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Anti-Theft Vehicle Locking System using CAN

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Abstract

As an advancement in automobile industry, real time vehicle safety technology has arrived a long way. Vehicles become very essential part of human life hence vehicle's safety is priority for its owner. Nowadays vehicle theft can happen anytime from anywhere such as common parking areas and some of the instable places. This paper is aimed for a novel Anti-Theft Vehicle Locking System .Here, with high speed reliable Control Area Network (CAN), a sensor based mechanism is interfaced with Engine Control Module (ECM) using ARM7 TDMI microcontroller. In order to prevent vehicle from theft fuel flow sensor observes ignition of engine and attached GSM sends an alert message to owner. In case of stolen, real time vehicle tracking with global positioning system enables owner to control the engine with mobile phone so vehicle will not work any longer. This system functionality makes vehicle locking technique more efficient and provides a complete security from theft

Keywords: ARM7, Control Area Network (CAN), Engine Control Module, Flow Sensor, Global Positioning System (GPS), Global System for Mobile Communication (GSM), Locking System

1. Introduction

In the most recent couple of decades, India has advanced at such a tremendous rate, to the point that numerous automobile sectors have emphatically settled themselves here. These automobile sectors carry a tremendous measure of workforce with them. Organizing transportation to such a tremendous mass is a bulky errand including numerous intricacies. For the most part, this vehicle is masterminded through the nearby transport sellers on a yearly contract premise, as of late happen incidents, for example, theft, assault cases and so on. The quick rate at which vehicle robberies has been expanding over the world has called for expanding pushed in the field of vehicle against burglary frameworks. This especially expect essentialness for costly vehicles and the individuals who go behind much more costly restorative changes. So, option is to provide your automobile with very precise security system with the help of anti-theft system. ECU(Electronic Control Unit) in a car makes sure the most effective guarantee to safeguard your automobile from completely different types of stealing cases[1]. Full Protection of an automobile is done by security device. Push button which is used to control the functioning of doors that is locking and unlocking is also the part of Electronic Control Unit security system in an automobile. Manual Electronic Control Unit and Automatic Electronic control unit are chiefly two sorts of Electronic control units that are utilized as a part of vehicle industry which guarantees secured and smoother operation. Again this framework couldn't demonstrate to give complete security also, openness of the vehicle if there should be an occurrence of robbery. So a more creative framework makes utilization of an inserted framework in light of GSM innovation. Moreover, it is easy to identify the location of a car due to the launch and improvement in satellite communication technology. Tracking framework for vehicles have conveyed this innovation to the routine

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life of the common people. Nowadays, on the roads of the developing countries one common sight is use of GPS in public cars, police vehicles, ambulance and even in armadas. All the current innovations and technologies bolster the vehicle tracking and status.

In this framework both GSM and GPS technologies are embedded together as GSM/GPS systems which are highly valuable. The principle point of the venture is to outline and build up a propelled vehicle locking framework in the real time environment. The owner sends a STATUS message from his/her mobile phone, and when the GSM module gets the message, it will check for the owner's validation and if observed to be substantial, it will quickly send the points of interest of the areas such as the latitude and the longitude using GPS module. So the owner can become more acquainted with the definite area of the vehicle. This System is basically created for four wheeler automobile. In this, GSM is being installed in an automobile which is interfaced with the Electronic control module through Control Area Network (CAN) bus that is, imparted to ECM[2]. The stolen vehicle can be controlled by controlling the engine using flow sensor and GSM. The ultimate location of the vehicle is retrieved by GPS which is interfaced with ARM7 TDMI controller.

Lot of work has been done in the field of vehicle Anti-theft system. The previous works mainly concentrate on recouping the car once it is being stolen[3]. A Vehicle Tracking Unit is installed in the car which can incorporate the GPS tracking framework with existing vehicle alarm system when somebody is messing around with vehicle. This system permits the vehicle tracking over the web, also identifies the security risk as soon as the vehicle is headed out[4]. The primary disservice of the current framework is that the framework gives just an expansive design of the geological address, and does not give exact location of the vehicle.

Locking and unlocking of the vehicle cannot controlled by the current frameworks, along these lines uncovering the helplessness of a framework[5]. Face detection system is used[6]. In this system, one small web cam is installed in the car, when somebody entered in the cabin it will capture the images and compare it with an image in the database. When it will not match it will send the images to the owner via MMS. Owner will also receive location and engine speed through SMS. In a framework[7], cloud computing interface is used. The sensors are used to screen the speed, driver condition and fuel level of the vehicle. All the information exchanged to cloud server using GSM empowered gadget. The GPS also used to track the vehicle and alcohol sensor is used to keep distant from drunk drivers. Authors actualized a security framework in light of the auto mechanical keys and which immobilizes the vehicle if there should be an occurrence of a wrong blend key data inside the vehicle[8]. Implemented security system based on finger print recognition[9], Minutiae is used to open the door. Also vibration sensors are used to prevent from glass braking of windows and Vehicle tracking is performed[10].

Rest of the paper is organised as follows- Section 2 highlights proposed framework, Section 3 deals with Methodology, Section 4 describes System Requirements, Section 5 shows Experimental Results and Section 6 gives Conclusion and Future Enhancements.

2. Proposed System

The purpose of this project is to alert the owner of the vehicle about theft by using wireless technology. An additional point of interest of this venture is that the owner can send back the SMS which will cripple the ignition of the vehicle. In this proposed framework if somebody tries to steal the vehicle, owner will get the message through GSM modem which is connected to microcontroller through switch mechanism. The proprietor gets the SMS that his vehicle is stolen. He can then send back a SMS to the GSM modem to 'stop the motor'. The GSM modem interfaced to the microcontroller, gets the message, the yield of which enacts a component that cripples the ignition of the vehicle by using flow sensor which results in stopping of the vehicle. This proposed framework acknowledges the message and through CAN Bus broadcasts the message to the whole Vehicle Network. The exact location of the vehicle will be send to the owner within matter of time.

3. Methodology

The proposed framework is designed and developed in two modules, first module locates the vehicle using GPS and the other module controls the ignition that is working of an engine using flow sensor by sending appropriate message to the system.

Figure 1 shows the block diagram of the proposed framework. This designed framework will be introduced in the vehicle. The principle idea in this design is to bring the mobile wireless communication into the embedded systems. For connecting several ECU and for engine management CAN network is used.

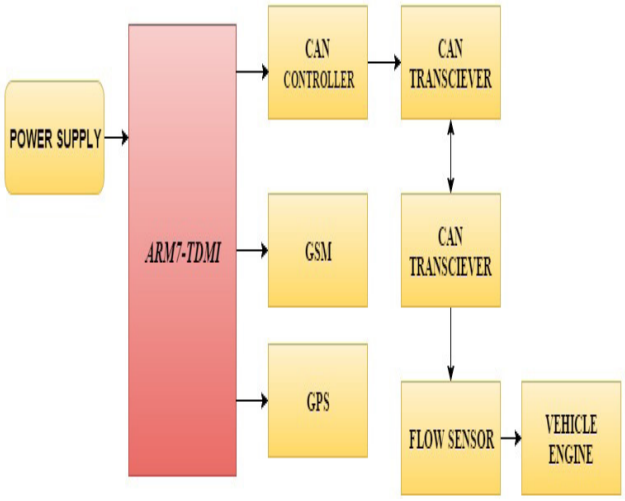

Figure 1. Block Diagram.

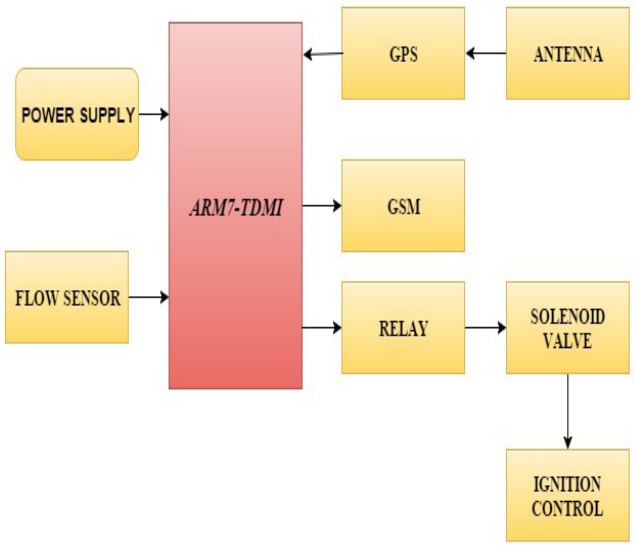

Figure 2. Ignition Control Module.

3.1 Location Retrieval

There is a two way process is used to find the exact location of the vehicle. At first GPS findslongitude and latitude of the automoile that is to be received from the various satellites. These obtained location codrdinates are utilized for the further calculation of accurate geographical location by invoking geocoder. This helps owner of automobile to recover the area just by sending a single SMS message. This is a predefined conditional message for the framework.

3.2 Fuel Control of the Vehicle

Methodology for Ignition/fuel control of the system is shown in Figure 2. Configuration of ignition/fuel flow control module includes a jolt to drive the procedure. The incitement is usually attained through an owner's message. After retrieving the automobile's location , the actual ignition of the engine often can be contrlled by the owner. As soon as the moduleretrive a control message from the owner, considereddesign parameters perform further activity. An additional configuration parameter considered that validates the bonafide nature of the message. In this architecture, message will be processed further only if this message is received from the owner's mobile number. Even though the locking password has known to others unlocking/locking cannnot be performed. Therefore managing and controlling ignition totally depends on owner. The essence of the design includes controlling the ignition the motor sending so as to be at a remote spot a message.

After getting the message and checking its confirmation, the microcontroller embedded in the automobile sends a signal to relay to unlock or lock the engine. Receiving and sending message to the microcontroller is done by the SIM card in the GSM modem. Also, message forwarding to and from the microcontroller is performed by MAX232 that is it acts as both driver and receiver.

4. System Requirements

To obtain the desired results we require a system which is reliable, secure and also efficient. A system must-

- Support real-time continuous and exact data collection.
- Support mobility.
- Minimum power consumption and 24/7 accessibility.
- Compact, fast and field configurable.
- Use off-the-shelf components, devices, and standards.
- Easy to use and deploy.

4.1 Hardware Architecture

This design basically uses CAN controller and transceiver, ARM 7 TDMI, Flow sensor, GSM and GPS modules.

4.1.1 CAN Bus

CAN bus (controller area network) is an automobile bus meant to enable microcontrollers along with devices to

speak with each other within an automobile with no use of any host device or computer[2]. CAN bus is a message-based convention, outlined particularly for car applications but nowadays it is used in other applications like aviation, industrial automation and medicinal appliances. For association with ECUs, CAN is used which is multi-master serial bus.

CAN Architecture: Every node requires a central processing unit or host processor. The host processor chooses the messages and decides the messages needs to be transmitted. Sensors, actuators and control gadgets can be associated with the host processor[3].

CAN Controller: System with a synchronous clock.

- *Transmitting:* The host processor stores it's transmit messages to a CAN controller, which transmits the bits serially onto the bus.
- *Receiving:* The CAN controller stores the received messages serially from the bus until whole message is accessible, which can then be retrieved by the host processor

CAN Transceiver: It has two sections sending and receiving.

- *Sending:* Here, bit signal received from the CAN controller is converted to signal which is sent on to a bus.
- *Receiving:* It adjusts signal levels from the bus to levels that the CAN controller expects and has defensive hardware that secures the CAN controller.

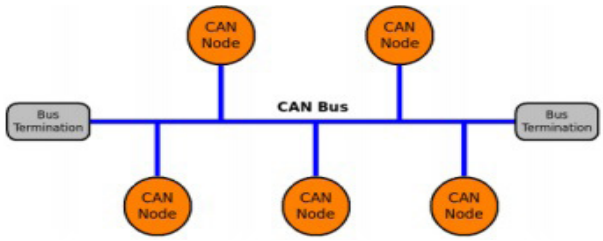

Figure 3. Overview of Controller Area Network.

Figure 3. shows CAN network topology. Each and every node can send and receive messages but it will not happen simultaneously. Every transmitted message has the priority and depends on that message will be transmitted serially onto the bus.

4.1.2 ARM7 TDMI Processor

In comparison with 32 bit microcontroller, 8 and 16 bit microcontroller has some deficiencies. This proposed framework plan utilizes the ARM processor. ARM has advanced RISC (Reduced Instruction Set Computer) based Architecture. The instructions set is much more simplified and suitable than micro programmed CISC (Complex Instruction Set Computer). The processor is having high instruction throughput and real time interrupt response from a processor core which is small as well as cost effective. Real time simulation takes place by LPC2148 that is based on ARM7 TDMI core (32 bit). Exactly when ARM processor joined with RTOS with timing basic can be recognized for the information procurement and data transmission with high precision.

4.1.3 GSM Module

GSM (Global System For Mobile Communication) modem is a particular kind of modem which acknowledges a SIM card, and works over a subscription to a versatile mobile operator, much the same as a cellphone. In this project we have used SIM900A GSM module. It is very compact and reliable wireless module. SIM900A delivers GSM/GPRS 900/1800MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. Advantage of using this modem is that its RS232 port can be used to communicate and develop embedded applications. It can communicate with controllers via AT commands.

4.1.4 GPS Module

The Global Positioning System (GPS) is a satellite based route framework comprises of a system with 24 satellites situated in space. The framework gives vital data to military, common and business clients around the globe, which is uninhibitedly available to anybody with a GPS receiver. GPS works in any climate circumstances at anyplace in the world. With four or more satellites in sight, the recipient can decide the client's 3D position (latitude, longitude and altitude). Once the vehicle position has been resolved, the GPS unit can decide other data like velocity, separation to destination, time etc., GPS receiver is utilized for this exploration work to distinguish the location of the vehicle and give data to authenticated individual through GSM.

GPS Receiver MT3333 Module is based on MT3333 chipset from MediaTek Inc. This GPS module has pretty good sensitivity with excellent tracking capability even in urban conditions. It is one of the most commonly used GPS in UAVs and ground based robots. It has 66channels for GPS tracking. GPS receiver data output follows NMEA standard format with update rate of 9600 bps. GPS module has LED indication to indicate GPS lock and onboard

battery for location information backup, which allows GPS module to quickly acquire GPS information on start up.

4.1.5 Flow Sensor

Flow estimation is the measurement of mass fluid motion. Flow can be measured in an assortment of ways. Positive-dislodging flow meters aggregate an fixed volume of liquid and after that check the quantity of times the volume is filled to measure flow. Other flow estimation techniques depend on strengths delivered by the flowing stream as it conquers a known tightening, to calculate flow indirectly. A flow sensor is a gadget for detecting the rate of liquid flow. Flow sensor is the detecting component utilized as a part of a flow meter, to record the flow of fluids. As is valid for all sensors, outright precision of an estimation requires a usefulness for calibration.

4.2 Software Used

KeilμVision4 provides Integrated Development Environment which is an open source front end for assembly and cross compilation. Embedded C is a HLL(high level language), which incorporates numerous parts of the ANSI (American National Standard Institute) C programming language. KeilμVision4 is utilized for composing embedded C programs. Standard libraries are modified or improved to address the characteristics of an embedded target processor.

5. Experimented Result

This section gives the insights about the results of the proposed system. The implementation and execution of Vehicle Locking System using CAN is done effectively.

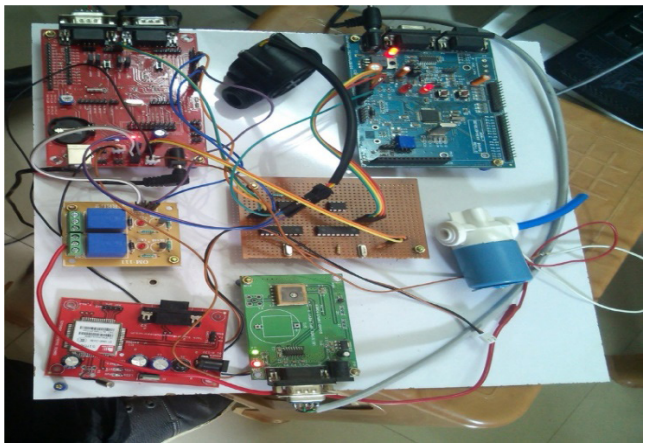

Figure 4. Hardware kit.

Figure 4. shows the hardware part of the project. Whenever ignition is ON, flow sensor senses the fuel and embedded GSM module will send text message to the owner's mobile number as shown in Figure 5

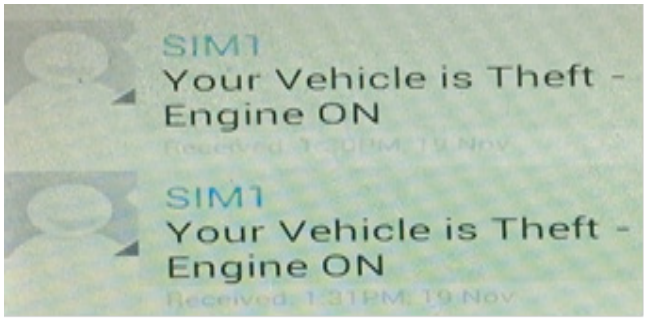

Figure 5. Mobile Screen displaying ignition state.

Whenever owner wants to stop the engine and want to retrieve the exact location of the vehicle, interrupt will be given via SMS. In this, 'a' is given as an interrupt. GSM module will recieve this message and instantly relay connected to flow sensor will be ON and stops the fuel flow. At the same time, location of the vehicle will be sent back to the owner of the car. Figure6. shows the mobile screen of the owner.

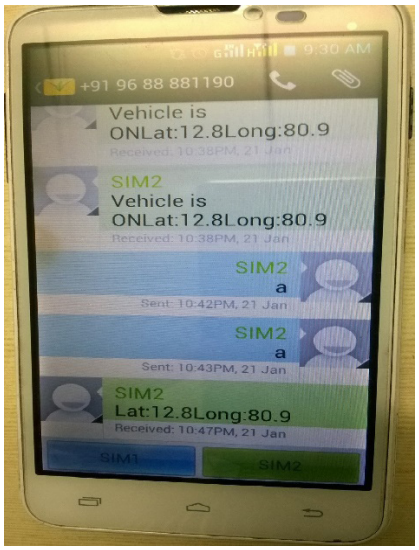

Figure 6. Screen displaying Location.

6. Conclusion

In this paper, modest attempt is made to track and lock the vehicle using GSM and GPS technology. This proposed system can be real threat to vehicle thieves and it

will not be esay to access the vehicle by unknown person since mobile communication is used. This project manages the outline and improvement of a theft control framework for a car, which is being utilized to counteract/ control the burglary of a vehicle.

In future, whole system can be made more compact and flexible. All the modules and sensing system can be brought under a single chip and System-On- Chip (SOC) for anti-theft control can be designed.

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