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Vehicle Theft Prevention and Tracking System

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ABSTRACT

Vehicle Thefts has been rapidly increasing in the present automobile industry, designing an intelligent security system for vehicles can be done by using a microcontroller. The developed security system makes use of ARM microcontroller, touch screen, a GSM module, and MEMS that is embedded in the vehicle by interfacing it to Engine Control Module (ECM).In the present day vehicles, remote keyless entry system and immobilizer system are used for prevention of vehicle theft. The proposed project aims to design a theft prevention and thief identification system by adding another level of security enhancements and improvising the existing system to overcome drawbacks. As automobiles become more sophisticated, security system for vehicles must be stronger. The list of features implemented in this project are, smart gravitational lock, touch screen ignition, thief identification by camera etc., The features are implemented by using triple axis MEMS Accelerometer, Touch screen, GPS Receiver, GSM cellular modem, VGA spy camera. The goal behind this design is to prevent vehicles thefts rather than finding the theft vehicle and a spy system to identify the thief for future assistance.

I. Introduction

As vehicles become more modernized, vehicle security systems must be as stronger. There is wide growth of automotive electronics; it results in better safety and greater comfort, which can be controlled by Electronic Control Units. A modern day automobiles contains up to 80 ECU's, sensing and taking tabs of the various parameters of the automobiles. This synchronized exchange of signals ensures the proper functioning of the car. ECUs are increasingly being deployed in automobiles to control electronic subsystems for various functions like engine management, the body electronics like door and roof control, lighting and air conditioning. CAN networks can be used in engine management to connect several ECUs. Electronic Control Unit contains information about the current state of the car as the driver continuously interacts with the car.

At present-day, automobiles are mainly affected by the thefts because of several new technologies to catch the signals from the key fob and can produce the same to access the vehicle when the owner is away, to avoid that vehicles contain immobilizer as the security system, when an unauthorized entry is happen. The engine will not start, if the immobilizer does not detect the key fob. But, if the key fob is stolen, it will be easier to theft the vehicle. To prevent this stolen key fob problem, a code will be installed in the key fob, so that even if the key fob is stolen, without the code the vehicle cannot be accessed. This becomes a dual layered security. If somehow the thief managed to enter the vehicle, it becomes as issue to overcome that issue there will be use of touch screen ignition which provides more security, so that only the authorized person can access the vehicle's different functionalities. Even with all these security systems included the vehicle is stolen, it needs to be tracked. At present satellite-based Global Positioning System (GPS) is widely used for such tracking.

Since the GPS receiver provides vehicle's velocity and position in global coordinates. The vehicle can be found by this approach, but to prevent further thefts there will be a spy camera which is embedded in the vehicle is used to identify the thief. The camera will be activated when there is unauthorized access in to the vehicle or it can be activated by using the cell phone and GSM modem embedded in the vehicle. The footage will be stored to catch the thief even if he escapes. This information will be sent to the user for further assistance to prevent future thefts.

Existing System For Theft Control:

[1] Remote Keyless Entry System:

This system consists of a smart chip which can be used to unlock the vehicle instead of a key, which is activated automatically by proximity or by a handheld device.

[2] Immobilizer

It is an electronic security device is embedded into an automobile that prevents the engine from running unless the matching chip or the correct key is present. This helps in preventing the vehicle from being "hot-wired".

Drawback: If the key fob is stolen then accessing the vehicle is easy, so a key fob available in the market is not actually that helpful.

[3] GPS Navigation

The theft vehicle can be found by using the GPS module embedded in the vehicle with GSM for sending details of the location obtained by the GPS. By getting the location theft vehicle can be located easily in the network available areas.

Proposed System

The project proposed here aims to develop an intelligent and automatic theft prevention system with thief

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identification by using additional significant enhancements to the existing system to overcome the drawback.

The proposed system consists of two units namely,

1. Smart key fob unit
2. Vehicle unit

1)Smart Gravitational Lock

The system checks key fob signals and the lock will be opened with the correct key code and the smart chip that is embedded in the fob. A gesture is needed for unlocking the vehicle which is done by using the triple-axis accelerometer tilting. If the correct gesture is made then the fob will send a unique code to the vehicle unit. If the code is correct then only the vehicle will be unlocked. The smart key fob communicates with the vehicle unit using radio frequency(RF) modulewith 8x3 decoder.

2)Dynamic Key Coding

Many of the vehicle thefts are being done by cracking the static codes send by the key fob. By this when the owner is away from the vehicle, thieves can send the same cracked static code and access the vehicle. To prevent such hacking of static codes, a software system will be developed to produce dynamic codes for every entry of the vehicle. This can be done by an automatic code generator which will change the codes with every authenticated entry into the vehicle. A specific algorithm will be used for generating random codes every time synchronously in both vehicle unit and key fob unit with every successful entry. This prevents thieves from detecting the static codes which were used in older keyless entry systems.

3)**Touch screen Ignition**

The present-day automobiles have push button start and stop without the key. When the key fob is within the vehicle the engine will start automatically. This feature involves a numeric key code with which the engine will be started with the push button. So, with the normal push button and key fob, the touch screen ignition becomes an additional layer of protection. This involves in both software and hardware keys. A unique touch gesture should be made on the touch screen to ignite which acts as the software key. The system verifies this and then accepts the hardware key which is the actual key fob.

4) Adjustable Motion Alarm Sensitivity

The vehicle unit will be monitored constantly for the vehicle motion after being locked. This motion sensing system measures the vehicle in three dimensions by using the triple-axis accelerometer to detect any unauthorized motion like lifting or moving the vehicle from its armed position. Whenever there is unauthorized motion sensed that is when given threshold tilt or motion exceeds, alarm triggers and the information will be sent to the user.

5) Vehicle Tracking

When the security system is compromised under any circumstances, the theft vehicle can be tracked by using the GPS and GSM technologies. The vehicle can be tracked by the GPS location which will be sent to the owner through GSM. Owner can also access the different vehicle's functionalities like remote fuel cut-off, setting GPS range, etc., with the cell phone from anywhere.

6)GPS Fencing

The GPS fencing feature restricts the vehicle within a particular area. When the vehicle moves out of the GPS boundary, then owner will be informed with an SMS alert with the current location. By this feature, the boundary range can be set by using the software programming. The boundaries will be set by giving the specific latitude and longitude location, by which when the current GPS position doesn't comply with the given boundary limit, alert will be sent. This allows the user to set a virtual fence at a range from building level to city or state level.

7)Thief Identification System

This feature includes a camera to identify the thief, so that if the thief escaped, camera will have the images of the thief. By this thief can be caught afterwards to prevent further thefts. A spy camera will be fitted such that it covers the driver's area in the vehicle. There is an extra benefit with this feature, if the vehicle is damaged by the thief, owner can claim the insurance with the available footage from the camera. So, even if the thief has gone it will store the identity in the control unit of the security system for future assistance and will be sent to nearest police station and also to the owner.

8)Automatic Door-Locking

This technology involves in locking of the doors automatically when the incorrect code limit exceeded or attempting to start the vehicle without authorized key. This helps in catching the thief in the car. As the owner gets the information of the unauthorized entry, owner can catch the thief in the vehicle, who is not able to come outside until a correct key passed.

9)Remote Fuel Cut-off

Even with all the security measures if the vehicle has been accessed by unauthorized entry, then the fuel can be cut-off by the sending a specific message to the security system to stop the vehicle where ever it will be. By this the vehicle will not move and at the same time the location of the vehicle will be sent to the owner for recovery. This feature will slowly stop the fuel supply to the vehicle.

II. Block diagram

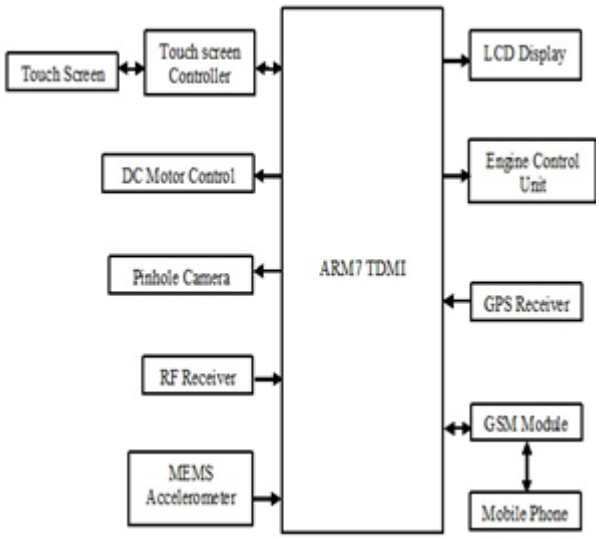


Fig1.Vehicle Unit Block Diagram.

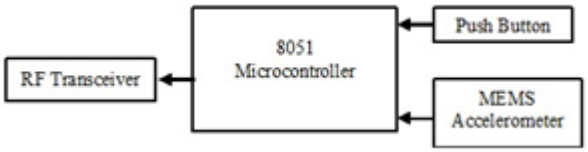


Fig 2.Key Fob Unit Block Diagram.

The vehicle unit and key fob unit consist of different modules such as RF Transmitter an receiver, 8051 microcontroller, GPS and GSM modules.

2.1 RF Transmitter

Description

This is only the 434MHz transmitter. This will work with the RF Links at 434MHz at either baud rate. Only one 434MHz transmitter will work within the same location. This wireless data is the easiest to use, lowest cost RF link we have ever seen!

Use these components to transmit position data, temperature data, and even current program register values wirelessly to the receiver. These modules have up to 500 ft range in open space. The transmitter operates from 2-12V. The higher the Voltage, the greater the range - see range test data in the documents section.

We have used these modules extensively and have been very impressed with their ease of use and direct interface to an MCU. The theory of operation is very simple. What the transmitter 'sees' on its data pin is what the receiver outputs on its data pin. If you can configure the UART module on a PIC, you have an instant wireless data connection. The typical range is 500ft for open area. This is an ASK transmitter module with an output of up to 8mW depending on power supply voltage. The transmitter is based on SAW resonator and accepts digital inputs, can operate from 2 to 12 Volts-DC, and makes building RF enabled products very easy.

Receiver

Description

This receiver type is good for data rates up to 4800bps and will only work with the 434MHz transmitter. Multiple 434MHz receivers can listen to one 434MHz transmitter.

This wireless data is the easiest to use, lowest cost RF link we have ever seen! Use these components to transmit position data, temperature data, and even current program register values wirelessly to the receiver. These modules have up to 500 ft range in open space. The receiver is operated at 5V.

We have used these modules extensively and have been very impressed with their ease of use and direct interface to an MCU. The theory of operation is very simple. What the transmitter 'sees' on its data pin is what the receiver outputs on its data pin. If you can configure the UART module on a PIC, you have an instant wireless data connection. Data rates are limited to 4800bps. The typical range is 500ft for open area.

This receiver has a sensitivity of 3uV. It operates from 4.5 to 5.5 volts-DC and has digital output. The typical sensitivity is -103dbm and the typical current consumption is 3.5mA for 5V operation voltage.

2.2 Global Positioning System (GPS)

Is space-based navigation satellite system (GNSS) that provides reliable location and time information in all weather and at all times and anywhere on or near the Earth when and where there is an unobstructed line of sight to four or more GPS satellites. It is maintained by the United States government and is freely accessible by anyone with a GPS receiver.

The GPS project was started in 1973 to overcome the limitations of previous navigation systems,[1] integrating ideas from several predecessors, including a number of classified engineering design studies from the 1960s. GPS was created and realized by the U.S. Department of Defense (USDOD) and was originally run with 24 satellites.

Major constituents of the GPS based tracking are

1. GPS Tracking Device

The Device Fits into the vehicle and captures the GPS location information apart from other vehicle information at regular intervals to a central server. The other vehicle information can include fuel amount, engine temperature, altitude, reverse geocoding, door open close, Tire pressure, cutoff fuel, turnoff ignition, turn on headlight, turn on taillight, battery status, GSM area code/cell code decoded, number of GPS satellites in view, glass open close, fuel amount, emergency button status, cumulative idling, computed odometer, engine RPM, Throttle position, engine RPM and a lot more. Capability of these devices actually decides the final capability of the whole tracking system.

2. GPS tracking Server

The tracking server has dual responsibility. One of receiving data from the GPS tracking unit and securely storing it, and other of serving this information on demand to the user. It is the intelligence, power and configuration of GPS tracking server, which culminates into usability and feature support..

3. User interface

User interface determines how you will be able to access information, view vehicle data and elicit business important details from it. Most usable is the one that is web based and doesn't demand installation of custom software.

2.3 GSM Modem

Global System for Mobile Communication (GSM) is a set of ETSI standards specifying the infrastructure for a digital cellular service. The standard is used in approx. 85 countries in the world including such locations as Europe, Japan and Australia[1].

Here we are using GSM MODEM to communicate with the mobile phone to which we are going to send the message. Here a predefined station names are stored in EEPROM and those messages are displayed on LCD and those names are sended to the mobile phone using GSM module.

Introduction To Gsm Technology:

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.

Results

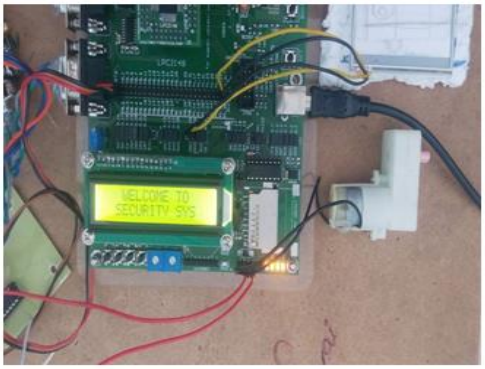
Testing is a process used to help identify the correctness, completeness and quality of developed system. With that in mind, testing can never completely establish the correctness of the system.

There are many approaches to testing, but effective testing of complex products is essentially a process of investigation, not merely a matter of creating and following rote procedure. One definition of testing is “the process of questioning of a product in order to evaluate it”, whwer the questions are things the tester tries to do with the product, and the product answers with its behavior in reaction to the probind of the tester. Although most of the intellectual processes of testing are nearly identical to that of review or inspection, the woed testing is connoted to mean the dynamic analysis of the product—putting the product through its paces.

The quality of the application can and normally does vary widely from system to system but some of the common quality attributes include reliability, stability, portability, maintainability and usability.Testing helps in verfiying and valaidating if the product is working as it is indtented to be working.this ivovles using static and dynamic methodiligies to test the application.

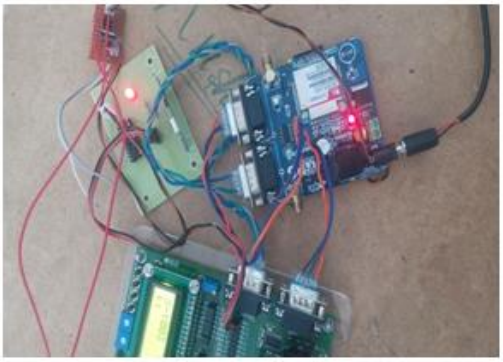
Testing has been done by giving various inputs to the product for obtaining the intended solution for the given input.

3.1 Welcome Note (Car Section)

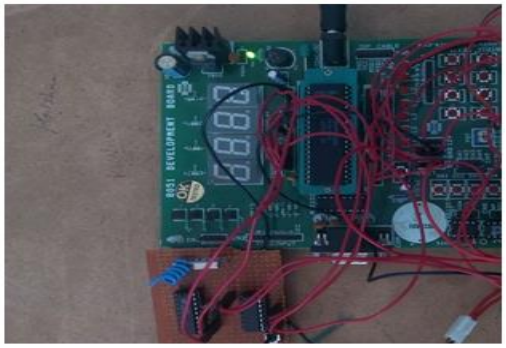


3.2 Touch Screen

3.3 GSM & GPS Implementation



3.4 Remote Section



Conclusions & Future scope

The security system developed here prevents the vehicles from being theft rather than finding the lost vehicle by using dual-layer protection to access the vehicle. The smart gravitational lock using MEMS accelerometer and touch screen ignition using resistive touch screen acts as the two layers of protection. This project includes a thief identification system that uses a spy camera to recognize the thief by taking photos or videos for future reference to prevent further thefts.The unique dynamic lock system prevents the scanning of static frequency codes send by the remote. By implementing these technologies, the intelligent system will provide high security to the vehicle.

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