IoT-BASED WIRELESS SECURITY SYSTEM FOR THEFT PREVENTION

A Project Report

Submitted in Partial Fulfilment of Requirements for the Award of the Degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

By

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

RISE Krishna Sai Prakasam Group of Institutions::Ongole

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NH-16, Valluru, -523272, Ongole, Prakasam District, A.P

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CERTIFICATE

This is to certify that the project work entitled **"IoT-BASED WIRELESS SECURITY SYSTEM FOR THEFT PREVENTION"** is a bonafide record of project work done jointly by **N.V.SASIPRIYA (208A1A0467) , SK.SULTHAN BI (208A1A0473) ,V.RAHUL (208A1A04A2), K.CHANDRASEKHARA BALAJI (208A1A0488)** under my guidance and supervision and is submitted in partial fulfilment of the requirements for the award of the Degree of Bachelor of Technology in Electronics & Communication Engineering by Jawaharlal Nehru Technological University , Kakinada during the academic year 2023-2024.

PROJECT GUIDE
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Department of Electronics & Communication Engineering

Vision of the Institute	To be a premier institution in technical education by creating professionals of global standards with ethics and social responsibility for the development of the nation and the mankind.
Mission of the Institute	Impart Outcome Based Education through well qualified and dedicated faculty.
	Provide state-of-the-art infrastructure and facilities for applicationoriented research.
	Reinforce technical skills with life skills and entrepreneurship skills.
	Promote cutting-edge technologies to produce industry-ready Professionals.
	Facilitate interaction with all stakeholders of foster ideas and innovation.
	Inculcate moral values, professional ethics and social responsibility
Vision of the Department	To become a center of excellence in Electronics and Communication Engineering to meet the global, technological and industrial requirements.
Mission of the Department	Provide modern technical knowledge, professional skills and attitude to meet industry needs.
	Promote innovations through professional training and development.
	Develop a team with professional ethics and social responsibility.

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Program Educational Objectives (PEOs):

Graduates of the program will be able to

PEO1: Core Skills	Intensive and extensive engineering knowledge and skill to understand, analyze, design and create novel products and solutions in the field of Signal Processing, Communication Systems, Embedded Systems and VLSI.
PEO2: Problem Solving and Lifelong Learning	Capability to pursue career in industry or higher studies with continuous learning.
PEO3: Entrepreneurship Skills	Leadership qualities, team spirit, multi-disciplinary approach, character Moulding and lifelong learning for a successful professional career.
PEO4: Professionalism	Professional and ethical attitude, effective communication skills, and sense of responsibility toward society.

Program Outcomes (POs):

PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment 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.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**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 and receive clear instructions.
PO11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs):

A student of the Electronics and Communication Engineering Program will be able to

PSO1	Design and implementation of complex systems by applying basic concepts in Electronics & Communication Engineering to Electronics, Communications, Signal Processing, VLSI, Embedded Systems (**Core Skills**).
PSO2	Solve complex Electronics and Communication Engineering problems, using hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions relevant to the society (**Problem-Solving Skills**).
PSO3	Quality in technical subjects for successful higher studies and employment (**Professional Career**).

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Department of Electronics & Communication Engineering

Project Outcomes

Name of the Course : Project Work **Year & Semester** : IV Year II Sem
Academic Year : 2023-2024 **Regulation** : R20

Co. No	Project outcome	BTL
	After completing this project the student will be able to	
C421.1	Envisaging applications for societal needs	Evaluating
C421.2	Develops skills for analysis and synthesis of practical systems	Creating
C421.3	Acquire the use of new tools effectively and creatively	Creating
C421.4	Work in team to carry out analysis and cost-effective, environmental friendly designs of engineering systems	Creating
C421.5	Write Technical / Project reports and oral presentation of the work done to an audience	Evaluating
C421.6	Demonstrate a product developed	Creating

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Name of the Course : Project Work **Year & Semester** : IV Year II Sem
Academic Year : 2023-2024 **Regulation** : R20

CO Vs PO Mapping

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C421.1	2	2	3	3	3	3	2	2	3	2	2	2
C421.2	2	2	3	3	3	3	2	2	3	3	3	3
C432.3	2	2	3	3	3	3	2	2	3	2	2	2
C421.4	2	2	3	3	3	3	3	3	3	3	3	3
C421.5	2	2	3	2	3	3	2	3	3	3	3	3
C421.6	2	2	2	2	3	3	3	3	3	3	3	3
C421	**2.00**	**2.00**	**2.83**	**2.67**	**3.00**	**3.00**	**2.33**	**2.50**	**3.00**	**2.67**	**2.67**	**2.67**

CO Vs PSO Mapping

Course Outcomes(COs)	PSO1	PSO2	PSO3
C421.1	3	3	3
C421.2	3	3	3
C421.3	3	3	3
C421.4	3	3	3
C421.5	2	2	2
C421.6	3	3	3
C421	**2.83**	**2.83**	**2.83**

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ABSTRACT

The Internet of Things is a significant component of many modern applications, including smart homes and smart transportation systems. The main issue that individuals in society are dealing with is vehicle theft. Currently almost of the public having an own vehicle, theft is happening on parking and sometimes driving insecurity places. The safe of vehicles is extremely essential for public vehicles. According to a statistical assessment, only one out of every four stolen vehicles gets found. The current solutions lock the car with a key and a remote. There are CCTV cameras everywhere, and they are used to find the stolen car. But not every location has CCTV cameras. Quick recovery of a stolen car can be facilitated by having control of the vehicle and knowing where it is even after theft.

The suggested solution uses GPS to assist in locating the vehicle and progressively lowers the vehicle's speed by slowing down the ignition motor. Finding the car as soon as you learn it's stolen is beneficial. The GPS technology allows for the tracking of the vehicle's where abouts. The IoT system, which is interfaced with a controller and receives the command from the smartphone, slows down and immobilizes the ignition motor. If a car is stolen or lost, the designed system can aid in its recovery because it is dependable, affordable, secured, reliable, low cost and easy to use.

Keywords: IoT, Smartphone, Ignition motor, GPS, Arduino UNO

CHAPTER-1
INTRODUCTION

1.1 Introduction:

Approximately 36,000 vehicles, valued at approximately Rs. 115 crores, are stolen annually in India. Only 14,500 of these have a traceable count of the vehicle. Many car thefts occur in locations with lower levels of safety. People steal a lot of cars because there is a good chance of getting away with it. When cars are left in an unsuitable manner and with less security, there may be a high risk of vehicle theft. The number of attempts made by thieves to take the car can be decreased by installing anti-theft systems in the vehicle. A total of 16 crore automobiles were registered in the nation in 2012, of which 1.7 lakh were reported stolen. Despite all of the assurances made by law enforcement to reduce car thefts, data presented in the Lok Sabha indicates that 1.65 lakh automobiles were taken in 2013 alone. With the use of the extra set of keys, the owner of the car frequently permits his driver or any member of his family to operate the vehicle. However, the thieves misuse this technique. Within the owner's car, they can locate another set of keys and attempt to start the vehicle using these keys. One type of theft is opportunistic, where the owner intentionally parks their car in an unattended area where the key is visible. Many car thefts also occur during test drives, when the thief can easily identify where the keys are kept in the car. The car may eventually be taken by the thief. Because each vehicle has to be tracked at all times, tracking systems were first created for the shipping sector. GPS technology is used to determine the vehicle's current location, which is then sent over a IoT modem. The GPS/IoT Based System is one of the most important systems, which integrate both IoT and GPS technologies. It is necessary due to the many of applications of both IoT and GPS systems and the wide usage of them by millions of people throughout the world . This system designed for users in land construction and transport business, provides real-time information such as location, speed and expected arrival time of the user is moving vehicles in a concise and easy-to-read format. This system may also useful for communication process among the two points. There are two phases to the work that is suggested in this. 1) Determining where the car is 2) Making the car unusable. After then, it is possible to quickly and simply locate the vehicle's location. 3) It offers the following features: door lock controls, remote car immobilization, and tracking and recovery of stolen vehicles. This technology can be used to track the location of the vehicle and monitor it when it is transporting valuables in order to determine the status of the deliveries of the goods it is carrying.

1.2 Introduction to Embedded Systems

Each day, our lives become more dependent on 'embedded systems', digital information technology that is embedded in our environment. More than 98% of processors applied today are in embedded systems, and are no longer visible to the customer as 'computers' in the ordinary sense. An Embedded System is a special-purpose system in which the computer is completely encapsulated by or dedicated to the device or system it controls. Unlike a general-purpose computer, such as a personal computer, an embedded system performs one or a few pre-defined tasks, usually with very specific requirements. Since the system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product. Embedded systems are often mass-produced, benefiting from economies of scale. The increasing use of PC hardware is one of the most important developments in high-end embedded systems in recent years. Hardware costs of high-end systems have dropped dramatically as a result of this trend, making feasible some projects which previously would not have been done because of the high cost of non-PC-based embedded hardware. But software choices for the embedded PC platform are not nearly as attractive as the hardware.

Typically, an embedded system is housed on a single microprocessor board with the programs stored in ROM. Virtually all appliances that have a digital interface -- watches, microwaves, VCRs, cars -- utilize embedded systems. Some embedded systems include an operating system, but many are so specialized that the entire logic can be implemented as a single program.

Physically, Embedded Systems range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights, factory controllers, or the systems controlling nuclear power plants.

In terms of complexity embedded systems can range from very simple with a single microcontroller chip, to very complex with multiple units, peripherals and networks mounted inside a large chassis or enclosure.

1.3 Definition of an Embedded System:

Embedded system is defined as, For a particular/specific application implementing the software code to interact directly with that particular hardware what we built. Software is used for providing features and flexibility, Hardware = {Processors, ASICs, Memory, is used for Performance (& sometimes security) There are many definitions of embedded system but all of these can be combined into a single concept. An embedded system is a special purpose computer system that is used for particular task.

1.4 Features of Embedded Systems:

The versatility of the embedded computer system lends itself to utility in all kinds of enterprises, from the simplification of deliverable products to a reduction in costs in their development and manufacture. Complex systems with rich functionality employ special operating systems that take into account major characteristics of embedded systems. Embedded operating systems have minimized footprint and may follow real-time operating system specifics. The special computers system is usually less powerful than general-purpose systems, although some expectations do exist where embedded systems are very powerful and complicated. Usually a low power consumption CPU with a limited amount of memory is used in embedded systems. Many embedded systems use very small operating systems; most of these provide very limited operating system capabilities.

Since the embedded system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product, or increasing the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale.

Some embedded systems have to operate in extreme environment conditions such as very high temperature & humidity.

For high volume systems such as portable music players or mobile phones, minimizing cost is usually the primary design consideration. Engineers typically select hardware that is just "good enough" to implement the necessary functions.

For low volume or prototype embedded systems, general purpose computers may be adapted by limiting the programs or by replacing the operating system with a real-time operating system.

1.5 Characteristics of Embedded Systems:

Embedded computing systems generally exhibit rich functionality—complex functionality is usually the reason for introducing CPUs into the design. However, they also exhibit many non- functional requirements that make the task especially challenging:

- Real-time deadlines that will cause system failure if not met;
- Multi-rate operation;
- In many cases, low power consumption;
- Low manufacturing cost, which often means limited code size.

Workstation programmers often concentrate on functionality. They may consider the performance characteristics of a few computational kernels of their software, but rarely analyze the total application. They almost never consider power consumption and manufacturing cost.

1.6 Overview of an Embedded System Architecture:

Every Embedded system consists of a custom-built hardware built around a central processing unit. This hardware also contains memory chips onto which the software is loaded. The operating system runs above the hardware and the application software runs above the operating system. The same architecture is applicable to any computer including desktop computer. However these are significant differences. It is not compulsory to have an operating system in every embedded system. For small applications such as remote control units, air conditioners, toys etc.

1.7 Applications of Embedded Systems:

Some of the most common embedded systems used in everyday life are:

Small embedded controllers:	8-bit CPUs dominate, simple or no operating system (e.g., thermostats)
Control systems:	Often use DSP chip for control computations (e.g., automotive engine control)
Distributed embedded control:	Mixture of large and small nodes on a real-time Embedded networks(e.g., cars, elevators, factory automation)
System on chip:	ASIC design tailored to application area (e.g., consumer electronics, set-top boxes)
Network equipment:	Emphasis on data movement/packet flow (e.g., network switches; telephone switches)
Critical systems:	Safety and mission critical computing (e.g., pacemakers, automatic trains)
Signal processing:	Often use DSP chips for vision, audio, or other signal Processing (e.g., face recognition)
Robotics:	Uses various types of embedded computing (especially Vision and control) (e.g., autonomous vehicles)
Computer peripherals:	Disk drives, keyboards, laser printers, etc.
Wireless systems:	Wireless network-connected “sensor networks” and “Motes” to gather and report information
Embedded PCs:	Palmtop and small form factor PCs embedded into Equipmen

Home Appliances, intercom, telephones, security systems, garage door openers, answering machines, fax machines, home computers, TVs, cable TV tuner, VCR, camcorder, remote controls, video games, cellular phones, musical instruments, sewing machines, lighting control, paging, camera, pinball machines, toys, exercise equipment

1.8 Types Of Embedded Systems:

Based on functionality and performance embedded systems categorized as 4 types

1. Stand alone embedded systems
2. Real time embedded systems
3. Networked information appliances
4. Mobile devices

1.8.1 Stand Alone Embedded Systems:

As the name implies, stand alone systems work in stand alone mode. They take i/p, process them and produce the desire o/p. The i/p can be an electrical signal from transducer or temperature signal or commands from human being. The o/p can be electrical signal to drive another system an led or LCD display

Ex: digital camera, microwave oven, CD player, Air conditioner etc.

1.8.2 Real Time Embedded Systems:

In this type of an embedded system a specific work has to be complete in a particular period of time.

Hard Real time systems: - embedded real time used in missiles

Soft Real time systems: - DVD players

1.8.3 Networked Information Appliances:-

Embedded systems that are provided with n/w interfaces and accessed by n/w such as local area n/w or internet are called Network Information Appliances

Ex A web camera is connected to the internet. Camera can send pictures in real time to any computers connected to the internet

1.8.4 Mobile Devices:-

Actually it is a combination of both VLSI and Embedded System

Mobile devices such as Mobile phone, Personal digital assistants, smart phones etc are special category of embedded systems

1.9 Microcontroller Versus Microprocessor

A system designer using a general-purpose microprocessor such as the Pentium or the 68040 must add RAM, ROM, I/O ports, and timers externally to make them functional. Although the addition of external RAM, ROM, and I/O ports makes these systems bulkier and much more expensive, they have the advantage of versatility such that the designer can decide on the amount of RAM, ROM and I/O ports needed to fit the task at hand.

A Microcontroller has a CPU (a microprocessor) in addition to a fixed amount of RAM, ROM, I/O ports, and a timer all on a single chip. In other words, the processor, the RAM, ROM, I/O ports and the timer are all embedded together on one chip; therefore, the designer cannot add any external memory, I/O ports, or timer to it. The fixed amount of on-chip ROM, RAM, and number of I/O ports in Microcontrollers makes them ideal for many applications in which cost and space are critical.

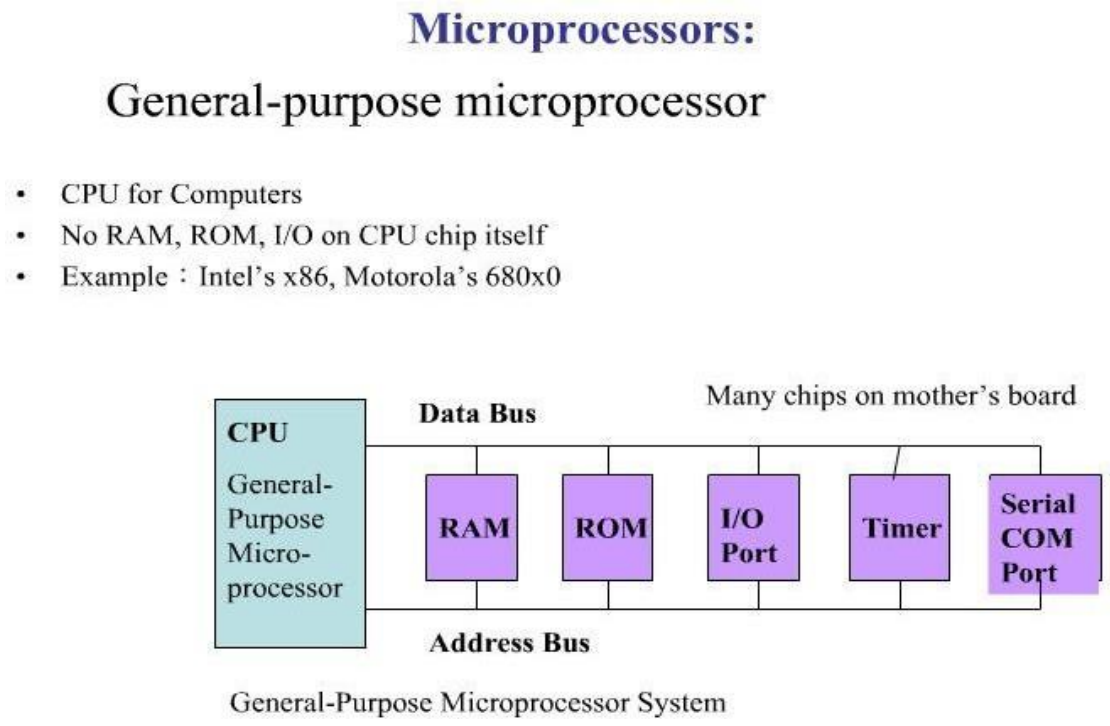


Fig 1.1: Microprocessor

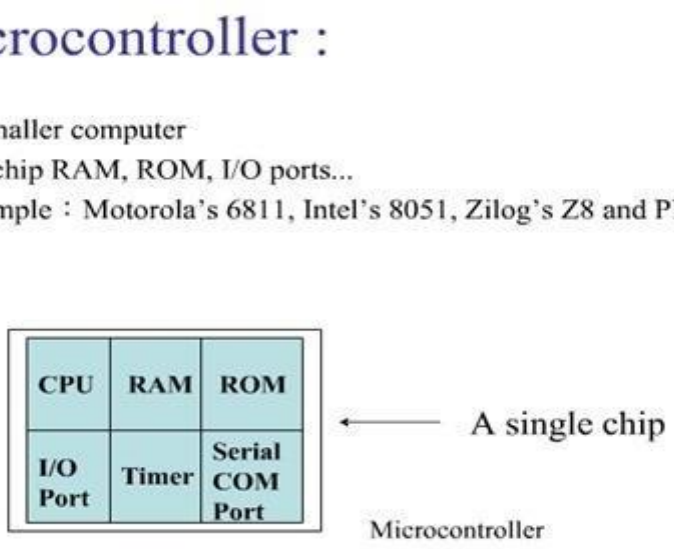


Fig 1.2: Microcontroller

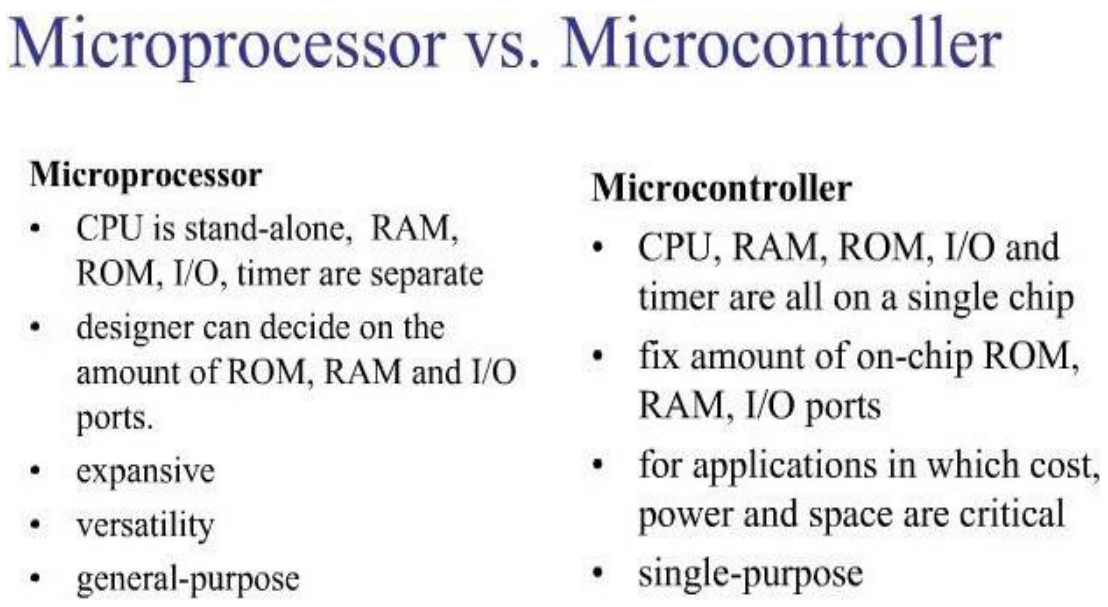


Fig 1.3: Microprocessor vs Microcontroller

CHAPTER-2

LITERATURE SURVEY

[2.1] Automated Navigation And Mobile Vehicle Control Using Wireless Sensor Network Technology.

Author: Young, Kar-Keung D.

Year: 2008.

In this , a new idea for automated mobile platform navigation and control is presented. To give the mobile platform embedded control system navigational data, it makes use of an ad hoc mobile wireless sensor network. The real-time, multi-thread software for the embedded controller is implemented utilizing a real-time Linux operating system framework on a single board computer with an ARM9 SOC. In this,they have conducted multiple interior tests of the automated navigation and control concept using a wheel-based mobile platform, and the results match our initial design objectives.

[2.2] An Android Application Sandbox System For Suspicious Software Detection.

Authors: Bläsing, T., Batyuk, L., Schmidt, A. D., Camtepe, S. A., & Albayrak, S.

Year: 2010.

Smartphones are steadily gaining popularity, creating new application areas as their capabilities increase in terms of computational power, sensors and communication. Emerging new features of mobile devices give opportunity to new threats. Android is one of the newer operating systems targeting smartphones. While being based on a Linux kernel, Android has unique properties and specific limitations due to its mobile nature. This makes it harder to detect and react upon malware attacks if using conventional techniques. In this paper, we propose an Android Application Sandbox (AASandbox) which is able to perform both static and dynamic analysis on Android programs to automatically detect suspicious applications. Static analysis scans the software for malicious patterns without installing it. Dynamic analysis executes the application in a fully isolated environment, i.e. sandbox, which intervenes and logs low-level interactions with the system for further analysis. Both the sandbox and the detection algorithms can be deployed in the cloud, providing a fast and distributed detection of suspicious software in a mobile software store akin to Google's Android Market. Additionally, AASandbox might be used to improve the efficiency of classical anti-virus applications available for the Android operating system.

[2.3] Cloud Computing Based Vehicle Tracking Information Systems.

Author: Albert Alexe, R.Ezhilarasie .

Year: 2011.

For Optimal Resource Management Techniques, cloud computing refers to internet-based computing (ORMT). Resource speed prediction, resource tracking, resource monitoring, and resource discovery are presented via a mobile cloud resource access in a vehicular ad hoc network (VANET). It also uses the historic distance computation technique and mobile routing service. This method is for the owner, occupants, or caregivers of the passengers who are willing to know the speed of their vehicle to find out how fast it is traveling. In this case, the resource serves as a vehicle, and the time and speed metrics for Quality of Service (QoS) monitoring. When this technology detects a car exceeding the speed limit, it alerts that vehicle. The car tracking system helps consumers avoid waiting times in two ways: first, for public users, and second, for interior passengers looking for a specific vehicle via VANET. In smart cities, The Way 1 tracks the present location of the car for an external passenger. Way 2 shows the inside passenger route map and the vehicle's current location. When keeping an eye on a car's loading, it keeps an eye on every passenger as well as the luggage. In smart cities, the resource discovery technique uses VANET to collect all vehicle data.

[2.4] Vehicle Tracking and Locking System Based on GSM and GPS.

Author: R.Ramani , S.Valamarthy.

Year: 2013.

Since practically everyone owns a car these days, theft occurs frequently when parking and occasionally while driving in unsafe locations. For vehicles used by the public, safety is paramount. The car is equipped with a tracking and locking system that allows it to track its whereabouts and lock its engine. The location of the car was determined by mobile communication using the Global Positioning System (GPS) and Global System (GSM). These devices continuously monitor a moving vehicle and provide status updates as needed. Once the theft has been recognized, the perpetrator sends an SMS to the microcontroller, which subsequently sends out control signals to turn off the engine. To restart the car and unlock the door, an authorized user must send the controller the password. This is less expensive, more dependable, and safer.

[2.5] A Research On Smart Transportation Using Sensors And Embedded Systems.

Author: Prabhu, B. Antony, A. J. & Balakumar, N.

Year: 2013.

Intelligent transportation systems (ITS) are sophisticated applications that strive to offer novel services related to various modes of transportation and traffic management, without actually being intelligent in the traditional sense. They also help different users become more informed and utilize transportation networks in a safer, more coordinated, and "smarter" manner. The lifeblood of contemporary industrialized nations is highway mobility. The bigger routes are severely overloaded; in the vicinity of the major cities, excessive traffic reduces most freeway travel during peak hours to less than 60 km/h. All told, heavy traffic delays more than five billion hours annually, wastes countless fuel gallons, and unnecessarily increases exhaust emissions. This paper's primary objective is to reduce driving's strain and accident rate, particularly on lengthy trips. This can be accomplished by including roadside technologies that would enable the congested highway system to be used more effectively and by integrating the highway itself into the driving experience. The car will have automated steering, braking, and throttle.

[2.6] An Efficient Signal Acquisition With An Adaptive Rate A/D Conversion.

Authors: Qaisar, S. M., Yahiaoui, R., & Gharbi, T.

Year: 2013.

The analog to digital conversion is an elementary part of the modern electronic systems. Almost all existing ADCs (Analog to Digital Converters) are based on the uniform sampling theory. It makes the signal acquisition time-invariant. Therefore, it can render a useless increase of the system activity, especially in the case of sporadic signals. Thus, an adaptive rate ADC which is based on the cross-level sampling is devised. It can adapt its conversion activity according to the input signal local variations. Therefore, it provides an intelligent signal acquisition which leads towards an efficient solution. The proposed ADC performance is studied for a speech acquisition. Results show a drastic reduction in the acquired number of samples and therefore promise a significant enhancement in the system power efficiency compared to the classical approach. A method to measure the proposed converter resolution is described. Moreover, its design flow is also presented.

[2.7] Adaptive Speed Control And Vehicle Security Using Speech Processing.

Authors: G.Kiruthikamani , E.Esakivigneswaran.

Year: 2015.

This Project aims at the design of a security system for automobiles and safety of pedestrians. This security system controls the door opening for the authenticated user, by means of speech processing, preventing theft of vehicle. As no physical key is required, this method leads to ease of use. Effective speed control in restricted areas plays a crucial role in today's environment particularly in specific zones. In this security system, the vehicle speed is controlled in specific restricted zones by means of radio frequency identification (RF-ID) technology providing security of pedestrians.

[2.8] Embedded Smart Car Security System on Face Detection.

Authors: Vikram Kulkarni & Viswaprakash Babu.

Year: 2015.

In this proposed embedded car security system, FDS(Face Detection System) is used to detect the face of the driver and compare it with the predefined face. For example, in the night when the car's owner is sleeping and someone theft the car then FDS obtains images by one tiny web camera which can be hidden easily in somewhere in the car. FDS compares the obtained image with the predefined images if the image doesn't match, then the information is sent to the owner through MMS. So now owner can obtain the image of the thief in his mobile as well as he can trace the location through GPS. The location of the car as well as its speed can be displayed to the owner through SMS. So by using this system, owner can identify the thief image as well as the location of the car This system prototype is built on the base of one embedded platform in which one SoC named "SEP4020"(works at 100MHz) controls all the processes .Experimental results illuminate the validity of this car security system.

[2.9] Vision-Based Unmanned Aerial Vehicle Detection for Sense and Avoid Systems.

Author: Krishna Raj Sapkota1, Steven Roelofsen.

Year: 2016.

In the framework of sense and avoid systems, we offer an approach for the on-line identification of small Unmanned Aerial Vehicles (UAVs) and the estimation of their relative positions and velocities in the 3D environment from a single moving camera.

Because there are no identifiers on the available targets, this problem presents challenges for both detection and tracking because of misdetection and false positives.

with limited payload. We suggest a multi-staged system to tackle these problems, which combines an on-line visual tracking algorithm, a recent sensor fusion and state.

[2.10] A Wireless Controlled Digital Car Lock for Smart Transportation.

Authors: L. Jamjoom, A. Alshmarani.

Year: 2018.

The Internet of Things or IoT, is becoming a significant aspect of modern life. It is used in many different applications, such as intelligent transportation systems, smart grids, and smart buildings. Advancing Internet of Things (IoT) applications in intelligent transportation systems is the goal of this research. The goal is to create an educational wireless vehicle lock demonstration powered by a smartphone. Every time someone with permission needs a car, they first submit a request online to a server-based application. The request is approved if a car is available, and vice versa. If such authorization is granted, a digital code is texted to the original car requester's smartphone. A specially designed Android-based application is created to transmit the digital code that was received on the smartphone to the front end embedded controller. The MIT Inventor app is used in its development. Installed on the smartphone, this program connects via Bluetooth to the digital car lock with an incorporated front-end controller. The concerned party uses this application to send the intended code to lock or unlock the vehicle. Through the Bluetooth interface, the command is sent to the front-end embedded controller. Following recognition, the front-end module executes the received instruction and returns a flag to the soft application running on the smartphone. The relevant vehicle's status, along with the time and date, is updated on the cloud and registered in the application platform. With a passcode, it enables worldwide access to this data at any time.

CHAPTER-3

EXISTING SYSTEM

➤Various vehicle anti-theft devices have been developed lately, however the result is still disappointing since all kinds of devices have its drawbacks.

➤Domestic and overseas vehicle anti-theft products are technologically classified into two categories:

3.1 Vehicle Alarm System:

It consists of an array of sensors which includes switches, pressure sensors, and motion detectors. Often a siren creates a variety of distinct sound that helps user to identify the vehicle. The advanced touch mechanism detects the touch and generates the alarm thereby helping the user to protect the vehicle.

Fig 3.1: Vehicle Alaram System

3.2 GPS Vehicle Tracking System:

This device with the help of GPS and GSM technology tracks and locates vehicles that are stolen. The vehicle is fitted with a device that consists of both GPS and GSM module. Whenever the user asks the vehicle for its location the GPS sends its coordinates through the GSM module. The vehicle also notifies the user when the key position is turned to ignition and the vehicle starts to move. The location of the vehicle is continuously updated to a database even when the user doesn't ask for the coordinates. Whenever the user requests the coordinates are retrieved from the database and sent to the user.

fig 1.2 GPS Vehicle Tracking System

Fig 3.2: GPS Vehicle Tracking System

3.3 Tracking Device:

In 2012, Asaad M. J. et al. developed a revolutionary technique. Using this technique, a tracking device is installed in a particular car to assist the owner in monitoring the whereabouts of the vehicle. The GPS and GSM technologies are used to do this. With this system, a car will be continuously monitored, and upon request, the owner will receive an automatic report on the status of the vehicle.

3.4 Obstacle Detection System:

In 2012, Ramya V et al. proposed an obstacle detection system. The car warns the driver of impending danger when an obstruction approaches. The driver of the car has the option to act right away to protect both the pedestrian and himself from any potential accidents. Additionally, it keeps an eye out for any harmful gas leaks in the system and alerts the owner if it detects one.

3.5 Remote Monitoring Of The Vehicle Parameters:

In 2008, Peijiang Chen et al. devised a method that allows remote monitoring of the vehicle parameters. The numerous parameters collected from the car are transmitted by GSM to a distant location, where a computer displays the data in VB.A system with a barcode scanner that reads the barcode on the object was proposed by Saranya.B, Sasikala.N, et al. The microcontroller verifies the input from the barcode scanner by comparing it to the specified code. The microcontroller will send a signal to the driver circuits to control the motor activities if the code and barcode do not match.

The speed of the vehicle is managed by communication via short-range RFID technology, according to a technique proposed by Kiruthikamani. Get al. Long distances won't be possible to use this. A system based on cloud computing technology was proposed by Albert Alexe, R. Ezhilarasie, and others. Here, sensor data is gathered, and necessary actions are made in response to that information. GPS is also used to determine the location of the car.

CHAPTER-4

PROPOSED SYSTEM

- The Arduino UNO microcontroller is used in the suggested method.
- An Arduino development board serves as the monitoring system's processing unit and handles all system control functions.
- It tracks the location of the car using GPS technology.
- The authorized person can use the internet to make a request to the server whenever a car is needed.
- If any vehicles are available, the user receives a SMS as a response from the server; if not, the user receives a request message indicating that the vehicle is unavailable.

4.1 Block Diagram:

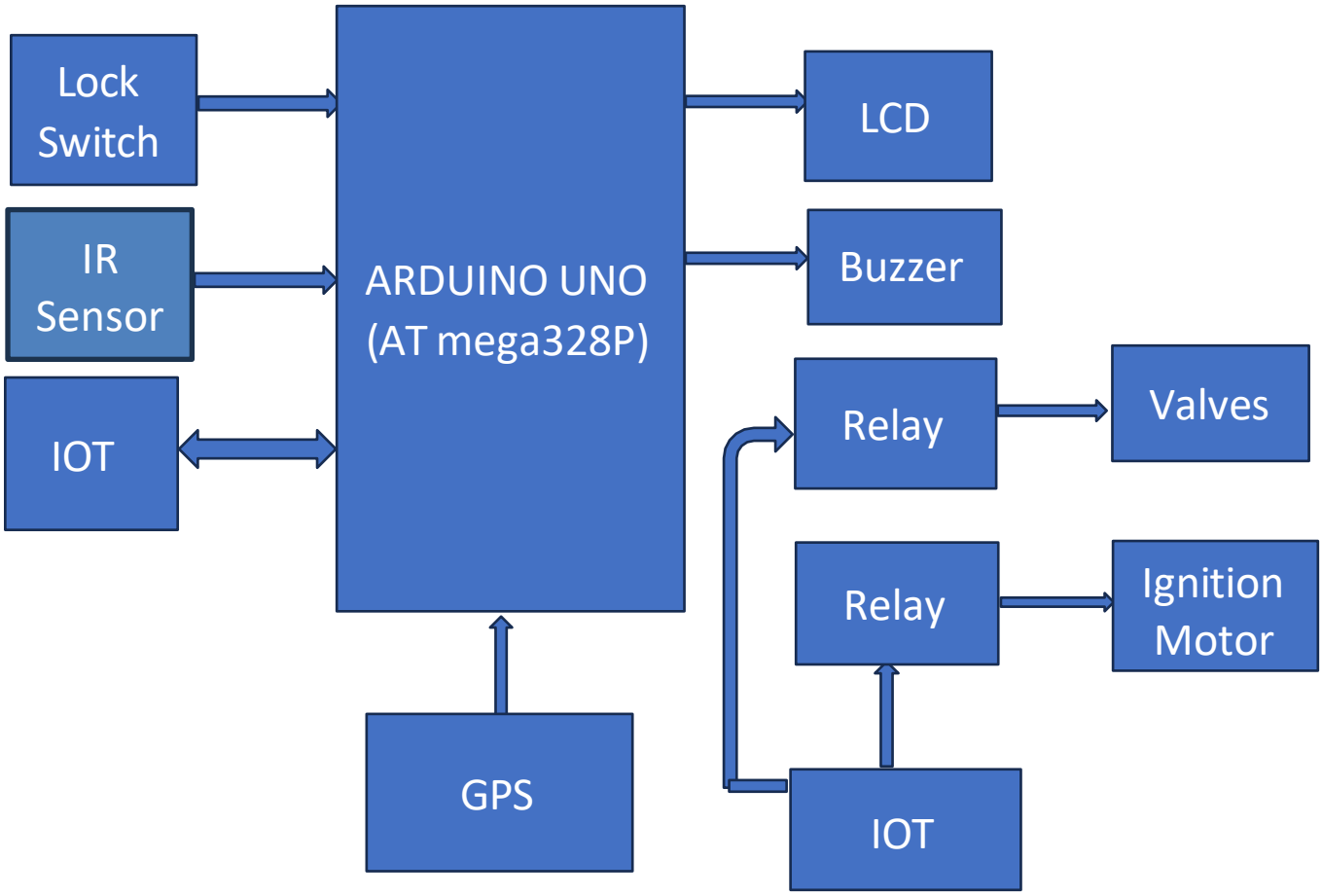


Fig 4.1: The Proposed System Block Diagram

- GPS fence is activated if the car leaves the owner's specifically designated region.
- An SMS alerting the owner of the car that it has passed the designated spot is sent.
- The buzzer activates and the vehicle owner receives an SMS if the vehicle is stolen.
- The IOT module that is interfaced with the Arduino UNO receives the ON or OFF command from the smartphone.
- When the Arduino UNO receives the command to turn off, it takes the appropriate action. In other words, it locks the car door, gradually reduces the ignition engine's speed, and closes the car's valves.
- Here, the engine is stopped, the speed is stalled, and the door is instantly locked thanks to IOT technology.
- Relay circuits are used to switch motor speeds and valves, progressively lowering them until the engine motor stops.
- The 3-axis magnetometer sensor, which serves as the tilt-compensated compass module, helps determine the precise direction of the car.
- Thus, utilizing IOT technology, the owner receives an SMS with the precise latitude and longitude of the vehicle position in that particular direction.
- This system is strong enough to take command from the owner of the car and operate it.
- Thus, this system in place can serve as a very secure theft prevention system. The vehicle's direction is also provided by the deployed system.

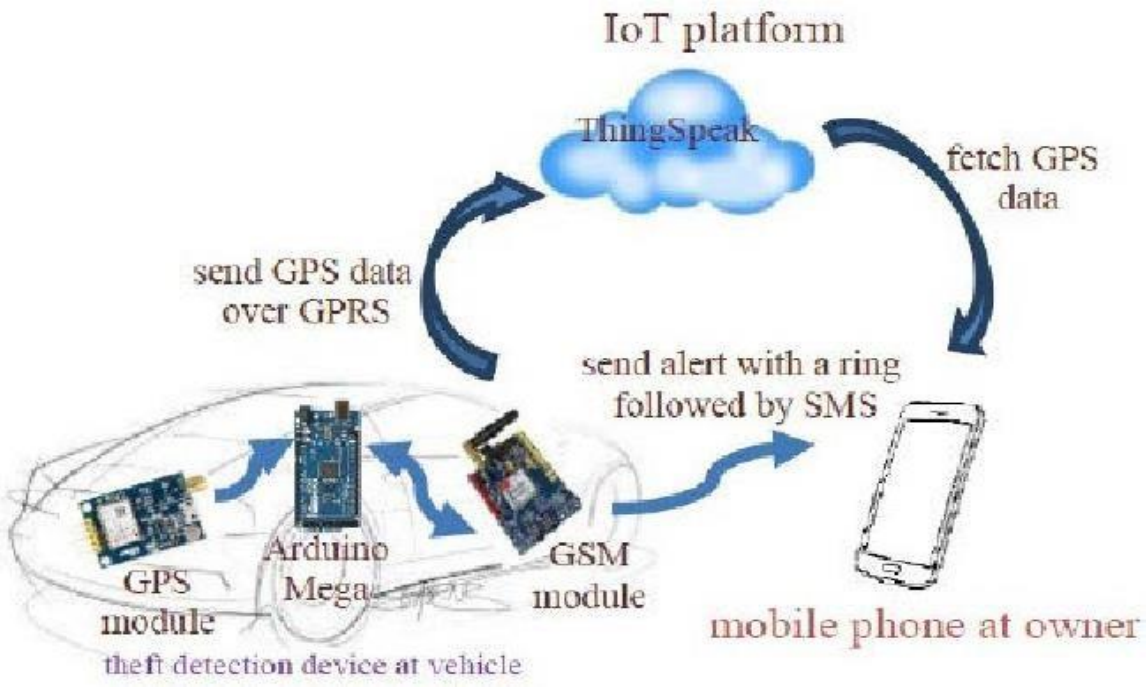


Fig 4.2: Vehicle Anti-Theft System Based On IoT

4.2 HARDWARE COMPONENTS

4.2.1 Arduino UNO ATmega328P:

Arduino is a both an open-source software library and an open-source breakout board for the popular AVR micro-controllers. The Arduino IDE (Integrated Development Environment) is the program used to write code, and comes in the form of a downloadable file on the Arduino website. The Arduino board is the physical board that stores and performs the code uploaded to it. Both the software package and the board are referred to as "Arduino."

Fig4.3: Arduino UNO ATmega328P

To begin, download the Arduino IDE from the Arduino website. Make sure to select the right version for your Operating System (OS). For a full getting started guide for each OS, please refer to the Arduino guide. Once the arduino.zip file has been downloaded, extract the file to a folder somewhere on your computer. There is no install simply open the folder and double click the .exe.

PIN configuration of Arduino

The components of Arduino UNO board are shown below:

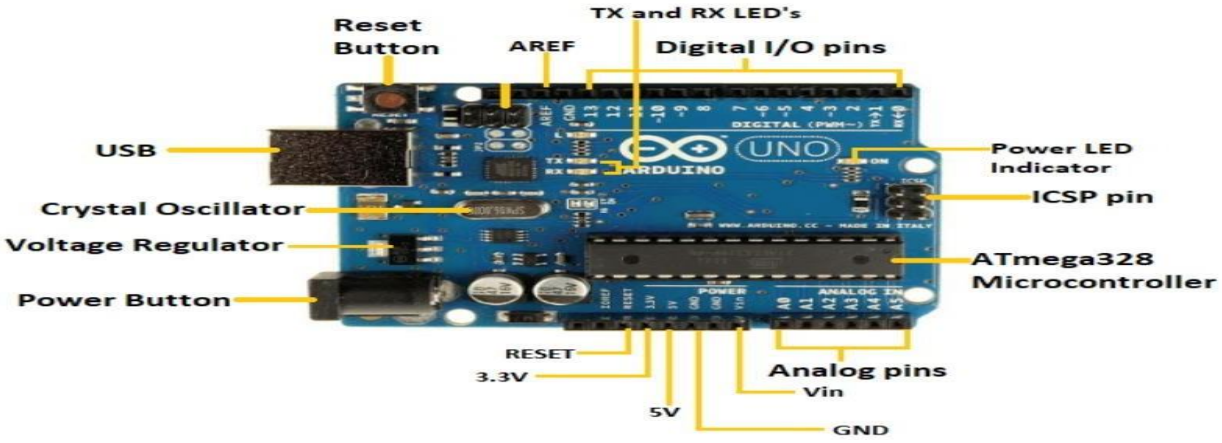


Fig 4.4: Arduino UNO Pin Configuration

Let's discuss each component in detail.

- **ATmega328 Microcontroller**- It is a single chip Microcontroller of the ATmel family. The processor code inside it is of 8-bit. It combines **Memory (SRAM, EEPROM, and Flash), Analog to Digital Converter, SPI serial ports, I/O lines, registers, timer, external and internal interrupts, and oscillator.**
- **ICSP pin** - The In-Circuit Serial Programming pin allows the user to program using the firmware of the Arduino board.
- **Power LED Indicator**- The ON status of LED shows the power is activated. When the power is OFF, the LED will not light up.
- **Digital I/O pins**- The digital pins have the value HIGH or LOW. The pins numbered from D0 to D13 are digital pins.
- **TX and RX LED's-** The successful flow of data is represented by the lighting of these LED's.
- **AREF-** The Analog Reference (AREF) pin is used to feed a reference voltage to the Arduino UNO board from the external power supply.
- **Reset button**- It is used to add a Reset button to the connection.
- **USB**- It allows the board to connect to the computer. It is essential for the programming of the Arduino UNO board.
- **Crystal Oscillator**- The Crystal oscillator has a frequency of 16MHz, which makes the Arduino UNO a powerful board.
- **Voltage Regulator**- The voltage regulator converts the input voltage to 5V.
- **GND**- Ground pins. The ground pin acts as a pin with zero voltage.
- **Vin**- It is the input voltage.
- **Analog Pins**- The pins numbered from A0 to A5 are analog pins. The function of Analog pins is to read the analog sensor used in the connection. It can also act as GPIO (General Purpose Input Output) pins.

Features of Arduino

- **ATMega328P Processor**
- **Memory**
    - AVR CPU at up to 16 MHz
    - 32KB Flash
    - 2KB SRAM
    - 1KB EEPR

4.2.2 IR Sensor:

The IR transmitter continuously emits the IR light and IR receiver Keeps on checking for the Reflected light. If the light gets reflected back by hitting any object in front it, the IR receiver receives this light. This way the object is detected in the case of the IR sensor.

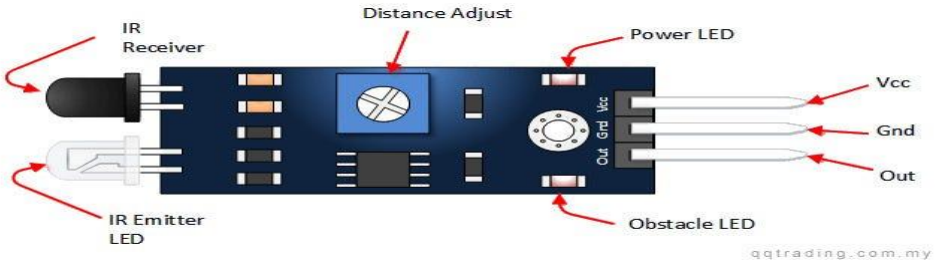


Fig 4.5:IR Sensor

Working of IR Sensor:

The white LED here is an IR LED which works as the transmitter and the component next to the IR LED is a photodiode that works as the receiver in the IR sensor.

The IR transmitter continuously emits the IR light and the IR receiver keeps on checking for the reflected light. If the light gets reflected back by hitting any object in front it, the IR receiver receives this light. This way the object is detected in the case of the IR sensor.

The blue knob here is a potentiometer. You can control the range i.e. from how far you want to detect the object by changing the value of the potentiometer.

An IR sensor has two small LED indicators – one for power, which is ON the entire time the sensor is ON; the other is the Signal LED which detects the object. The signal LED has two states or situations:

- ON (Active) when it detects an object
- OFF (Inactive) when it doesn't detect any object

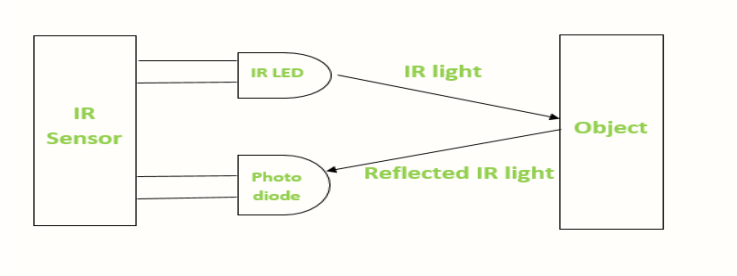


Fig 4.6: Working of IR Sensor

4.2.3 Lock Switch:

- A key switch (sometimes called a keyswitch or lock switch) is a key-operated switch.
- Key switches are used in situations where access to the switch's functions needs to be restricted. Key switches are available as components with solder connections, and are available with a variety of ampere ratings.

Fig 4.7: Lock Switch

Switch:

In electronics engineering, an ideal switch describes a switch that:

- has no current limit during its ON state
- has infinite resistance during its OFF state
- has no voltage drop across the switch during its ON state
- has no voltage limit during its OFF state
- has zero rise time and fall time during state changes
- switches without "bouncing" between on and off positions

Practical switches fall short of this ideal, and have resistance, limits on the current and voltage they can handle, finite switching time, etc. The ideal switch is often used in circuit analysis as it greatly simplifies the system of equations to be solved, however this can lead to a less accurate solution.

Selecting a Switch:

There are three important features to consider when selecting a switch:

- Contacts (e.g. single pole, double throw)
- Ratings (maximum voltage and current)
- Method of Operation (toggle, slide, key etc.)

Switch Contacts:

Several terms are used to describe switch contacts:

- Pole - number of switch contact sets.
- Throw - number of conducting positions, single or double.
- Way - number of conducting positions, three or more.
- Momentary - switch returns to its normal position when released.

For example: the simplest on-off switch has one set of contacts (single pole) and one switching position which conducts (single throw). The switch mechanism has two positions: open (off) and closed (on), but it is called 'single throw' because only one position conducts.

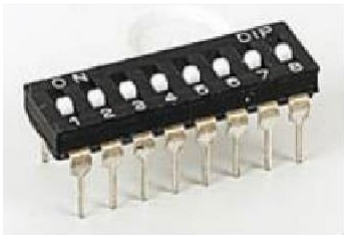
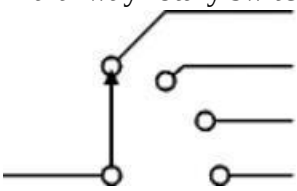
Switch Contact Ratings:

Switch contacts are rated with a maximum voltage and current, and there may be different ratings for AC and DC. The AC values are higher because the current falls to zero many times each second and an arc is less likely to form across the switch contacts.

For low voltage electronics projects the voltage rating will not matter, but you may need to check the current rating. The maximum current is less for inductive loads (coils and motors) because they cause more sparking at the contacts when switched off.

Special Switches

Type of Switch	Example
Push-Push Switch (e.g. SPST = ON-OFF) This looks like a momentary action push switch but it is a standard on-off switch: push once to switch on, push again to switch off. This is called a **latching action**.	
Microswitch (usually SPDT = ON-ON) Microswitches are designed to switch fully open or closed in response to small movements. They are available with levers and rollers attached.	
Keyswitch A key operated switch. The example shown is SPST.	
Tilt Switch (SPST) Tilt switches contain a conductive liquid and when tilted this bridges the contacts inside, closing the switch. They can be used as a sensor to detect the position of an object. Some tilt switches contain mercury which is poisonous.	

Reed Switch (usually SPST) The contacts of a reed switch are closed by bringing a small magnet near the switch. They are used in security circuits, for example to check that doors are closed. Standard reed switches are SPST (simple on-off) but SPDT (changeover) versions are also available. **Warning:** reed switches have a glass body which is easily broken!	
DIP Switch (DIP = Dual In-line Parallel) This is a set of miniature SPST on-off switches, the example shown has 8 switches. The package is the same size as a standard DIL (Dual In-Line) integrated circuit. This type of switch is used to set up circuits, e.g. setting the code of a remote control.	
Multi-way Switch Multi-way switches have 3 or more conducting positions. They may have several poles (contact sets). A popular type has a rotary action and it is available with a range of contact arrangements from 1-pole 12-way to 4-pole 3 way. The number of ways (switch positions) may be reduced by adjusting a stop under the fixing nut. For example if you need a 2-pole 5-way switch you can buy the 2-pole 6-way version and adjust the stop. Contrast this multi-way switch (many switch positions) with the multi-pole switch (many contact sets) described above.	 Multi-way rotary switch  1-pole 4-way switch symbol

4.2.4 Ignition Motor:

An ignition switch is a device in a car that is used to start the engine and control the power supply to various electrical systems. When the key is inserted and turned in the ignition switch, it activates the starter motor, which in turn starts the engine. When the key is turned to the "off" position, it cuts off power to the engine and electrical systems, effectively shutting off the car.

When the front-end microcontroller and the code from the smartphone are coupled, the DC motor is utilized to initiate and stop the vehicle's movement. These rotating electrical machines are in the class that transforms direct electrical energy into mechanical energy. It's a robotic application that uses a 12V, 100 RPM geared motor.

Fig 4.8: Ignition Motor

Whenever a motors hobbyist talk about making a motor, the first thing comes to his mind is making the motor move on the ground. And there are always two options in front of the designer whether to use a DC motor or a stepper motor. When it comes to speed, weight, size, cost... DC motors are always preferred over stepper motors. There are many things which you can do with your DC motor when interfaced with a micro controller. For example you can control the speed of motor, you can control the direction of rotation, you can also do encoding of the rotation made by DC motor i.e. keeping track of how many turns are made by your motors etc. So you can see DC motors are no less than a stepper motor.

Principle of Operation

In any electric motor, operation is based on simple electromagnetism. A current carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current -carrying conductor and an external magnetic field to generate rotational motion. Let's start by looking at a simple 2-pole DC electric motor (here dark black represents a magnet or winding with a "North" polarization, while light **color** represents a magnet or winding with a "South" polarization).

Every DC motor has six basic parts -- axle, rotor (a.k.a., armature), stator, commutator, field magnet's, and brushes. In most common DC motors, the external magnetic field is produced by high-strength permanent magnets.. The rotor (together with the axle and attached commutator) rotates with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the commutator. The above diagram shows a common motor layout -- with the rotor inside the stator (field) magnets.

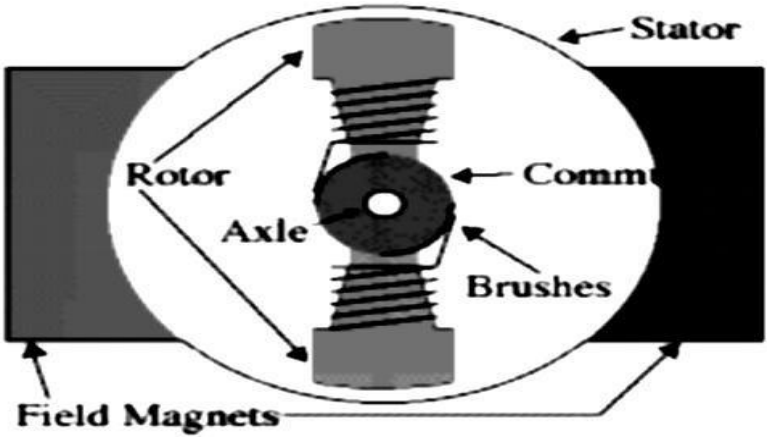


Fig 4.9: Motor Layout

The geometry of the brushes, commutator contacts, and rotor windings are such that when power is applied, the polarities of the energized winding and the stator magnet(s) are misaligned, and the rotor will rotate until it is almost aligned with the stator's field magnets. As the rotor reaches alignment, the brushes move to the next commutator contacts, and energize the next winding. Given our example two-pole motor, the rotation reverses the direction of current through the rotor winding, leading to a "flip" of the rotor's magnetic field, driving it to continue rotating.

In real life, though, DC motors will always have more than two poles (three is a very common number). In particular, this avoids "dead spots" in the commutator. You can imagine how with our example two-pole motor, if the rotor is exactly at the middle of its rotation (perfectly aligned with the field magnets), it will get "stuck" there. Meanwhile, with a two-pole motor, there is a moment where the commutator shorts out the power supply (i.e., both brushes touch both commutator contacts simultaneously). This would be bad for the power supply, waste energy, and damage motor components as well. Yet another disadvantage of such a simple motor is that it would exhibit a high amount of torque "ripple" (the amount of torque it could produce is cyclic with the position of the rotor).

D.C. Motors with field coils are classified as series. Shunt, compound and separately excited according to how the field windings and armature windings are connected. With the series wound motor the armature and fields coils are in series. Such a motor exerts the highest starting torque and has the greatest no-load speed. With light loads there is a danger that a series wound motor might run at too high a speed. Reversing the polarity of the supply to the coils has no effect on the direction of rotation of the motor, it will continue rotating in the same direction since both the field and armature currents have been reversed.

4.2.5 Relay:

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism, but other operating principles are also used. Relays find applications where it is necessary to control a circuit by a low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits, repeating the signal coming in from one circuit and re-transmitting it to another. Relays found extensive use in telephone exchanges and early computers to perform logical operations. A type of relay that can handle the high power required to directly drive an electric motor is called a contactor

Solid-state relays control power circuits with no moving parts, instead using a semiconductor device triggered by light to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protection relays".

SOLID-STATE RELAY:

A solid state relay (SSR) is a solid state electronic component that provides a similar function to an electromechanical relay but does not have any moving components, increasing long-term reliability. With early SSR's, the tradeoff came from the fact that every transistor has a small voltage drop across it. This voltage drop limited the amount of current a given SSR could handle. As transistors improved, higher current SSR's, able to handle 100 to 1,200 Amperes, have become commercially available. Compared to electromagnetic relays, they may be falsely triggered by transients.

Fig4.10: Relay

RELAY INTERFACING WITH 8051

Relays are devices which allow low power circuits to switch a relatively high Current/Voltage ON/OFF. For a relay to operate a suitable pull-in & holding current should be passed through its coil. Generally relay coils are designed to operate from a particular voltage often its 5V or 12V. **T**he function of relay driver circuit is to provide the necessary current (typically 25 to 70ma) to energize the relay coil.

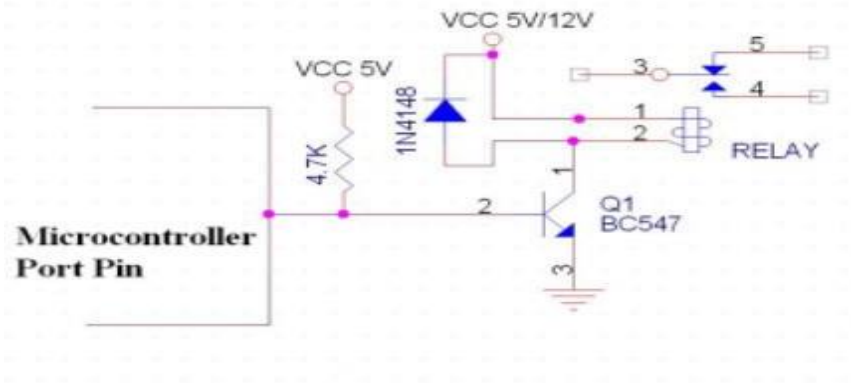
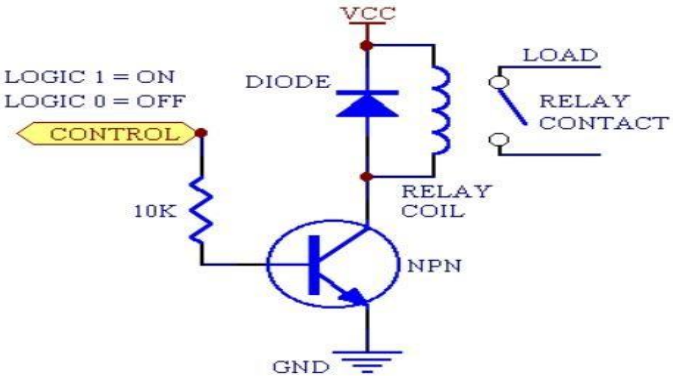


Fig 4.11: Relay Driver Circuit

Above figure shows the basic relay driver circuit. As you can see an NPN transistor BC547 is being used to control the relay. The transistor is driven into saturation (turned ON) when a LOGIC 1 is written on the PORT PIN thus turning ON the relay. The relay is turned OFF by writing LOGIC 0 on the port pin.

A diode (1N4007/1N4148) is connected across the relay coil, this is done so as to protect the transistor from damage due to the BACK EMF generated in the relay's inductive coil when the transistor is turned OFF. When the transistor is switched OFF the energy stored in the inductor is dissipated through the diode & the internal resistance of the relay coil. As you can see we have used a pull up resistor at the base of the transistor. AT8951/52/55 has an internal pull up resistor of 10k so when the pin is pulled high the current flows through this resistor so the maximum output current is 5v/10K = 0.5ma, the DC current gain of BC547 is 100 so the maximum collector current we can get is 0.5ma x 100 = 50ma, but most of the relays require more than 70ma-130ma current depending on the relay that we have used, 0.5ma of base current is not suitable enough for turning ON the relay, so we have used an external pull up resistor. When the controller pin is high current flows through the controller pin i.e. 5v/10k=0.5ma as well as through the pull up resistor. We have used 4.7k pull up resistor so 5v/4.7k=1.1ma so maximum base current can be 0.5ma + 1.1ma=1.6ma i.e. collector current =1.6ma x 100 = 160ma which is enough to turn ON most of the relays. The right relay depends on what you want to switch and how fast. What voltage, current, etc... You won't be able to drive it directly from the Arduino pin, as most general purpose relays require at least 150mW to switch which is >30mA @ 5V. You will need to use something like this



The NPN can be just about any general purpose NPN (2N2222, BC337, etc) and the diode can be most general purpose diodes (1N4001 or similar) VCC is your +5

If you go to somewhere like Farnell, and use the parametric search to narrow down you options, you will get hundreds of choices, here is an example search with 5VDC general purpose relays capable of >10A and >250VAC selected.EDIT

It seems this is to turn an ATX supply on by pulling the PC_ON (usually green) connection to ground. In this case the relay is a bit overkill, and a simple open collector NPN transistor circuit can be used:

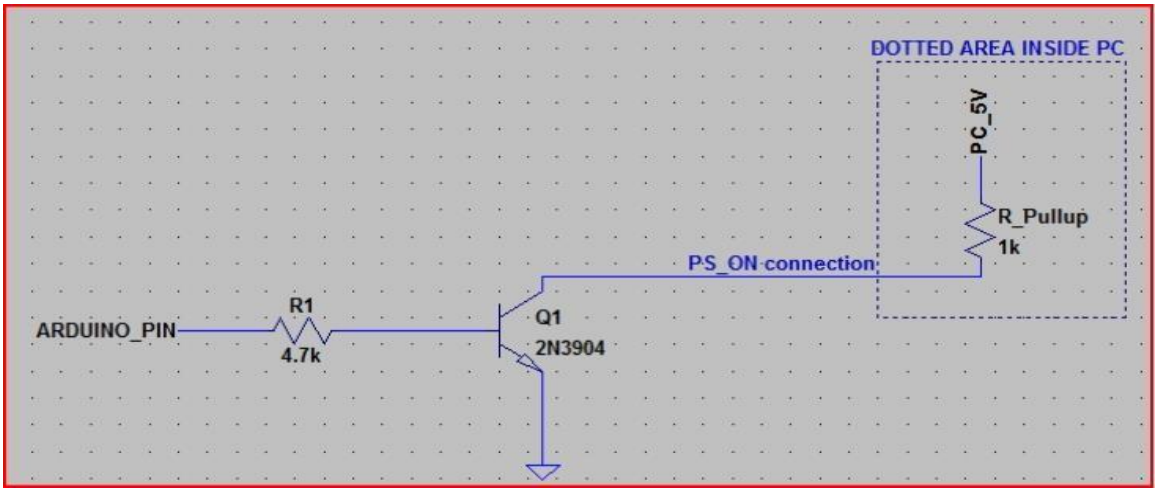


Fig 4.10: Open Collector NPN transistor Circuit

The dotted area is inside the PC, so all you need is the NPN transistor (almost any general purpose will do) and the resistor (4.7kOhm is shown, but depending on the transistor gain, R1 can be between say, 50kOhm and 1kOhm - between 1kOhm and 10kOhm should work with just about anything though)'The R pull up of 1kOhm is assuming about the worst case - it will probably be between 2kOhm and 10kOhm. The circuit as shown would work with a pull up down to around 100 ohms though if needed

4.2.6 Liquid Crystal Display(LCD):

Liquid Crystal Display also called as LCD is very helpful in providing user interface as well as for debugging purpose. The most commonly used Character based LCDs are based on Hitachi's HD44780 controller or other which are compatible with HD44580. The most commonly used LCDs found in the market today are 1 Line, 2 Line or 4 Line LCDs which have only 1 controller and support at most of 80 characters, whereas LCDs supporting more than 80 characters make use of 2 HD44780 controllers.

Pin Description:

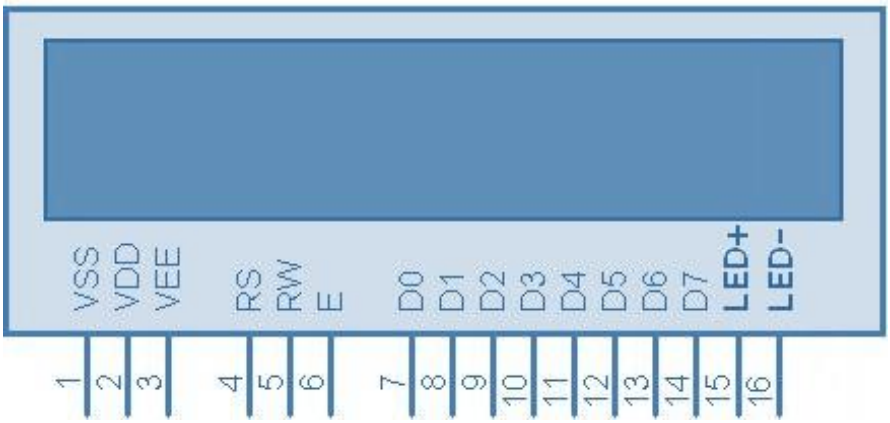


Fig4.13: LCD Pin Description

Pin No.	Name	Description
1	VSS	Power supply (GND)
2	VCC	Power supply (+5V)
3	VEE	Contrast adjust
4	RS	0 = Instruction input 1 = Data input
5	R/W	0 = Write to LCD module 1 = Read from LCD module
6	EN	Enable signal

7	D0	Data bus line 0 (LSB)
8	D1	Data bus line 1
9	D2	Data bus line 2
10	D3	Data bus line 3
11	D4	Data bus line 4
12	D5	Data bus line 5
13	D6	Data bus line 6
14	D7	Data bus line 7 (MSB)
15	LED+	Back Light VCC
16	LED-	Back Light GND

LCD INTERFACE WITH MICROCONTROLLER

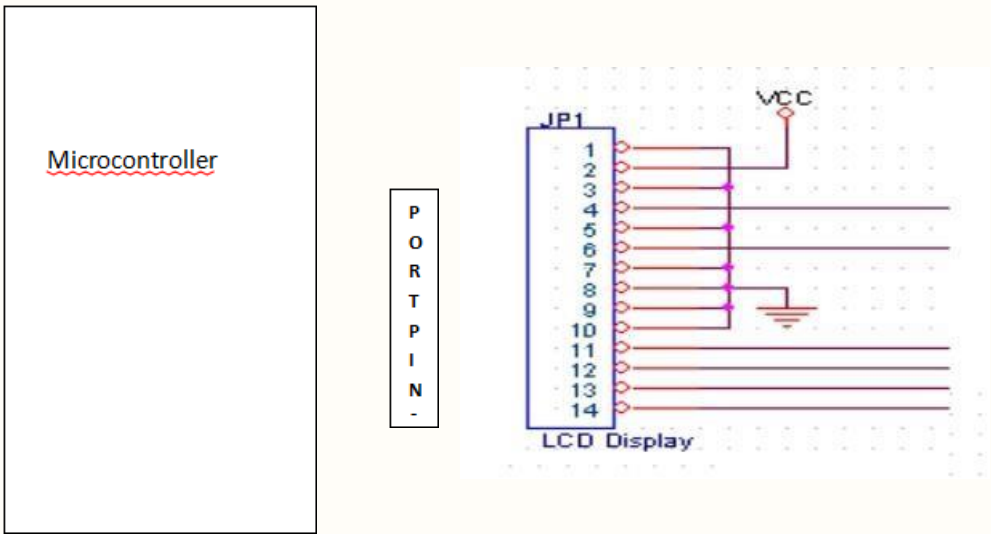


Fig4.14: Lcd Interface with Microcontroller

INTERFACING LCD TO MICROCONTROLLER

The LCD is generally interfaced in 8-bit mode or 4-bit mode. in this project LCD is connected in 4-bit mode the interface connections of LCD with microcontroller are as follows

RS of LCD is connected to p0.0 of microcontroller

EN of LCD is connected to p0.1 of microcontroller

D4 of LCD is connected to p0.4 of microcontroller

D5 of LCD is connected to p0.5 of microcontroller

D6 of LCD is connected to p0.6 of microcontroller

D7 of LCD is connected to p0.7 of microcontroller

In 8-bit mode, the complete ASCII code is sent at once along with the control signals. But in 4-bit mode, the data is divided into two parts, i.e. MSB & LSB, and are called upper nibble & lower nibble.

The control signals are RS, R/W & E. RS is used to select the internal registers i.e. data register & command register. R/W is used to set the mode of LCD to read mode or write mode. E is used as chip select and is used to push the data internally to the corresponding registers.

To transfer the data/command in 8-bit mode, the data is written to the 8-bit data bus after selecting the required register and setting the mode to write mode. The E signal pin is then given a high to low signal to transfer the data.

To transfer the data/command in 4-bit mode, the higher nibble is first written to the MSB of the data port and the E is given a high to low signal. After a little delay or when the LCD is not busy, the lower nibble is transferred in the same procedure.

4.2.7 Global Positioning System(GPS):

Introduction

Global Positioning System (GPS) technology is changing the way we work and play. You can use GPS technology when you are driving, flying, fishing, sailing, hiking, running, biking, working, or exploring. With a GPS receiver, you have an amazing amount of information at your fingertips. Here are just a few examples of how you can use GPS technology.

- Know precisely how far you have run and at what pace while tracking your path so you can find your way home
- Pinpoint the perfect fishing spot on the water and easily relocate it
- Get the closest location of your favorite restaurant when you are out-of-town
- Find the nearest airport or identify the type of airspace in which you are flying

WHAT IS GPS?

The Global Positioning System (GPS) is a satellite-based navigation system that sends and receives radio signals. A GPS receiver acquires these signals and provides you with information. Using GPS technology, you can determine location, velocity, and time, 24 hours a day, in any weather conditions anywhere in the world—for free GPS, formally known as the NAVSTAR (Navigation Satellite Timing and Ranging) Global Positioning System, originally was developed for the military. Because of its popular navigation capabilities and because you can access GPS technology using small inexpensive equipment, the government made the system available for civilian use. The USA owns GPS technology and the Department of Defense maintains it.

GPS technology requires the following three segments

- Space segment
- Control segment
- User segment

APPLICATION OF THE GPS TRACKING SYSTEM

- **Fleet control.** For example, a delivery or taxi company may put such a tracker in every of its vehicles, thus allowing the staff to know if a vehicle is on time or late, or is doing its assigned route. The same applies for armored trucks transporting valuable goods, as it allows to pinpoint the exact site of a possible robbery.
- **Stolen vehicle searching**. Owners of expensive cars can put a tracker in it, and "activate" them in case of theft. "Activate" means that a command is issued to the tracker, via SMS or otherwise, and it will start acting as a fleet control device, allowing the user to know where the thieves are.
- **Animal control.** When put on a wildlife animal (e.g. in a collar), it allows scientists to study its activities and migration patterns. Vaginal implant transmitters are used to mark the location where pregnant females give birth. Animal tracking collars may also be put on domestic animals, to locate them in case they get lost.
- **Race control.** In some sports, such as gliding, participants are required to have a tracker with them. This allows, among other applications, for race officials to know if the participants are cheating, taking unexpected shortcuts or how far apart they are. This use has been featured in the movie "Rat Race", where some millionaires see the position of the racers in a wall map.
- **Espionage/surveillance.** When put on a person, or on his personal vehicle, it allows the person monitoring the tracking to know his/her habits. This application is used by private investigators, and also by some parents to track their children.
- **Internet Fun.** Some Web 2.0 pioneers have created their own personal web pages that show their position constantly, and in real-time, on a map within their website. These usually use data push from a GPS enabled cell phone.

GPS INTERFACE WITH MICROCONTROLLER

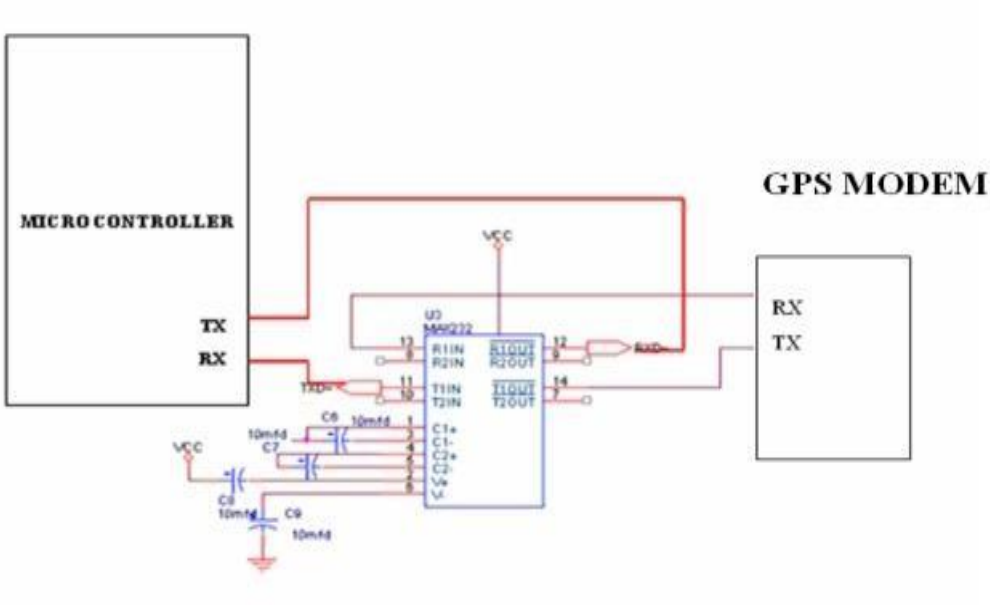


Fig 4.15: GPS Interface with Microcontroller

In this project GPS Modem is interfaced with the microcontroller through rs232 interface. Since the voltage levels of the microcontroller are different with that of the GPS modem we use a voltage converter or the line driver such as MAX232 to make them rs232 compatible.

4.2.8 Buzzer:

Piezo Electric buzzers are Solid state devices that produce an Audible signal when powered.

_ They are basically made up of piezo crystal.

_ The fundamental property of Piezo crystal states that when a voltage is applied to the crystal in a particular plane. It enters into oscillations.

_ A simple oscillator circuit is used to make these signals audible.

Fig 4.16: Buzzer

Piezo electric buzzers operate right from 3V up to 24V DC. Similar to the LED drive, a transistor driver is used for driving the load. The other advantage with this scheme is that the drive voltage can be much higher than the operating voltage of the microcontroller.

A protection diode is included in all inductive load circuits to prevent the back emf from damaging the driving transistor & subsequently the microcontroller.

BUZZER INTERFACE WITH MICROCONTROLLER

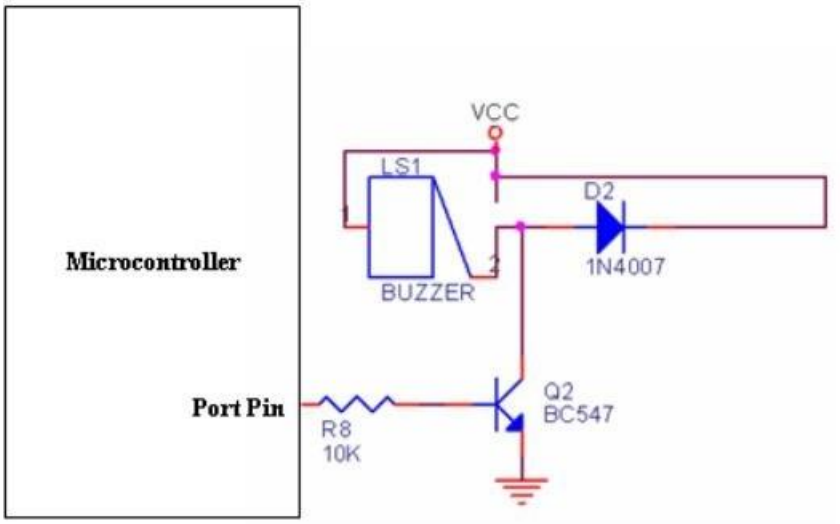


Fig 4.17: Buzzer Interface with Microcontroller

4.2.9 Valves:

Engine valves are mechanical components used in internal combustion engines to allow or restrict the flow of fluid or gas to and from the combustion chambers or cylinders during engine operation. Functionally, they perform similarly to many other types of valves in that they block or pass flow, however, they are a purely mechanical device that interfaces with other engine components such as rocker arms in order to open and close in the correct sequence and with the correct timing.

There are two types of engine valves:

- Intake valve and exhaust valve.
- Naturally, the intake valve function is to let air in and the exhaust valve function is to let the exhaust gases out from the combustion process after ignition occurs.

The term engine valve may also refer to a type of check valve that is used for air injection as part of the emission control and exhaust gas recirculation systems in vehicles. This type of engine valve will not be addressed in this article.

Engine valves are common to many types of combustion engines, whether they run off a fuel such as gasoline, diesel, kerosene, natural gas (LNG), or propane (LP). Engine types vary by the number of cylinders which are the combustion chambers that generate power from the ignition of fuel. They also vary by the type of operation (2-cycle or 4-cycle), and by the design placement of the valves within the engine [overhead valve (OHV), overhead cam (OHC), or valve in block (VIB)].

Fig 4.18: Valves

Types of Engine Valves

Besides the characterization of engine valves by function (intake versus exhaust), there are several specific types of engine valves that exist based on design and materials. The primary types of engine valves include:

- Monometallic engine valves
- Bimetallic engine valves
- Hollow engine valves

Monometallic engine valves, as their name implies, are fabricated from a single material that forms both the valve stem and valve head. These types of engine valves provide both high heat resistance and exhibit good anti-friction capabilities.

Bimetallic engine valves, also known as bimetal engine valves, are made by joining two different materials together using a friction welding process to create a valve that has austenitic steel on the valve head and martensitic steel for the valve stem.

Hollow engine valves are a special bimetallic valve that contains a hollow cavity that is filled with sodium. The sodium liquifies as the valve temperature rises and is circulated by the motion of the valve, which helps dissipate heat from the hotter valve head.

4.2.10 Internet of Things (IoT):

The Internet of Things (IoT) has taken over the conventional methods used in industries; it is simply a network of connected devices which interact with one another to exchange information, collect data, and use it to make optimum decisions. Gadgets with IoT devices are capable of performing more efficiently; they can also adapt to the environment to which they are exposed. IoT has also changed the face of today's industries. To list a few advancements: boosting production rate, product improvement, data-based analysis, risk reduction in business, and so on.

NETWORK ARCHITECTURES IN MODERN VEHICLES:

Smart vehicles possess the ability to communicate with and within the vehicle, which is where communication plays an important role in terms of safety. Various network systems are installed in vehicles that enable them to communicate effectively. Network architecture would paint a good picture of how they work and their applications.

GPS (GLOBAL POSITIONING SYSTEM):

GPS is the most common network provided in vehicles, they navigate the driver to the destination via the path with the least traffic. It helps to keep track of vehicles in case of emergency and not to violate the privacy of an individual. GPS performs its functions by communicating with the satellite system GNSS (global network satellite system), which enables them to share speed, location, time, etc.

MOST (MEDIA ORIENTED SYSTEMS TRANSPORT)

MOST is the network architecture developed to tackle the media and infotainment system of the vehicle. The increase in media-related functions, such as sound systems, video players, voice input, etc., led to the development of MOST, as they demand high-bandwidth network architecture. MOST is the most cost-effective method in the market to deal with audio, video, and data transmission.

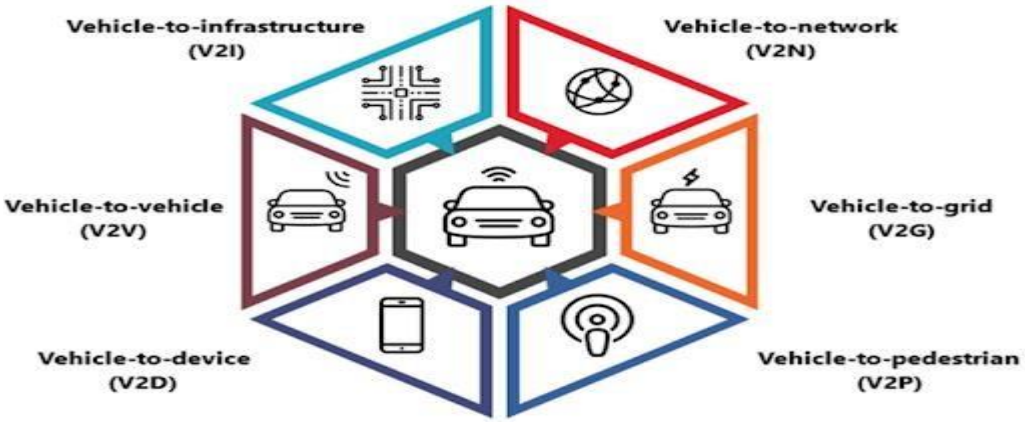


Fig4.19: Communication Architectures in Vehicles

4.3 Software Used

Arduino idle

Arduino is a both an open-source software library and an open-source breakout board for the popular AVR micro-controllers. The Arduino IDE (Integrated Development Environment) is the program used to write code, and comes in the form of a downloadable file on the Arduino website. The Arduino board is the physical board that stores and performs the code uploaded to it. Both the software package and the board are referred to as "Arduino."

To begin, download the Arduino IDE from the Arduino website. Make sure to select the right version for your Operating System (OS). For a full getting started guide for each OS, please refer to the Arduino guide. Once the arduino.zip file has been downloaded, extract the file to a folder somewhere on your computer. There is no install simply open the folder and double click the .exe.

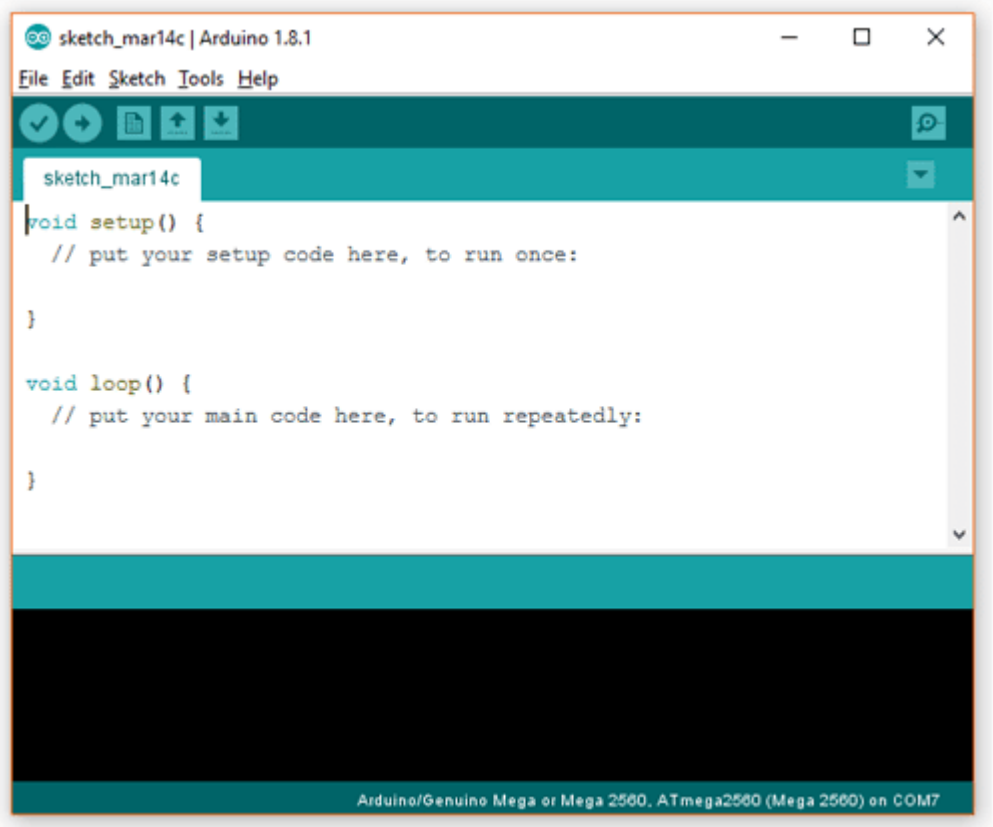


Fig 4.20: Arduino Sketch

4.4 Advantages And Disadvantages

Advantages:

The proposed solution addresses a critical issue in society, which is vehicle theft, by leveraging IoT technology and GPS tracking to enhance vehicle security and facilitate quick recovery in case of theft. Here are some advantages and considerations for the suggested solution:

1) Enhanced Vehicle Security: By integrating IoT technology and GPS tracking, the solution offers an additional layer of security beyond traditional methods like key locks and remote systems.

2) **Quick Recovery**: The ability to track the vehicle's whereabouts in real-time enables quick recovery efforts, increasing the likelihood of retrieving stolen vehicles before they are irreversibly damaged or sold.

3) Remote Control: The system allows remote control of the vehicle's ignition motor, enabling gradual speed reduction and immobilization, which can aid in safe recovery and prevent further theft or damage.

4) Cost-Effective: Compared to traditional security measures such as CCTV cameras, the proposed solution is relatively affordable, making it accessible to a wider range of vehicle owners.

5) User-Friendly: The interface with a smartphone controller simplifies the process of activating the security measures, ensuring ease of use for vehicle owners.

Disadvantages:

Certainly, here are some potential disadvantages of the proposed IoT-based solution for vehicle theft prevention:

1) Dependency on Technology: The system's effectiveness is heavily reliant on technological components such as GPS trackers, IoT devices, and smartphone controllers. Any malfunction or technical issues with these components could compromise the system's ability to prevent theft or facilitate recovery.

2) False Alarms: Inaccurate GPS readings or communication errors between the IoT devices and the controller could lead to false alarms, triggering unnecessary immobilization of the vehicle or causing inconvenience to the owner

3) Battery Drain: Continuous operation of GPS trackers and IoT devices may lead to increased power consumption, potentially draining the vehicle's battery if not managed efficiently.

4) Hacking Risks: IoT devices connected to the vehicle's control system could be vulnerable to hacking or unauthorized access. Malicious actors could exploit security weaknesses in the system to remotely immobilize or manipulate the vehicle, posing a security risk to the owner.

5) Limited Coverage: The effectiveness of the solution may be limited in areas with poor GPS signal reception or inadequate IoT network coverage. In remote or rural areas with limited connectivity, the system may not function optimally, reducing its reliability in preventing theft or aiding in recovery efforts.

6) Integration Challenges: Retrofitting existing vehicles with IoT-based security systems may pose integration challenges, especially for older vehicles with limited electronic compatibility. The cost and complexity of integrating the system into different vehicle models could be prohibitive for some owners.

7) Privacy Concerns: Constant tracking of the vehicle's location using GPS technology raises privacy concerns for some individuals. Owners may be hesitant to adopt the system due to concerns about their location data being collected and potentially shared with third parties.

8) Regulatory Compliance: Compliance with local regulations and laws related to vehicle security and data privacy may pose challenges for the deployment and use of the IoT-based solution. Ensuring compliance with relevant regulations is essential to avoid legal issues and ensure acceptance by authorities and users

Overall, while the proposed IoT-based solution offers potential advantages in enhancing vehicle security and facilitating theft prevention, careful consideration of these potential disadvantages is essential to address technical, security, privacy, and regulatory challenges for successful deployment and adoption.

4.5 Applications:

The proposed IoT-based solution for vehicle theft prevention and recovery has several potential applications across various industries and use cases:

1) **Consumer Vehicles**: The solution can be integrated into consumer vehicles, including cars, motorcycles, and recreational vehicles, to provide owners with an added layer of security against theft. This application is particularly relevant in urban areas with high rates of vehicle theft.

2) **Fleet Management**: Fleet operators in industries such as logistics, transportation, and delivery can use the solution to enhance the security of their vehicles and assets. Real-time tracking and immobilization capabilities can help prevent unauthorized use or theft of fleet vehicles.

3) **Rental and Carsharing Services:** Rental car companies and carsharing services can deploy the IoT-based solution to monitor the location and status of their vehicles. In the event of theft or unauthorized use, the system can facilitate quick recovery and minimize financial losses.

4) **Law Enforcement and Recovery Agencies:** Law enforcement agencies and vehicle recovery services can leverage the solution to track and recover stolen vehicles more efficiently. Real-time location data and remote immobilization capabilities can aid in law enforcement efforts to apprehend perpetrators and recover stolen property.

5) **Insurance Industry:** Insurance companies can partner with vehicle manufacturers or service providers to offer IoT-based theft prevention and recovery solutions as part of their insurance packages. This can help reduce the risk of vehicle theft and lower insurance premiums for policyholders.

6) **Smart Cities:** Municipalities and urban planners can incorporate the IoT-based solution into smart city initiatives aimed at enhancing public safety and security. By deploying the solution across public transportation fleets and municipal vehicles, cities can improve asset management and reduce the impact of vehicle theft on public services.

7) **Asset Tracking:** Beyond vehicles, the IoT-based solution can be applied to track and secure other high-value assets, such as construction equipment, trailers, and cargo containers. Real-time tracking and remote immobilization capabilities can help prevent theft and improve asset management efficiency.

Overall, the proposed IoT-based solution for vehicle theft prevention and recovery has diverse applications across industries and use cases, offering benefits such as enhanced security, improved asset management, and reduced financial losses associated with theft.

CHAPTER-5

RESULTS

- The Below Kit shows the “IoT-Based Wireless Security System for Theft prevention " which consists of Arduino board, Buzzer, LCD, IoT module, IR Sensor and Lock Switch Sensor.

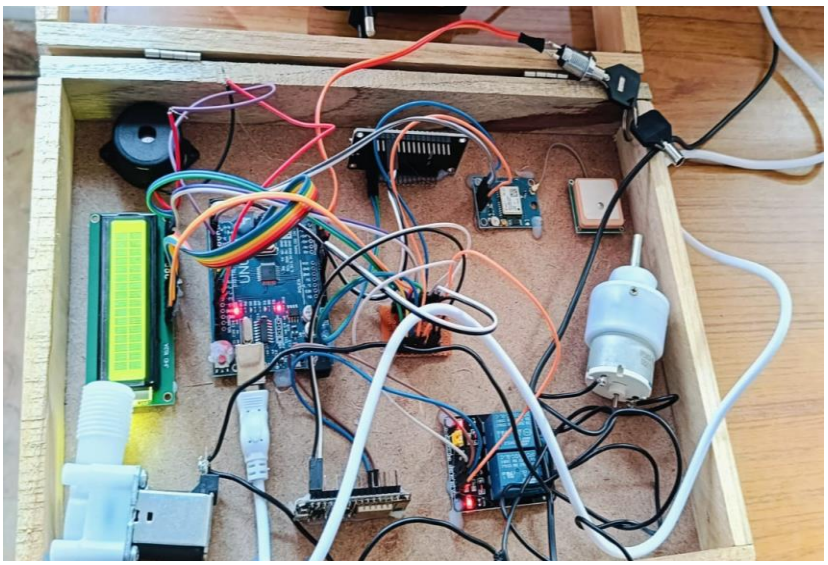


Fig5.1: IoT-Based Wireless Security System for Theft Prevention

- The LCD display in the following figures indicates that the system is starting up and is prepared to accept the GPS through the IoT Module.

Fig 5.2 LCD Demonstrating that The Device is a Theft Detecting System

Fig:LCD Displaying that System Intialised Succesfully

- The IoT module sends an alert message via the Telegram app link if someone attempts to move the vehicle from its parking location or tamper with the vehicle key.

Fig 5.4: LCD Displaying that Vehicle is Stolen

Fig 5.5: LCD Displaying that SMS is Sending to Smart Phone

- When a car is stolen, the sensor is triggered. As a result, the owner receives an SMS through the Telegram app link that contains the exact latitude and longitude of the vehicle's position in that direction. This is made possible by IoT Technology.

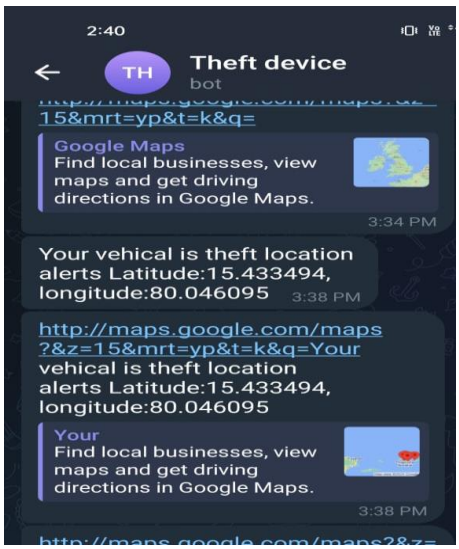


Fig5.6:Vehicle Location Through Telegram App.

- The instructions are then sent to the car's microcontroller using an Android-specific smartphone app. This application was made with the help of the WiFi module.
- The vehicle's ignition motor and valves will cease when the user selects the "OFF" command from the application platform home page, which was provided to them by the owner.

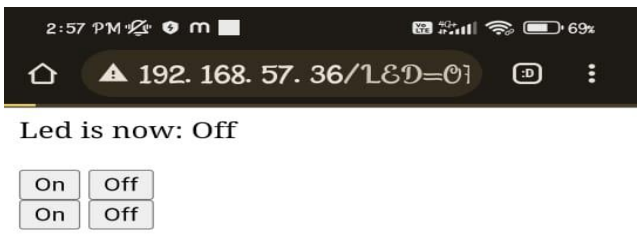


Fig:5.7 Commands to Turn on and off The Ignition Motor and Valves

CHAPTER-7
CONCLUSION

In conclusion, the proposed IoT-based solution for vehicle theft prevention and recovery presents a promising approach to addressing the pressing issue of vehicle theft in society. By leveraging IoT technology, GPS tracking, and remote control capabilities, the solution offers an advanced and effective means of enhancing vehicle security and facilitating quick recovery in the event of theft or missing. It is a car anti-theft device; if a car is stolen or lost, we may quickly locate its position (longitude and latitude) using the GPS in that direction.

Throughout this discussion, we have explored the advantages, considerations, applications, and potential disadvantages of the proposed solution. Advantages include enhanced security, quick recovery, cost-effectiveness, user-friendliness, and diverse applications across industries. However, considerations such as privacy, reliability, security vulnerabilities, regulatory compliance, integration challenges, and maintenance/support requirements must be carefully addressed to ensure the successful deployment and adoption of the solution.

Despite these considerations, the proposed IoT-based solution holds significant promise in improving vehicle security, reducing theft-related losses, and enhancing public safety. Whether deployed in consumer vehicles, fleet management operations, rental services, law enforcement agencies, smart city initiatives, or other industries, the solution offers tangible benefits in terms of asset protection, operational efficiency, and risk mitigation.

Moving forward, continued research, development, and collaboration among stakeholders, including vehicle manufacturers, technology providers, insurers, law enforcement agencies, and urban planners, will be essential to refine and optimize the IoT-based solution for widespread adoption and impact. By addressing the identified considerations and leveraging the full potential of IoT technology, we can work towards a safer, more secure, and resilient transportation ecosystem for the benefit of society as a whole. Since this technology is fully integrated, installing it in any car is quite simple.

CHAPTER-8

FUTURE SCOPE

The future scope of the proposed IoT-based solution for vehicle theft prevention and recovery is promising, with several potential areas of development and advancement:

1. **Enhanced Security Features**: Future iterations of the solution can incorporate advanced security features, such as biometric authentication, multi-factor authentication, and tamper-resistant hardware, to further safeguard vehicles against theft and unauthorized access.
2. **Artificial Intelligence Integration**: Integration of artificial intelligence (AI) and machine learning algorithms can enhance the predictive capabilities of the solution, enabling proactive theft prevention measures based on behavior analysis and anomaly detection.
3. **Blockchain Technology**: Integration of blockchain technology can enhance the security and integrity of data transmitted and stored within the IoT-based system, ensuring tamper-proof records of vehicle movements, transactions, and ownership transfers.
4. **Autonomous Vehicle Integration**: With the rise of autonomous vehicles, future iterations of the solution can be integrated directly into autonomous vehicle systems, enabling real-time monitoring, control, and security measures to prevent theft and ensure safe operation.
5. **Smart Infrastructure Integration**: Integration with smart city infrastructure, such as connected traffic signals, road sensors, and surveillance cameras, can provide additional data inputs and enhance the overall effectiveness of the solution in urban environments.

In summary, the future scope of the proposed IoT-based solution for vehicle theft prevention and recovery is vast, encompassing advancements in technology, integration with emerging trends such as autonomous vehicles and smart infrastructure, global expansion, collaboration with stakeholders, data-driven insights, and a focus on sustainability and social impact. By embracing these opportunities and addressing challenges collaboratively, we can unlock the full potential of IoT technology to create safer, more secure, and resilient transportation ecosystems.

CHAPTER-9

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