International Journal of Trend in Scientific Research and Development, Volume 1(2), ISSN: 2456-6470
www.ijtsrd.com

Application of Micro-Controller in Vehicle Monitoring and Security System

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ABSTRACT
Improvements in ICT have allowed people to enjoy more relaxed lifestyles. Vehicle monitoring while parked or driving is an example of a problem that needs to be addressed. Car owners, especially those whose hard-earned money was spent on a vehicle or whose loss would cause significant hassles to their family and workplaces, need to be aware of the importance of vehicle security. The primary problem faced by all vehicle owners is thus made much more difficult. Using GSM and GPS technologies, the Microcontroller-based Car Security System with Tracking Capability is a system that can trace the position of a missing vehicle and provide authorities with solid evidence that the vehicle has been stolen. This technology allows for the continuous monitoring and tracking of vehicles in a given area.

Keywords: *Vehicle, Vehicle Monitoring, Vehicle Monitoring System, VMS, Microcontroller, GPS, GSM*

Introduction
The dramatic rise in vehicle theft highlights the importance of using technological advancements to protect one's vehicle. The purpose of combining GPS and GSM module tracking of vehicles with in-vehicle audio monitoring is to keep tabs on their whereabouts and on any conversations that may be taking place therein. [1] Even though global positioning system (GPS) and global navigation satellite system (GLONASS) technologies are the most prevalent types of automatic vehicle location technology employed by modern car tracking systems, additional options do exist.

The created Vehicle Monitoring System (V.M.S.) centres on keeping tabs on a vehicle that already has this system installed. As soon as you turn on this system, it will keep vigil within the car, looking for any dangers and recording any incidents that may occur. V.M.S. will continue to carry out its predetermined tasks for as long as it is operational and receiving power.

After data collection and monitoring by the V.M.S., the results are sent to the user by text message. The SMS includes incident-specific details, as well as the V.M.S. location where the incident took place and a link to the user's mobile's preinstalled Google Maps software, where the user can view the incident scene. [2] By doing so, the user is alerted and can monitor the location of his or her vehicle or other equipment equipped with the V.M.S. The system operates entirely offline. This means that sending and receiving SMS messages is all that's needed to access and interact with the entire system. Therefore, the vehicle monitoring system may be simply controlled and interacted with by any user with a mobile phone, a sim card, and the ability to send and receive SMS messages. [3]

The system's functions extend beyond mere vehicle tracking, into the realm of security. A personal ID and a remote with an entry/exit/panic button will be issued to each passenger or worker. To signal an emergency, the driver or passenger can use the "Panic" button. If the passenger or worker presses this button, an alarm will sound to aid them in an emergency and keep them safe during the trip. A remote immobilizer system is available for the car. [4]

Every five minutes, the GPS Module broadcasts the current location of the vehicle along with its longitude, latitude, heading, and Greenwich Time. A GSM network set up in a valid region and with a valid service provider is necessary for the GSM wireless communications feature to work. The GPS-GSM VMSS sends its location and operational status to the control centre via short message service (SMS) from the cellular network. Meanwhile, the VMSS receives the control information from the control centre via the same SMS. [5] Next, the GPS-GSM VMSS transfers the information contained in the microcontroller through an RS-232 port.

The VMSS alarm feature can be triggered in two ways: with a buzzer or with an LCD display. There

are two ways to report an alarm to the command centre: one is to get the command from the centre, and the other is to manually provide the information. Both a GIS workstation and a landline modem make up the base station. At the base station, the vehicle data is processed and shown on a PC map. Electronic maps allow users to access vehicle data via the Internet or specialised software. [6] In order to keep track of how the public transportation system is functioning, Geographic Information Systems (GIS) creates a spatial map that is always up to date. It's a specialised form of DBMS in which different databases pertaining to different geographic areas are linked together using a standard system of geographical coordinates.

Applications of the system

- For Personal Vehicle

As an example, the proposed system may be installed in a private automobile and used to send an SMS with directions to the driver as soon as possible. GPS technology allows for the location of the damaged vehicle in the event of an accident.

- Insurance Companies

Commonly, the claimed amount is the result of a staged accident in which the claimant is injured. This auto system can then be installed in the insured vehicle by the insurance company. Everything about the vehicle, up to and including the moment of impact, would be recorded by the system. Information captured can be simply analysed by the insurance company to determine if the event was staged or not. As a result, the insurance company will be able to avoid paying out on fraudulent claims. [7]

- Research and Development of Vehicle

An engineer needs data about the vehicle at varying speeds and times in order to evaluate the car in R&D. However, it is not possible to measure the data for every second and the number of factors at the same time, therefore this information is not precise. However, with the implementation of the proposed system, the information can be made available for each and every second. The data can be represented graphically as speed against time and engine temperature vs time with the aid of any software (LABVIEW).

- Military Applications

Ammunition is transported in vehicles used by the military. Knowing this, conspirators may attempt to attack such vehicles in order to either steal the weapons or destroy them. Military vehicles can be equipped with this mechanism to compensate for the loss this causes. The SMS alerts the military base station immediately if the truck is assaulted or disabled, preventing the weapons from falling into the wrong hands.

- Avoiding Fuel Theft

One way to prevent the fuel level from dropping too low is to set a minimum value for the fuel engine. When this occurs, an SMS message will be sent to the owner[8].

Review of Literature

There is a new, simple circuit that J.Pelegr et al. [9] developed to detect the magnetic disturbance created by cars using two GMR Magnetic Field Gradient Sensors embedded directly into the asphalt of a freeway or other high-speed road, without the need for any wiring. A Microcontroller analyses the signal from sensors as a car passes above the board, allowing us to determine its speed and length in real time.

A novel concept for speed detecting devices based on LASER beams is presented by Hameed Hamada and Malathi [10]. The developed system can measure vehicle velocity on streets, major thoroughfares, and other areas where drivers have legal leeway to increase their rate of travel. The LADAR technology that was developed is more dependable and yields more precise results.

The goal of the study by Pornpanomchai and Kongkittisan [11] is to create an image processing-based system for detecting vehicle speeds. Together, these tasks constitute the software creation of a system that makes use of a video scene that includes a moving vehicle, a starting reference point, and an ending reference point.

An on-board system designed by A. Rajasekhar et al. [12] is able to continually monitor and trace the location of cargo or goods put on board for digital supply. RFID and GPS are used in tandem in this system. The CPU is a low-power 16-bit RISC microprocessor due to its tiny size and high efficiency. Auto-identification of loaded cargos is achieved by the vehicle's terminal system, real-time location, information and voice communication, and constant observation. Use of RFID and GPS improves the system's accuracy and productivity.

For uses that call for continuous location data about a vehicle, P. Muruganandham and R. Mukesh[13] reported research on a real-time vehicle monitoring system. In order to obtain a self-sufficient positioning

system capable of logically communicating regional data, active structures are generated. The GPS/GSM module incorporates an SMS feedback mechanism.

The primary components of the vehicle's technology are a GPS/GSM module and a remote tracking server. A RealTime automotive monitoring system was presented by Muhammad Adnan Elahi, Yasir Arfat Malkani, and Muhammad Fraz [14] to identify attempts by unauthorised individuals to get access to a vehicle's engine. When the user enters their PIN, their phone is immediately notified of the vehicle's location and the time of entry. The system does not have any input methods specified.

Objectives

- To study obstacle detecting circuit
- To study circuitry diagram of GPS & GSM integration with microcontroller unit
- To study vehicle monitoring system
- To study vehicle monitoring system application

Research Methodology

A research methodology can be defined as a standard approach to a research topic that includes steps like gathering relevant data, analysing that data, and drawing conclusions from it. In scientific inquiry, a research method is the blueprint for how things will be done. To broaden our understanding of a topic, researchers collect and examine data in a systematic way. Finding answers to theoretical and applied conundrums is the reason for the research. The research can benefit from an in-depth reading of and analysis of secondary sources in order to apply analytical and descriptive methodologies. To fully develop the textual analysis, it is necessary to read a small number of secondary sources closely.

Result and Discussion

In this analysis, we take into account the vehicle monitoring system's block diagram as well as the architecture of its individual modules. Fig. 1 is a block diagram of the system.

Fig. 1 Block diagram of vehicle monitoring system

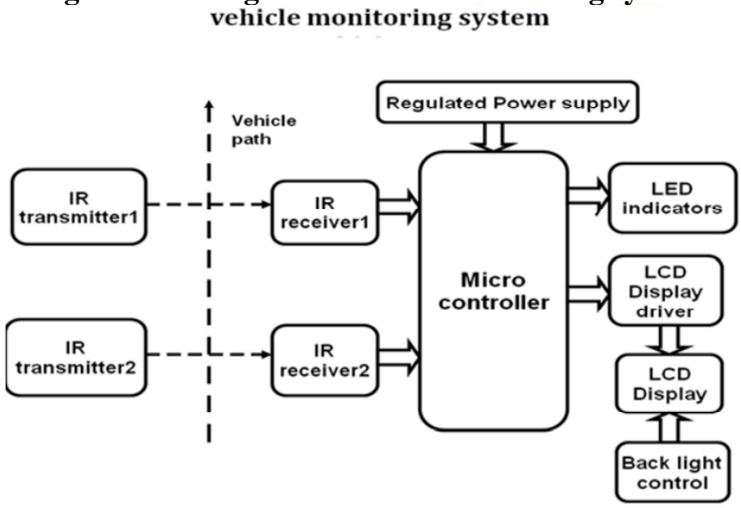

Fig 2 is the proteus design of GPS & GSM integration with microcontroller unit.

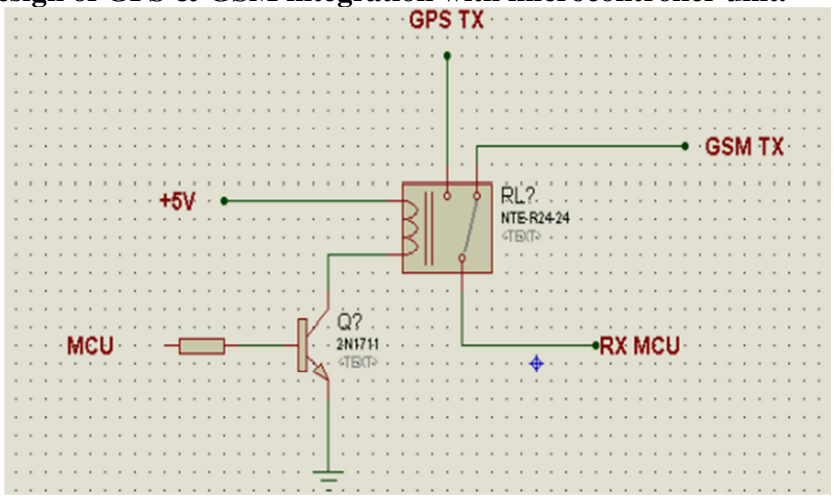

Fig. 2 Circuitry diagram of GPS & GSM integration with microcontroller unit

With the GSM module's transmit pin connected to the normally open (NO) pin of the relay and the GPS module's transmit pin connected to the normally close (NC) pin of the relay, the common of the relay is connected to the receive pin (RX) of the MCU, and since the common of a relay rests on the NC when at rest, the GSM module communicates directly with the MCU by default, while the GPS module communicates with the MCU only when requested. [15]

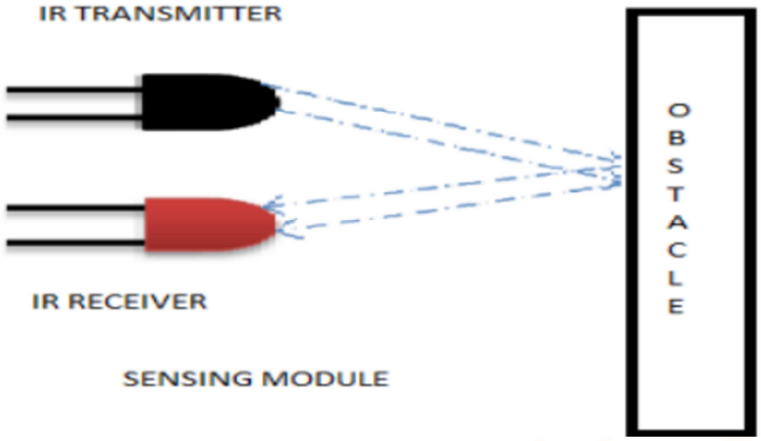

Fig. 3 Obstacle detecting circuit

Especially at night, when it's more difficult to see, incidents involving automobiles accidentally parking themselves or colliding with trees and other obstacles can be prevented with the help of the obstacle detection module. Various techniques, such as ultrasonic sensors, could be used to detect these obstructions. The primary obstacle detection circuit is depicted in Fig. 3.

Conclusion

The Vehicle Tracking System with Audio Surveillance through GPS and GSM integrates multiple communication technologies and display configurations to efficiently pinpoint the location of the vehicle on a map. Vehicle locations are displayed on a Google map, and data is collected and transmitted by GPS and GSM modems. A microprocessor that communicates with the various hardware components handles tracking, receiving and sending SMS notifications, and activating and deactivating key switches, the engine, and the alarm. The final product could be constructed and evaluated with many different tools. The results coming from the microcontroller match up with what was anticipated. The developed project has many benefits, including low costs, high reliability, the ability to deter theft, and an accurate tracking system. The recommended device was built using an Arduino board upgraded with a GSM modem, GPS, and gyroscope. In the event that the car is unlocked or stolen, the registered driver will get a ringing tone and an SMS message with the vehicle's position. When the vehicle is in danger, the device can also send out an SOS signal to notify emergency personnel and loved ones.

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