Anti-Theft Device and Traffic Safety Alert System for Automobiles

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Abstract: *Presently almost of the public having an own vehicle, the safety of the vehicle is crucial for public vehicles. The proposed system as a social asset provides safety and security. Image processing techniques along with current technologies such as GSM and GPS is implemented in this system. So tracking is easier and also commanding is simpler. Furthermore safety is provided by the ultrasound sensors integrated in this system.*

Keywords: ultrasonic sensor; GPS; GSM;FDS;NMEA

1. Introduction

The vehicle tracking and anti- theft system using an embedded system coupled with a single module of GPS and GSM. It can provide the real time location of a vehicle and also report theft via Short Message Service (SMS) text to the client and alternatively the tracking server. The GPS reads the current coordinates of the vehicle and the data is sent to client via GSM network using the GSM modem. The client mobile or tracking server can be used to stop vehicle theft by simply sending SMS text to the vehicle tracking device to switch off the vehicle ignition system. The system displays that the vehicle is theft at the back screen of the car and then the camera placed inside the car would take the snap of the thief. SMS is implemented due to its wide usage by mobile phone subscribers across the globe. Moreover the ultrasonic sensor integrated into the robbed vehicle prevents the vehicle from further accidents by detecting the distance between the robbed vehicle and the vehicle behind them.

2. System Architecture

a) PIC microcontroller
PIC is a family of Harvard architecture microcontrollers made by microchip technology. PICs are most popular with both industrial developers and hobbyists alike due to their low cost, wide availability, large user baser, extensive collection of application notes, availability of low cost or free development tools, and serial programming. Demo boards are available with a small boot loader that can be used to load user programs over an interface such as RS-232 or USB, thus obviating the need cvfor a programmer device.

b) GPS
The Global Positioning System (GPS) is a satellite-based navigation system consists of a network of 24 satellites located into orbit. The system provides essential information to military, civil and commercial users around the world and which is freely accessible to anyone with a GPS receiver. GPS works in any weather circumstances at anywhere in the world. Normally no subscription fees or system charges to utilize GPS. A GPS receiver must be locked on to the signal of at least three satellites to estimate 2D position (latitude and longitude) and track movement. With four or more satellites in sight, the receiver can determine the user's 3D position (latitude, longitude and altitude). Once the vehicle position has been determined, the GPS unit can determine other information like, speed, distance to destination, time and other. GPS receiver is used for this research work to detect the vehicle location and provide information to responsible person through GSM technology. The hardware interface for GPS units is designed to meet the NMEA requirements.

GPS and GSM based vehicle tracking system that provides the owner of a mobile asset with full security and track of the asset. To track any vehicle, the owner has to send an SMS to the system installed inside the vehicle. The microcontroller takes the current location from GPS, upon receiving the SMS, and sends it to the owner using GSM. The owner of the asset can find the status of the vehicle and control to turn its engine off with just an SMS, this service is available 24/7. The only owner can access the website and use android app to communicate with their vehicles. This system is specially designed to overcome the problems of traffic organization, vehicle theft and surveillance. The system does not provide user with an independent tracking system because it uses GPRS and SMS gateways. It fails if the SMS gateway and GPRS is blocked, so, it is totally dependent and is not standalone. The limited and portable battery power is a bottleneck in WSNs. Consequently, this cannot be used for long-term, standalone and reliable tracking system. Above all, the cost of this system is much less comparatively, which makes it economical. The system design turns out to be the most efficient, robust and powerful tracking system design with a number of features to offer. It can be easily installed in any vehicle to check status with just an SMS.

c) GSM
GSM (Global System for Mobile Communications), is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile phones, first deployed in Finland in July 1991.As of 2014 it has become the default global standard for mobile communications - with over 90% market share, operating in over 219 countries and territories.2G networks developed as a replacement for first generation (1G) analog cellular networks, and the GSM standard originally described a digital, circuit-switched rates for GSM Evolution or EGPRS).Subsequently, the 3GPP developed third-generation

(3G) UMTS standards followed by fourth-generation (4G) LTE Advanced standards, which do not form part of the ETSI GSM standard."GSM" is a trademark owned by the GSM Association. It may also refer to the (initially) most common voice codec used, Full Rate. The GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services. GSM differs from first generation wireless systems in that it uses digital technology and time division multiple access transmission methods.

GSM is a circuit-switched network optimized for full duplex voice telephony. This expanded over time to include data communications, first by circuit-switched transport, then by packet data transport via GPRS (General Packet Radio Services) and EDGE (Enhanced Data system that divides each 200 kHz channel into eight 25 kHz time-slots; GSM supports data transfer speeds of up to 9.6 Kbit/s, allowing the transmission of basic data services such as SMS (Short Message Service).

d) FDS

Face detection is to find whether there are faces in one image or not and their positions, and it belongs to "pattern recognition", one hot study spot of computer intelligence. Many methods have been put forward to solve the problem. Face detection is to find faces in one image by the trained cascade classifiers. Every node determines whether there are faces in the image according to the data in classifiers' data file which is the outcome of training process. As a result, face detection process is pure calculation process, and most of the results of face detection research papers are obtained by detecting images on personal computer platform. But in the low-cost extendable embedded smart car security system, no

Powerful CPU could be utilized. In several papers of the recent years, DSP (Digital Signal Processor) or FPGA (Field Programmable Gate Array) are used to speedup the detection process and to meet the real-time target, but the cost of whole system is increased at the same time.

In car security system, the demand of "real-time" may not be as rigorous as other application environment, such as to distinguish a criminal out of people in street. Since the driver will not leave the car in a very short time, the car security system has a few seconds to make the judgment of the face is detected, and the period of time is enough long for the car security system to accomplish the face detection process. In the system prototype, one USB camera is used to catch images in car, and the data are transmitted to FDS module by USB channel, and the data are transferred into jpeg format files by the chip embedded camera before the transmission. Every image is set to be 320*240 pixels in resolution ratio to remain small in size and could be detected fast.

e) Ultrasonic Sensor

Ultrasonic transducers are transducers that convert ultrasound waves to electrical signals or vice versa. Those that both transmit and receive may also be called ultrasound transceivers; many ultrasound sensors besides being sensors are indeed transceivers because they can both sense and

transmit. These devices work on the principle similar to that of the transducers used in radar and sonar system, which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Active ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object. Passive ultrasonic sensors are basically microphones that detect ultrasonic noise that is present under certain conditions, convert it to an electrical signal and report it to a computer.

f) Alarm

Here buzzer is used for audio indication. Here a 12V piezo buzzer is used. This contains a piezo-electric crystal. The crystal is so cut that the natural frequency lies between 1 and 2 KHz. In order to oscillate this crystal at this frequency it is necessary to apply the same frequency between the opposite faces. This crystal is stamped to a thin metal film. This metal film is mounted on a plastic or acrylic enclosure, which produce a sufficient air column. Whenever the buzzer is vibrating in its natural frequency the metal film will also vibrate which results in an air column vibration or simply the audible sound. Since the user do not know the exact natural frequency it is impossible to vibrate the crystal efficiently. Hence the manufactures introduced an LC oscillator along with a transistor inside the enclosure. The natural frequency of the LC tank circuit is so calibrated that it will be exactly same as the natural frequency of the crystal. This internal oscillator will contain a BC 547 transistor with the above LC circuit connected at its collector. The crystal is also connected in parallel to this LC circuit. There is feedback element, which is also stamped in the metal frame. When the metal frame vibrates this feedback element vibrate producing an electrical voltage in the same frequency. Out of the two terminals one is connected to the positive rail, which is common to the above circuit, and the other is connected to the base of the transistor via a current limiting resistor.

This arrangement will keep the oscillation from damping resulting in a continuous sound. The entire arrangement will reduce the cost, weight and the external circuitries. Hence the user is supposed to connect only a DC voltage across the two wires, which are leading out from the enclosure. One of this is connected to the emitter of the transistor. This must be connect to the negative terminal of the battery while the other one to the positive terminal.
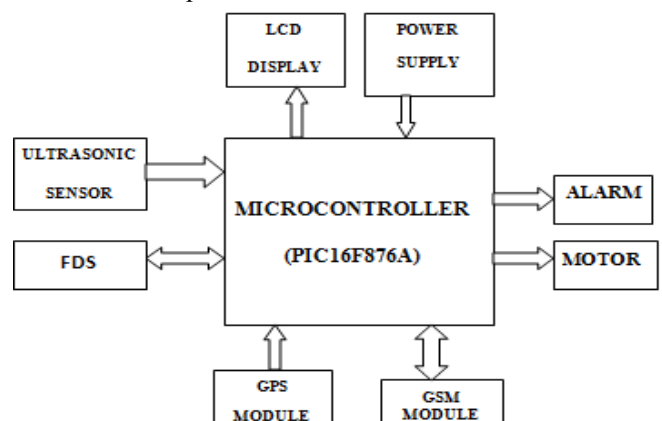

Figure 1: System architecture

3. System Overview

When a theft is detected by the owner, he sends a message to the device attached in the car. And the microcontroller gets activated and constantly analyzes the GPS and GSM modules. Whenever the device attached to automobile gets a message to trace the location, the GSM module sends the GPS information via sms. Within that time camera gets activated and captures the image of the person sitting in the driver seat instead of the owner. MMS of the image is send to the owners mobile. If the owner further sends a message to stop the vehicle then the vehicle stops. To avoid the accidents that can occur while abruptly stopping this vehicle can be avoided using ultrasonic sensor that constantly checks the distance and if it is less than 2m then the vehicle will not stop, and if it is greater than 2m the vehicle stops. Whenever the vehicle is stopped, the buzzer gets activated and alert the traffic or nearby people.

4. Conclusion

The main motto of the system is to integrate the digital image processing and the wireless technology effectively for automotive environments. Secured and safety environment system for automobile users and also key points for the investigators can easily find out the hijackers image. This project will help to reduce the complexity and improve security, also much cheaper and 'smarter' than traditional ones. This system has the advantages of low cost, portability, small size and easy expansibility. When the theft identified, the responsible people send SMS to the micro controller, then issue the control signals to stop the engine motor. After that all the doors locked. To open the doors or to restart the engine authorized person needs to enter the passwords. In this method, easily track the vehicle place and doors locked. In our project the security system is based on embedded control which provides security against theft. The GSM modem provides information to the user on his request. The owner can access the position of the vehicle at any instant. He sends a message in order to lock the vehicle. The GPS receiver on the kit will locate the latitude and longitude of the vehicle using the satellite service. Ultrasonic sensors assure safety for both the own vehicle and public vehicles.

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5. Acknowledgement

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