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Gps/Gsm Technology For Anti-Theft Control System

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ABSTRACT: *This work presents a secured and reliable anti-theft control system for vehicles using GSM/GPS technology. This device creates the possibility of accessing the vehicle from a remote location. The system adopts GSM technology in form of AT command to notify the user through SMS once there is an intruder. The notification provides information on the details of the vehicle position (longitude and latitude), speed and other information concerning the vehicle. An additional feature of this device other than the conventional anti-theft system is the inclusion of data base of security agencies so that the SMS (including the details of the vehicle) is also sent to the nearest security agency for help. The work is in two part ; the hardware aspect which comprises of GPS, GSM, microcontroller (PIC16f877A), MAX 232, Relay, LCD and software part which involves interfacing of GSM/GPS module, relay and LCD with the microcontroller (PIC16f877A) unit. The latter forms the heart of the circuit. It performs control actions on the vehicle from a mobile phone. This is an advantage of the wide coverage area of GSM networks. The GSM Module is configured to be scanned by the microcontroller in such a way that if any AT command is prompted, it is quickly stored in the memory of the controller, thus displaying its output on the LCD which is configured in 4bit mode. On implementing this system, the vehicle owner has the ability to send command to immobilize the vehicle upon intrusion so that it can be recovered.*
KEYWORDS: *Vehicle Tracking, Microcontroller, GSM/GPS technology, Mobile Phone, AT command.*

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I. INTRODUCTION

Road transportation is one of the most common means of transport system, for this reason, lots of awful incident is recorded on daily basis. The most alarming is the rate of car theft. It is therefore important to provide excellent security with a reliable anti-theft device. An anti-theft vehicle control system is an electronic device installed on a vehicle so that it could be tracked by its owner or a third-party in order to determine the time, position and speed of the vehicle. The difficulty in finding the exact location of the vehicle when stolen, and giving further information to the appropriate authorities is the objective of this work. Over time, people find it difficult to indentify the exact location of vehicle when stolen; as most times the vehicle may not be at the exact location it was stolen.

This problem is solved by monitoring, tracking and immobilizing the vehicle. All this is achieved using anti-theft control system for vehicle via GPS/GSM technology.

Communication components such as cellular (GSM) and satellite transmitter are employed to transmit the vehicle's position to remote user. Other applications of the anti-theft control systems are for monitoring driving behaviors of an employee by an employer, a parent with a teenage driver, theft prevention and retrieval device for commercial vehicles and a replacement for traditional car alarm. This device certainly will aid in reducing insurance cost of vehicles. Hence this work is therefore relevant to every individual that is security conscious.

II. REVIEW OF RELATED WORKS

Several studies have been done on anti-theft control system for vehicles using GSM/GPS technology. The different techniques and approaches adopted are based on the specific scenarios and circumstances under consideration.

Vehicle control in-front obstacle detection system provides vehicle cabin safety and security. It is based on embedded system in which IR sensors are deployed to show immobile hindrances such that the vehicle is

stopped if any obstacle is detected [1] . However Face detection systems are used to detect the face of a driver to further make comparism with that of a predefined face meant for that particular vehicle. The system obtain images via small web camera install in the car and compare the obtained images with the stored image and send the information the car owner's phone via MMS [2].

[3] described an anti-burglary vehicle security framework which allows access to the vehicle when individual's finger matches the one stored in the framework.

The GPS/GSM based system has two parts; the mobile unit and control station. The system processes, interfaces, and ensures data transmission/reception among the mobile units/ control stations are in perfect working condition [4] . Other forms of control system adopting GSM technology include the use of smart phones. In [5] Eddie proposed simple bus tracking system in UCSI University Malaysia. The system provides students with the location information of a bus, within a fixed route at precise interval using smart phones. Hence students spend less time waiting for bus.

ARM 7 microcontroller, GSM, GPS module, an accelerometer and temperature sensor was utilized by Joshi and Mahajan [6] in vehicles for Shake Orientation and Tap Detection. Ibrahim and Victor [7] described a security framework that used Dual Tone Multi Frequency (DTMF) and a GSM to screen and shield an automobile against burglary attacks. When activated, it naturally grounds the system by disconnecting the ignition scratch supply from the battery. When an intruder makes attempt via the doors, the system performs two functions simultaneously. It gives the information to the owner of the vehicle via SMS and triggers an alarm system for further notification.

In [8] Fleischer P.B. et al described development and deployment of GPS/GSM based Vehicle Tracking System, the system allows vehicle to be tracked in real-time and provides security from theft and accident occurrences.

In this paper, a stolen vehicle can be tracked, monitored and immobilized using GPS and GSM technology. When a vehicle's ignition is turned on, the vehicle's owner receives a confirmation SMS that the vehicle is powered on with the location detail (Latitude and longitude). If the access to the vehicle is illegal, the owner sends an SMS to immobilize the vehicle and a message will be sent to a nearby police station as Help me! while including the vehicle coordinates (longitude and latitude). A Smartphone embedded with Google Earth is used for tracking and viewing the location and status of the vehicle on a map. Hence tracking the vehicle is made easy, and the safety of the vehicle will be guaranteed.

III. METHODOLOGY

The design and implementation of an anti-theft control system for vehicle using GSM/GPS technology comprises of the DC power supply section, voltage regulator, GSM (SIM900B), GPS(SIRF3), microcontroller (PIC16f877A), System unit (relay driver), LCD, level converter (MAX232) and Transistor I.C (ULN2004). This is represented in the block diagram of figure 1.

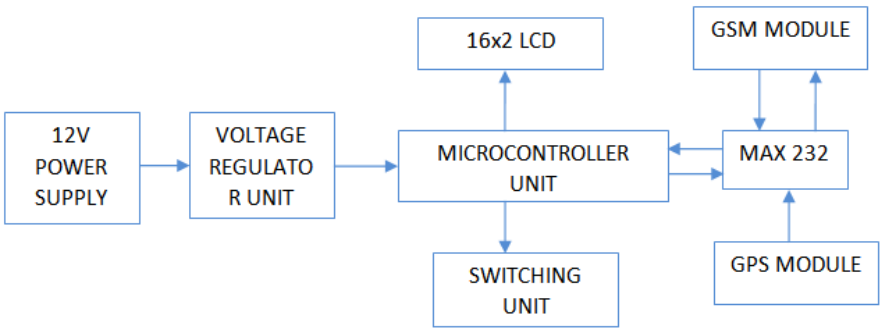

Figure 1: Block diagram of vehicle anti-theft system control using GSM/GPS technology.

The 12 volts battery provide the source of excitation to the entire circuit, a voltage regulator unit is connected to regulate the voltage to 5v for efficient operation of the entire component of the design work. The microcontroller unit contains programs that communicate with the GSM/GPS module via Max232 converter. The switching unit is responsible for stopping the vehicle when the command is given. The GPS module generates the location and position of the vehicle at any time giving its latitude and longitude while the GSM module is for communication between the administrator and the device. In analyzing the methodology, it is important to give brief description of some useful components and their function with respect to this work as described below.

THE MICROCONTROLLER

Microcontroller is a system with peripherals, memory and a processor which can be deployed as an embedded system. The microcontroller accepts its input information in digital form, processes the input in accordance with the instruction stored in its memory and provides the relevant result as output. However, in this work the PIC16F877A microcontroller was used. It is a low power, high performance speed CMOS flash with EEPROM technology. For this reason one can edit as many times as possible. It performs all the logical functions as instructed by the programmer. It has a total number of 40 pins with 33 pins for input and output.

GSM MODEM (sim900B).

The GSM modem can be described as a cell phone devoid of a display unit. It has a slot which allows for the use of a SIM card with a mobile number which operates over the internet. However, in this work, the GSM modem used is SIM900B. It is a compact and reliable wireless module, which is compatible with the modules-SIM300/340 and SIM340E. It has a very powerful single-chip processor. Based on design specification, the SIM900B offers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS and Data with low power consumption.

GPS MODULE (SIRF3 CHIP)

GPS Module continuously receives data such as the location coordinates, speed, and time from the satellite and transmits correspondingly to the microcontroller via MAX 232. The antenna receives the input from the GPS module and information concerning the position, velocity and time is displayed at the interface unit. In this project, the GPS Module used is SiRF3 chip. The SiRF3 is a range of high sensitivity GPS microcontroller chips. This chip decodes the signal from the satellite in other to obtain the location of the GPS receiver.

LCD (Liquid Crystal Display)

LCD is an electronic display module. However, in this work, the LCD used is 16x2 type. This specific type is readily available and is in common use in devices and circuits. A 16x2 LCD describes the fact that it can display 16 characters per line by 2 lines.

RELAY DRIVING CIRCUIT

Two relays were used in the circuit to implement device control. These include; 1. to turn ON or OFF the devices. 2. the switching relay is used to reduce the pump supply in the advent of immobilization of car.

VOLTAGE REGULATOR IC 7805

A voltage regulator generates a fixed output voltage of a preset magnitude that remains constant regardless of changes to its input voltage or load conditions. The voltage regulator 7805 was selected to provide a regulated fixed 5v which is used to supply the microcontroller, LCD, and the level converter.

SOFTWARE DESIGN

The followings software was used for the implementation of the entire system.

- PROTEUS; is electronic design automation (EDA). It has schematic capture, simulation and PCB layout modules.
- MPLAB IDE: MPLAB is a proprietary freeware integrated development environment (IDE) to handle the build up of embedded applications with respect to the PIC
- TOPWIN COMPILER SOFTWARE; is used to program microcontrollers, EPROMs, EEPROMs etc.

The flow chart for actualizing the entire process is shown in fig 2.

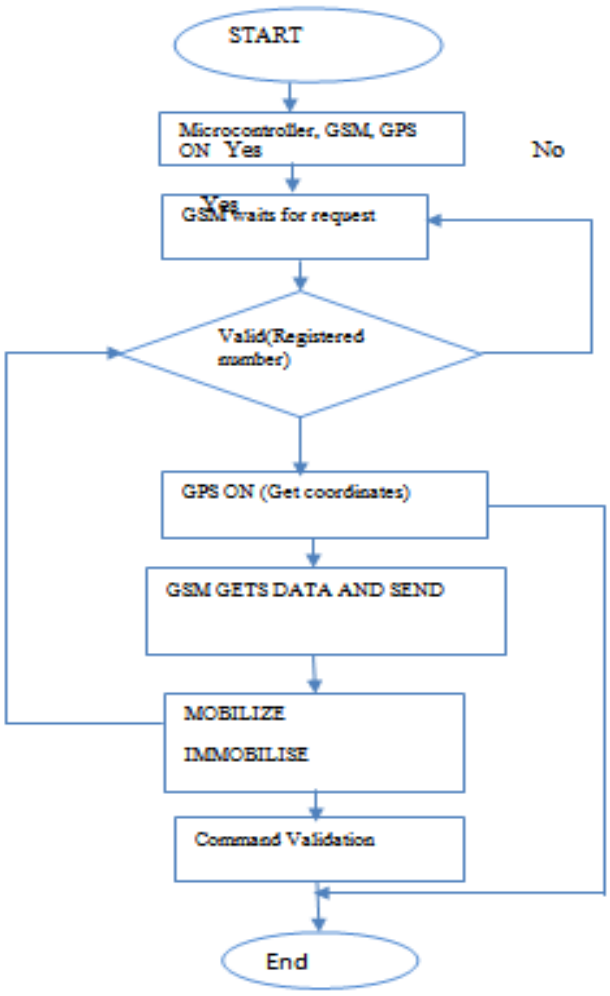

Figure 2: Flowchart of the system operation

AT COMMANDS

In this work, the AT commands are deployed to ascertain the activities of the modem. Just as the acronym AT stands for attention command, it ensures each command is executed before approaching the modem.

Table 2: AT Commands

The AT commands	Short Description
Begin+password	When this command is sent as a text message to microcontroller the responds to the user number is begin ok as reply, there by noting the number for other command but not as an administrators number.
Admin+password	This command assign right of admin to the phone number used, thereby having access to give command and receive response in a full duplex mode. This is achieved by sending admin+password+space+phone number (i.e admin123456 080xxxxxxxx) as text to the module. The user receives feedback reply of **admin ok**
Check+password	when this command check123456 is sent as text to the system, microcontroller respond by sending the status of GPS, GSM, door status, power level, ignition status (ACC) to the admin as reply.
Resume+password	When an admin number send this command resume123456 as a text to the module. The module respond **resume engine succeed** as text to the admin number and the microcontroller activate the relay (fuel pump ON).

Stop+password	When this command stop123456 is sent as text to the module. Knowing well that the number sending the command is an admin number, hence the microcontroller will receive a stop command from the module to operate a relay that automatically stop the vehicle from moving (ie fuel line cut off). Microcontroller will respond **stop engine succeed** as text to the sender.
ACC+password	The ACC here represent ignition status of the car (ACC means Accessory) when this is sent a text message to the module, it activate the code from the program to monitor the ignition status of the car either ON or OFF this is achieved by sending ACC123456 as text. The respond gotten include either ACC is off/on! The lat/long details, speed, time are sent from the module to the user (admin)
noACC+password	This command is use to deactivate the monitoring function of the ignition status thereby if there is change in ignition position the microcontroller/module will not respond to it. This is achieved by sending **noACC+password** (i.e noACC 123456) as a text.
Calling/dialing	When a registered admin number want to know the position of the car or device, he /she can will place a call to the device. The module response is hang up the call and respond in real time the **longitude and latitude including the speed ,time and status of the door.**
SOS button	SOS simply means save our soul, it's an emergency code which simply signify a call of distress. when this button is pressed it will sent help me! with latitude and longitude for every 3 minutes. To all the admin number registered in the module including police station number that is registered as an admin in case of emergency.

The microcontroller is programmed to implement these commands based on the instructions given. This is done to perform the specific task so that, any command sent which was not captured by the UNIQUE command is ignored by the system. The microcontroller is configured with 8MHz crystal biased with 15pf capacitor. In an advent of wrong password the system will respond (pwdfail) but if no password is typed, the system will not respond.

MODE OF OPERATION

The diagram below (figure 3) shows the circuit diagram of the system. It is designed such that when the car ignition is turned on; the system becomes energized hence initializing both the Microcontroller and the GSM/GPS module. Upon this, the microcontroller picks the signal to acquire the vehicle's location information (speed, position, date, time, latitude and longitude) from the GPS module via MAX 232. The signal is transmitted to the GSM module through MAX232. The vehicle's geographic co-ordinates; latitude and longitude are stored in the memory. With a smart phone having Google map application, the vehicle location can be displayed using the recorded values. The GSM module immediately sends a message to the owner's phone within the reach of network. When a vehicle is stolen, the owner with knowledge of the AT commands (as shown in table 3.3) decides on the action to take knowing that the microcontroller has already being programmed. Hence the vehicle owner sends command to the microcontroller, to immobilize the vehicle and SMS is sent to the nearest police department for help. The system demonstrates its effective performance to track a vehicle's location anytime from anywhere.

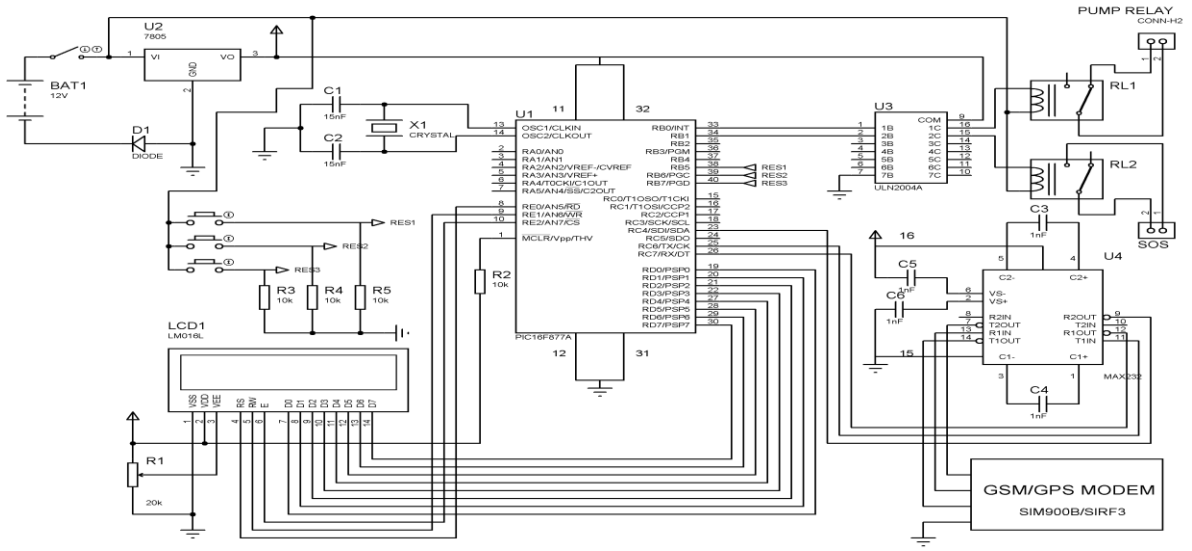

Figure 3: Circuit diagram of anti-theft vehicle using GSM/GPS technology

The pictorial presentation of the work is shown in the figure below. It has a dimension of 22.6cm x15cm x5.5cm.

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Figure 4: The pictorial layout of the system casing.

PRECAUTION

I the course of this work, the following precautions were taken:

- Components which include; the GSM/GPS module, microcontroller (PIC16F877), level converter (max232), Power regulator (LM7805), and other components were handled with great care.
- The application of heat on the components was done meticulously to avoid damage of the components.
- Proper IC handling procedures were followed when dealing with components that are susceptible to electrostatic discharge.
- The power rating of the components was not exceeded.
- IC socket were used for the IC's to prevent damage.

IV. TESTING AND RESULT

Test was carried out on the circuit such as power supply test, program test and other test to ensure that circuit was in perfect working condition as desired. Tables 4.1 and 4.2 respectively show the test result of the battery condition and voltage regulator condition on loads.

Table 3: Battery Condition Test using digital multimeter

Battery condition test		
	Ideal condition	Test result
Battery	12.5v	12v
Battery on load	12v	11.9v

Table 4: Voltage regulator condition test using digital multimeter

Voltage regulator condition test		
	Ideal condition	Test result
Voltage regulator	5v	5v
Voltage regulator on load	5v	4.5v

The proposed system was also tested from various mobile Phones and at different locations it was observed that SMS was sent to the designated number. The project was tested on several occasions after loading the software onto the microcontroller. Proper troubleshooting was performed and the errors encountered were error adequately removed.

V. CONCLUSION

The design, implementation and testing of the anti-theft control system for vehicle using GSM/GPS technology was successfully carried out. The proposed device was aimed at monitoring, tracking, immobilizing and detecting exact locations of vehicle when stolen in real-time. The system demonstrates its effective performance to monitor, immobilize and track a vehicle's location anytime from anywhere.

A major contribution to this work include the fact that; information on the location of security agencies are provided in the tracking system, so that a Help me! Message is sent to the nearest rescue team. This will accelerate the recovery of the vehicle.

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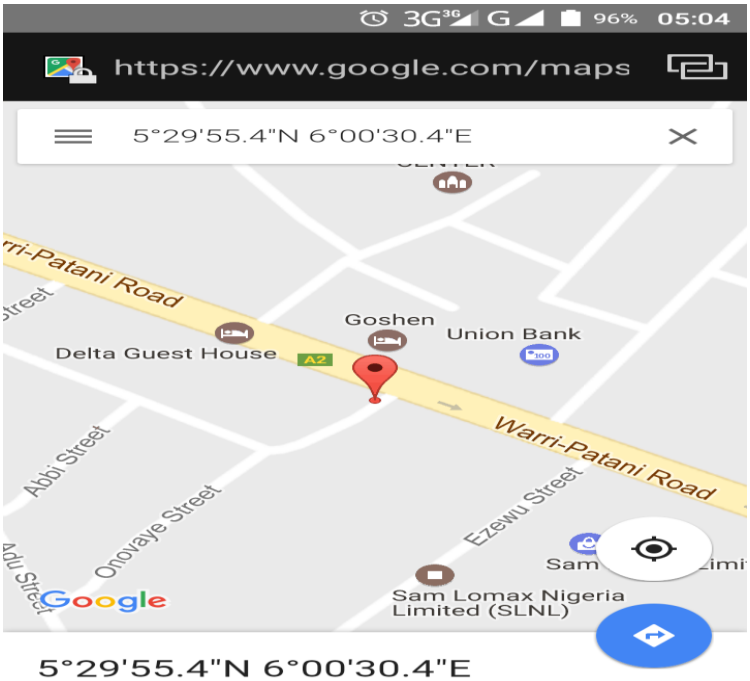
help me!
Lat:5.498707
Long:6.008437
Speed:0.00
T:16/12/07 15:49



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