

Automated Vehicle Theft Prevention Using Atmega Embedded Systems

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Abstract: In this steep rise of vehicle theft, vehicle safety has become a major thought in the minds. Most happen due to the parking in unsecured areas even in residential areas. Investigations shows its due to the lack of space in parking lot in residential areas and lack of availability of sophisticated security implants. As a solution to it this paper proposes a prototype model of fingerprint-based security system for vehicles. It includes global positioning system (GPS) and global system for mobile(GSM) controlled by Arduino Uno which provides the data about vehicle position to have a better knowledge to track down if theft occurs. The system implemented is very simple which ensure great security for vehicle ant-theft protection and low cost technique.

Keywords: Arduino Uno, Fingerprint sensor, Microcontroller ATmega329p, Vehicle theft prevention, GPS, GSM.

1. Introduction

Automobile security is one of the rising concerns in India. Safeguarding of vehicle against theft is one of the major issues confronting developing countries. Various methods have been implemented to protect and secure the automobiles.

Embedded computing is an emerging technology widely used in enhancing security against the theft of vehicles. In 2013, Radiofrequency Identification (RFID) cards were designed for ignition start of automobile. However, the chances of losing the card or it being stolen led to the failure of the system.

Kulkarni et al. proposed a face detection subsystem with GPS and GSM module [12]. A digital camera was used to capture the video which was continuously uploaded into the web server using the ARM9 processor. AdaBoost algorithm Face detection was adopted in a security system to identify the person who is trying to start the vehicle. This methodology, however, proved to be error-prone in detecting those faces, not

in front of the camera. Using the Global System for Mobile (GSM) and GPS technology, the vehicle can be identified and located very easily. However, the main disadvantage is that the signal can become degraded and receiver system may not provide location due to poor weather conditions.

Z. Brijet et al. combined Fingerprint sensor and Arduino. The ignition switch that supplies voltage is given to the voltage regulator which is connected to Arduino in-order to turn it on

and off. Fingerprint sensor activated the relay which in turn controlled the starter relay resulting in the vehicle turning on. If the finger image does not match any of the images stored in the database, then the starting system is disabled [13].

Hsiao and Chang developed analytical model to analyze the optimal location update strategy with the objective of minimum total cost [14]. Tamil et al. did similar works [15].

In this work we try to implement cost effective embedded system that allows only finger print authorized user to put the vehicle in motion. Our system consists of Arduino Uno which receives and transmits the data among the modules and coordinates the entire system, fingerprint sensor allows the user to read his/her fingerprint and the pattern matching algorithm validates the authentic user. Upon matched fingerprint the solenoid valve near the fuel system open to allow the flow fuel and required voltage is provided using relay switch to ignition and otherwise occurs when there's unauthorized recognition and in-turn provides the data about the current location of the vehicle through GPS and GSM. LCD display shows the status and output of the system.

2. Problem Statement

The automobiles have been stolen for different reasons viz. For using the vehicles for transport, commission of crimes and for reusing or reselling parts dismantled from the vehicles or resale of the vehicle itself. The professional thieves can dismantle the stolen vehicle and re-sell the components. The thieves will also have the luxury of time to remove once if the vehicle is out of reach.

3. Objectives

The main objective is to establish an effective security system using a low cost embedded system that provides access to vehicle by the authentic user and reduce the theft in automobiles.

1. To prevent theft by blocking the fuel supply using solenoid valve
2. To shut down the ignition system using relay switch

3. To obtain the location of vehicle when the theft occurs using GPS
4. To notify the authorized user about the situation using GSM.

4. Proposed System

In this paper we propose a novel method which uses finger print to put the vehicle in motion. ATmega328p micro controller has been used. It consists of 28 pins of which 14 digital pins and 6 analog pins. Here relay is used to trip/build the circuit which provides voltage to ignition system and solenoid valve to regulate the flow of fuel. This is a GPS based vehicle tracking system the tracks the vehicle and sends the tracking data through messages. The design is mounted in the vehicle with fingerprint accessible to it. The microcontroller acts as the controlling head of the system. The finger print data of the entire authorizing person are saved in the Arduino UNO memory. The number to which the message to be sent is also saved using the GSM.

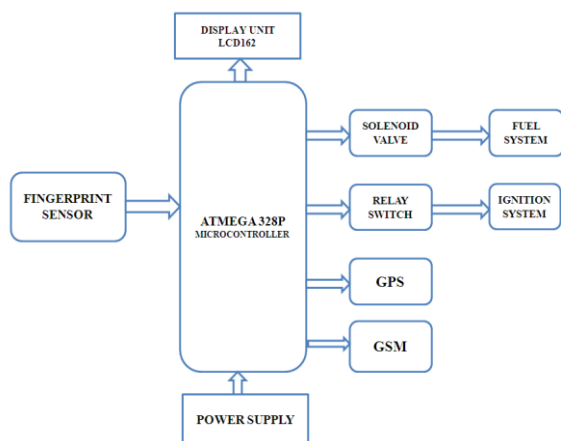


Fig. 1. Block diagram of the system

When the authorized person tries to access the vehicle through fingerprint the circuit of the valve senses the current sent the microcontroller upon verification of the fingerprint in the data. The current passes through the coil of wire wound around the iron plunger in the solenoid valve. This electric current induces magnetic field ergo the valve opens the fuel is supplied to the engine. During unauthorized person tries to current is passed to the solenoid valve unless the access is granted the user which is sent via message from the registered number.

The flow of process is same in the ignition system as above. The circuit of the relay sense the voltage sent to it when the authorized person accesses it. This energizes the relay which produces the temporary magnetic field and moves the relay armature for connection due to which the ignition system of the vehicle turns on. And the opposite no current of required voltage is sent to the ignition system during the unauthorized access.

When an unauthorized person tries to access a message is

sent to the registered number as 'unauthorized access', 'grant?' further action take place upon the reply yes/no. if 'no' no further action in the solenoid or ignition system takes and location of current position of the vehicle is sent using GPS. Coordinates are sent to a server. The server uses the coordinates and geo-coding services like goggle maps to convert the coordinates into map location. If 'yes' is replied the fuel flows and ignition system works and the vehicle starts.

GSM modem is interfaced to the microcontroller through level shifter IC MAX232 the SIM mounted on GSM modem upon receiving missed call from user gets activated. When unauthorized person accesses the programmed messaged as discussed previously is sent and acts accordingly to perform further actions. GSM module is used to provide wireless communication between user and the vehicle.

5. Hardware

A. Arduino Uno

Arduino Uno is a micro controller board based on the ATmega32p.It has 14 digital input/output,6 analog input, a 16MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the micro controller simply connecting it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started, these can be programmed using an Arduino software (IDE). The ATmega328p on it comes with a boot loader that allows us to upload new code to it without the use of an external hardware programmer.



Fig. 2. Arduino Uno

B. Transformer

A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled conductors without changing frequency. A varying current in the first or primary winding creates a varying magnetic flux in the transformer's core and thus a varying magnetic flux in secondary winding. If a load is connected to the secondary winding the current flows in the secondary winding and electrical energy will be transferred from primary through the transformer to the load.

C. Rectifier

A rectifier is an electrical device that converts alternating current (AC) to direct current (DC), a process known as

rectification. Rectifiers have many uses including as component of power supplies and as detectors of radio signals. Rectifiers may be made of solid-state diodes, vacuum tube diodes, mercury arc valves and others. When a diode is used to rectify AC, the difference between the term diode and term rectifier is merely one of usage i.e., the term rectifier describes a diode that is being used to convert AC to DC.

D. Filter

The process of converting a pulsating direct current to a pure direct current using filters is called as filtration. Electric filters are electronic circuits, which perform signal-processing functions, specifically to remove unwanted frequency components from the signal, to enhance wanted one.



Fig. 3. Regulated supply

E. Regulator

You cannot use a 12V regulator to make a 5V power supply. Voltage regulators are very robust. These can withstand over-current draw due to short circuits and also over-heating. In both cases, the regulator will cut off before any damage occurs. The only way to destroy a regulator is to apply reverse voltage to its input. Reverse polarity destroys the regulator almost instantly.

F. GPS

GPS or Global Positioning System is a satellite navigation system that furnishes location and time information in all climate conditions to the user. GPS is used for navigation in planes, ships, cars and trucks also. The system gives critical abilities to military and civilian users around the globe. GPS provide continuous real time, 3-dimensional positioning, navigation and timing worldwide.



Fig. 4. Global Positioning System

G. Solenoid Valve

Solenoid valve differ in the characteristics of the electric current they use, the strength of the magnetic field they generate, the mechanism they use to regulate the fluid, and the type and characteristics of fluid they control. The valve can use 2-port design to regulate a flow or use a three or more port design to switch flows between ports. Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids. Solenoids

offer fast and safe switching, high reliability, long service life, good medium compatibility of the materials used, low control power and compact design.

H. Relays

Relays are most commonly used switching device in electronics. Let us learn how to use one in our circuits based on the requirement of our project. Before we proceed with the circuit to drive relay we have to consider two important parameter of the relay. Once is the Trigger Voltage, this is the voltage required to turn on the relay that is to change the contact from Common->NO. Our relay here has 5V trigger voltage, but you can also find relays of values 3V, 6V and even 12V so select one based on the available voltage in your project. The other parameter is your Load Voltage & Current, this is the amount of voltage or current that the NC, NO or Common terminal of the relay could withstand, in our cases for DC, it is maximum of 30V and 10A. Make sure the load you are using falls into this range.

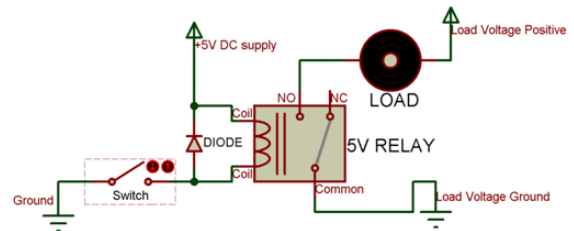


Fig. 5. Relay

6. Software

A. Arduino IDE

Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programmed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board.

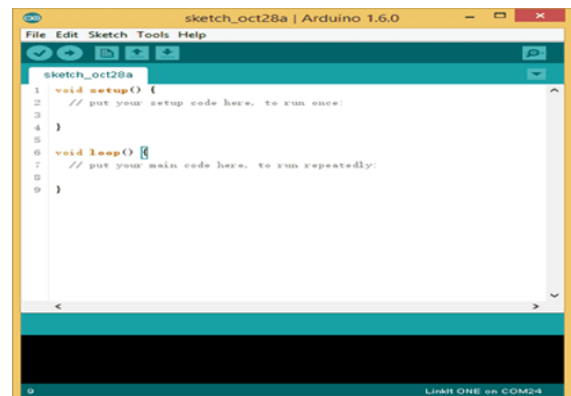


Fig. 6. Arduino IDE

Arduino provides a standard form factor that breaks the functions of the microcontroller into a more accessible package.

A program for Arduino may be written in any programming language for a compiler that produces binary machine code for the target processor. Atmel provides a development environment for their microcontrollers, AVR Studio and the newer Atmel Studio. A program written with the IDE for Arduino is called a sketch. Sketches are saved on the development computer as text files with the file extension. ino. Arduino software (IDE) pre-1.0 saved sketches with the extension. pde. The Arduino IDE supports language C and C++ using special rules of code structuring.

B. Embedded C

Embedded C is one of the most popular and most commonly used Programming Languages in the development of Embedded Systems. Embedded C is perhaps the most popular languages among Embedded Programmers for Programming Embedded Systems. There are many popular programming languages like Assembly, BASIC, C++ etc., that are often used for developing Embedded Systems but Embedded C remains popular due to its efficiency, less development time and portability. As mentioned earlier, Embedded Systems consists of both Hardware and Software. If we consider a simple embedded system, the main Hardware Module is the Processor. The processor is the heart of the Embedded System and it can be anything like a Microprocessor, Microcontroller, DSP, CPLD (Complex Programmable Logic Device) and FPGA (Field Programmable Gated Array).

All these devices have the one thing in common: they are programmable i.e. we can write a program (which is the software part of the Embedded System) to define how the device actually works.

7. Future Scope

We can use the EEPROM to store the previous Navigating positions up to 256 locations and we can navigate up to N number of locations by increasing its memory. We can reduce the size of the kit by using GPS+GSM on the same module.

With the help of high sensitivity vibration sensors, we can detect the accident whenever vehicle unexpectedly had an accident on the road with the help of vibration sensor we can detect the accident and we can send the location to the owner, Hospital and police. We can use our kit to assist the traffic, by keeping the kits in the entire vehicles and by knowing the locations of the vehicles. If anybody steals our car we can easily find our car around the globe, by keeping vehicle positioning vehicle on the vehicle.

8. Conclusion

Vehicle tracking both in case of personal as well as business

purpose improves safety and security, communication medium, performance monitoring and increases productivity. Moreover, this design is going to play a major role in our day-to-day living. Main motto of the project is to incorporate different type of system so that they help in decrease the chances of vehicle theft which we can't stop efficiently from occurring.

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