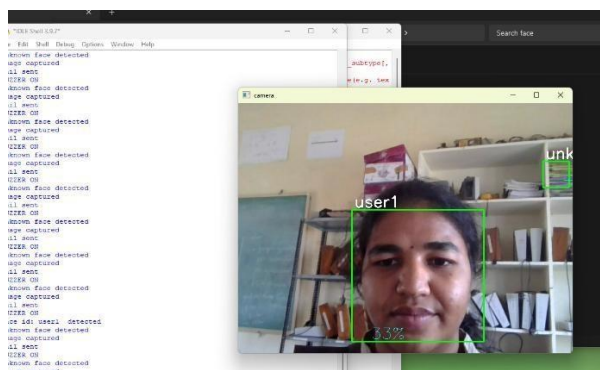


Fig 6.3 Mail alert of their image

(6.3) By the figure we come to a conclusion that the owner of the vehicle is the true identity person. (6.4) By this figure we could form a conclusion that the owner of the vehicle is not the true identity person but someone with the intention of theft.



preferences, fostering greater acceptance and adoption of the technology in practical settings.

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X. CONCLUSION

In conclusion, the project on "Vehicle Anti-Theft Detection and Protection with Shock using Facial Recognition" represents a significant advancement in vehicle security technology. By integrating facial recognition systems and shock mechanisms, the project aims to provide robust protection against vehicle theft and unauthorized access. Throughout the development and implementation phases, several key insights and outcomes have emerged, highlighting the effectiveness and potential of the system. Firstly, the project underscores the importance of adopting multifaceted security solutions to safeguard vehicles in an increasingly complex threat landscape. Traditional security measures, such as mechanical locks and alarms, have proven vulnerable to sophisticated theft techniques. In contrast, the integration of facial recognition technology adds an additional layer of authentication, ensuring that only authorized

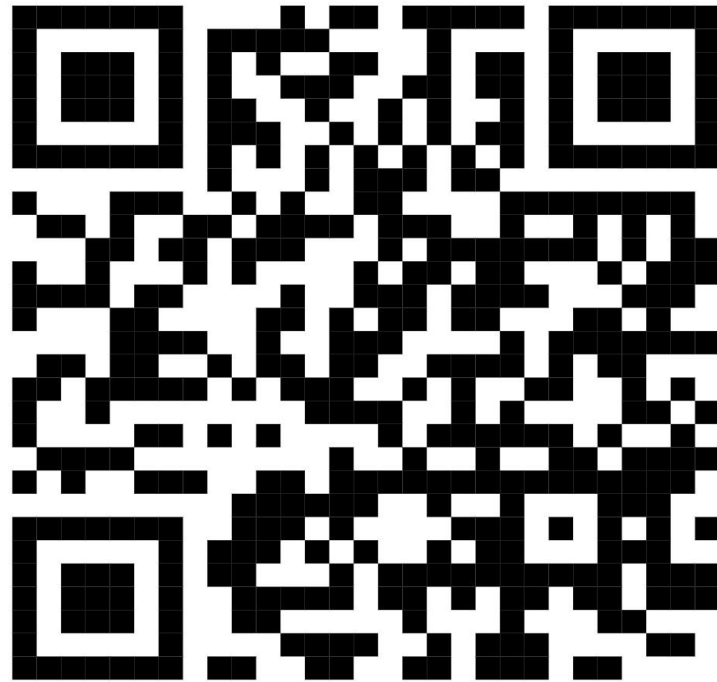
individuals can access the vehicle. Moreover, the incorporation of shock mechanisms acts as a deterrent, further enhancing the security posture



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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING



BATCH MEMBERS

SIGNATURE

1 UNDELA HYMA REDDY

U.HYMA REDDY

2 SURAM JAHNAVI

S JAHNAVI

3 VALERU THANYA

V THANYA

4 PUTLA VANDANA

P VANDANA

SIGNATURE OF GUIDE

SIGNATURE OF HOD