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VEHICLE MONITORING CONTROLLING AND TRACKING SYSTEM BY USING ANDROID APPLICATION

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Abstract— **Integrated engineering is a latest trend to solve problems. To be able to design a product using an integrated technology will be beneficial to any engineering problems and a huge contribution to the community. This paper presents the design and implementation of vehicle tracking, vehicle function (such as door locks, parking lights) monitoring, controlling and vehicle status (status about the engine, door and temperature) notification at anywhere by using mobile phone applications. The design system consists of Sensor-actuator module and communication module to acquire the input signals and control the vehicle functions and monitor the vehicle by using GPS and Android mobile phones. A dedicated portable affordable cost and flexible vehicle tracking, function monitoring and controller implemented catered with automobile, electronic and mobile technologies. To demonstrate the feasibility and effectiveness of the proposed system, vehicle door, parking lights and side mirrors are monitored and controlled by the mobile phone along with vehicle tracking by using Google map and status notification for vehicle engine, temperature and door have been implemented and evaluated with vehicle**.

Index: **Sensor actuator module communication module, GPS, GSM**

I. INTRODUCTION

Every year thousands of vehicles are stolen in the roads and unsecured car park. Sometimes, steals try to steel the vehicle parts by opening doors or breaking glass. Because of this people are afraid to park the vehicles in the road or unknown car parks.

To avoid this problem many designs and techniques have been designed and implemented in the vehicles. However designing a vehicle security system and interfacing the monitoring by the owners mobile phone will be the absolute solution for the current situation and the need.

II. METHODOLOGY

In vehicle monitoring and controlling system: sensor-actuator module and communication module used monitor and control the vehicle.

Sensor – Actuator Module: This module directly connected to the vehicle to acquire the input signals from vehicle to and control the relevant functions by through the actuators. This

module design and implemented by using vehicle sensors such as limit switch, reed switches, shock sensor and actuators such as relays. PIC

microcontroller used as a controller in the module to interface the sensors and actuators.

Communication module: This module designed by interfacing GPS and GSM units with microcontroller via USART protocol. In the module GPS technology used to track the vehicle positions and GSM technology used to communicate between the mobile phone and the communication module. Radio Frequency (RF) technology used to interconnect both the modules; therefor modules can place it in to the vehicle separately and anywhere in the vehicle. Communication unit design and implemented in a smaller size and this will able to hide the module inside the vehicle for more security. PIC microcontroller used as a controller in communication modules due to cheap cost and easy interface with GSM and GPS units.

Mobile Application: An android application used as a main interface between user and the mobile phone. Password protection is being used in the application to only allow authorised users from accessing the mobile phone. Modules are powered by vehicle power supply and backup batteries. A relay is used to switch the vehicle power supply to backup battery; therefore if vehicle supply is removed, still system can work through backup battery for a limited time.

III. MODULE DESIGN

PIC microcontrollers are used to design both the modules. PIC16F876A microcontroller used in the design of sensor-actuator module and PIC18F45K22 microcontroller used in the design of communication unit.

Sensor – Actuator module Design

PIC 16F876 interface with relays to actuate the vehicle control and microcontroller interface with temperature sensor, reed sensor, limit switches and vibration sensor to monitor the vehicle.

Interfacing relays with PIC microcontrollers: Relays are widely used in automobile used to control or switch high voltage and current path by using small voltage. As well as it provides complete isolation between the main circuit and the automobile devices. Relays cannot be directly connected with microcontrollers due to fly back current. In order to interface relay to microcontroller relay driver circuit used, it basically contain a BC547 transistor as a switch. As well as there is a 4.7K Ω resistor and 1N4148 diode. 4.7KΩ resistor is used as current limiting resistor for the transistor. And the diode is used for block fly back current from the relay. Therefore it helps to protect the transistor, from fly-back current of the relay.

Interfacing temperature sensor with PIC microcontrollers: To acquire vehicle temperature by using owners mobile phone LM35 temperature sensor interface with PIC. LM35 is liner temperature sensor and generate analogue output voltage level according to the temperature.

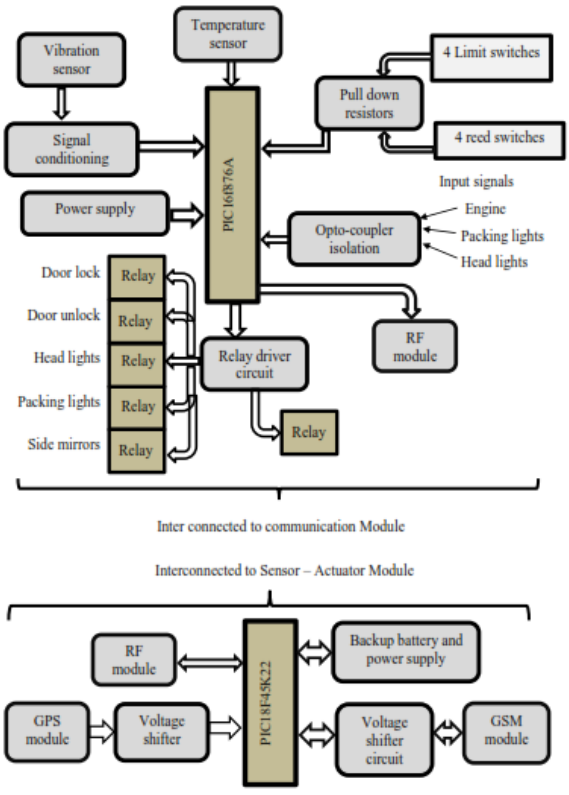

Figure 1: System block diagram

Interfacing vibration sensor with PIC microcontroller: In sensor-actuator module

vibration sensor used to detect the external disturbances to the vehicle. The internal resistance of the sensor changed according to the vibration or shock. The changes in the resistance are very small and therefore it cannot be directly connect to the microcontroller. Signal conditioning circuit used to control the signal; this circuit consist of single operational amplifier based comparator. The normal internal resistance of the vibration sensor is about 10kΩ, therefore is directly connected to the inverting terminal of the operational amplifier and with 10 kΩ resistor and a variable resistor is connected with non-inverting terminal for change the sensitivity of the sensor. The output of the circuit is always high and when the sensors get vibration the output will change to low.

Interfacing reed switches and limit switches with PIC microcontrollers: Reed switches and limit switches are used to acquire emergency inputs to the systems. Basically reed switch is simple ON/OFF switch, which is operated by magnetic force. Normally opened reed switches are used to detect if someone tries to pull the door handle and these reed switches are mounted inside the moving parts of the door handle with a permanent magnet. Therefore when the door handle is pulled by someone, the reed switch gets closed. That signal is fed to the microcontroller. Reed switches are connected with the microcontroller by using pull down resistor for the signal is low at normal time. Limit switches are used to detect whether a doors are opened or closed. In general, limit switches are in built in every vehicle these signals can be directly used to interface with microcontroller.

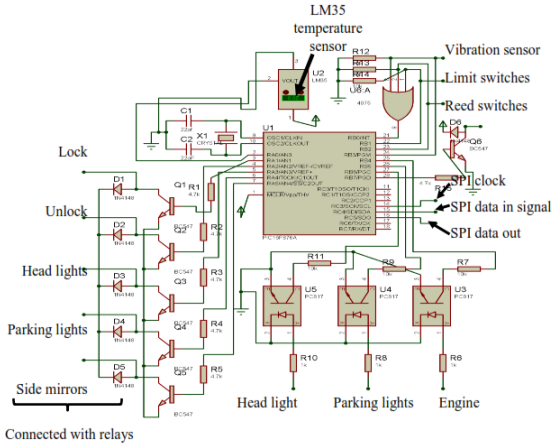

Figure 2: Sensor –actuator module

Interfacing opto-isolators with PIC microcontrollers for input signals: Using the vehicle monitoring and controller, user canget more information about their vehicle and the vehicle functions works according to the inputs from the vehicle. Normally vehicle electronic systems design with 12V signalling or controller. Therefore those signals cannot be directly connected to the microcontroller, in order to get those signals to microcontroller optical isolation is used. PC817 Opto-isolator is used to isolate microcontroller with 12V systems.

Communication module design

Interfacing GSM module with the microcontroller: Communication between system and the mobile phone is an important part of the design. GSM module is used to provide the communication path. The selected TC35i GSM module is manufactured by Siemens and the module can be connected with PIC microcontroller via serial communication. But the GSM module works with RS-232 logic level signals. Therefore MAX232 voltage level converting circuit interconnect between the module and the microcontroller to transfer the CMOS to TTL logic. GSM module is controlled by the microcontroller using stranded AT commands. Generally AT commands are used to control GSM and fax devices by other connected devices.

Interfacing GPS module with the microcontroller: GPS module is used to get position information of the vehicle by using satellite GPS data. This GPS module provides NMEA formatted GPS data according to the GPS signals from satellites. "Fastrax UP 501" GPS module is used as the GPS module in the design. The selected GPS module connected with PIC microcontrollers via serial port (UART) and it produces NMEA formatted GPS data in every 1 second. There are different format in NMEA GPS formats of GPS data, such as $GPBOD, GPFSI, $GPGSV, $GPGGA, $GPVPW. In the design, $GPGGA GPS data format is selected. $GPGGA is known as Global positioning system fix data. Basically it consists of many GPS based data. Such as time, latitude, longitude, numbers of satellites are in view, altitude

Example $GPGGA data is given bellow.

$GPGGA,062000.000,0650.5463,N,07956.7813,E,1,7,1.17,33.6,M,-96.7,M,,*4C

Latitude Longitude

Latitude and longitude directly from the above GPS data cannot be used for find location from any online map application such as Google maps. Therefore the data must be rearranging and calculated.

The latitude and longitude calculation,

$$\text{Latitude} = 6 + \left(\frac{50.5463}{60}\right)$$

Latitude = 6.842438

$$\text{Longitude} = 79 + \left(\frac{56.7813}{60}\right)$$

Longitude = 79.946355

Geographical coordinates for from above data = 6.842438, 79.946355

Now these coordinates are ready to enter any online map application for see the location. This calculation is done by program in the PIC18F45K22.

Power supply unit for communication module: Voltage regulator based small power supply unit designed to supply power for communication module. Communication module of the system has been designed for powered directly from vehicle main power supply (vehicle battery) and backup battery. A relay is used to switch to between vehicle power and backup battery power. When the system is powered by vehicle power the relay is activated and all circuit is powered by vehicle power and normally closed path of the relay is connected with the backup battery. Therefore if someone removed the vehicle battery, the system still can keep running from backup battery power. In the design two LM7805 voltage regulator are used for regulate 12V voltage to 5V voltage to supply both the modules.

Interfacing RF module with the microcontroller: 433 MHz carrier frequency RF module is used to communicate between sensor-actuator module and communication module of the system. These modules use SPI communication to communicate with PIC microcontroller. Therefore SPI clock signal, SPI data in and SPI data out used in the communication. As well as module uses 433 MHz as communications carrier frequency.

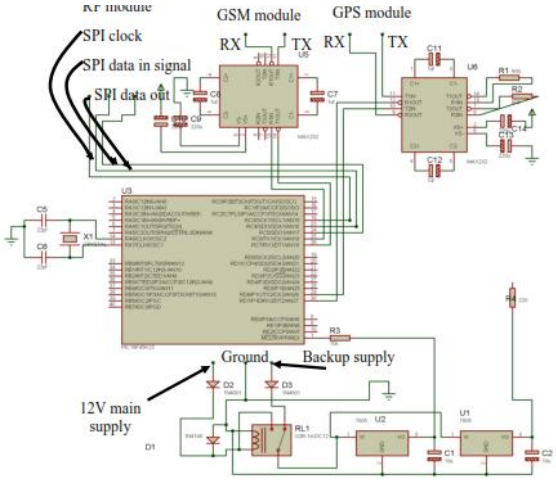

Figure 3: Communication module

IV. RESULTS

Sensor-actuator module and communication module was design and tested. Android mobile application designed using eclipse Android Development Tools, and interface with communication module by using GSM. Communication module controls the vehicle function by using sensor-actuator module.

Screenshot "A" shows the login screen of the application, in this screen user should enter the SIM card number which is installed in the security system.

Vehicle tracking, function monitoring and control tested by designed android application Figure 3, shown the application tested process.

Figure 4: Android Application for vehicle tracking monitoring and controlling

Main menu of the control and monitoring shown in screenshot B, by clicking the relevant button user can control the vehicle features by using communication and sensor-actuator module. When the user presses the status button the application screen will be changed into the status screen which is shown in screenshot C in figure. In this screen when user clicks update button this application requests the status data from the sensor-actuator module. Once the status has been received by SMS via communication module mobile application screen will be refreshed with new status.

Tracking the position of the vehicle is the most important part of this system. Screenshot D shows the screen which is used to see the location of the vehicle. By using communication module GPS will locate the vehicle location and send the coordinates by using SMS.

The develop system design to activate the emergency alert. Sensor-actuator system in the vehicle sends the alert commands to the mobile phone when system acquire reed sensor, vibrator sensor or limit switch signal. If one of those command received by the mobile application it will pop up an emergency alert screen on the mobile phone and play warning sound until user clicks the ignore button on the particular emergency alert screens.

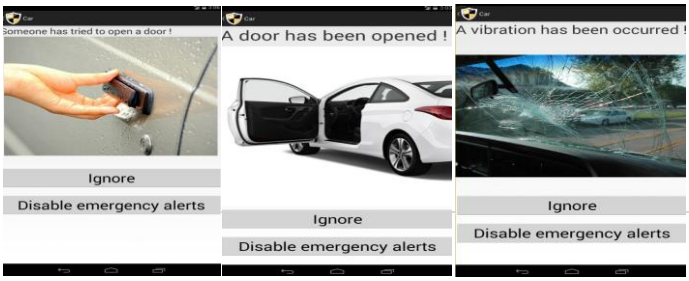

Figure 5 : Emergency alert

V. CONCLUSION

This paper discusses the complete solution for monitoring and controlling the vehicle functions by using sensor actuator module, communication module and android application. Designed system also can track the vehicle by using GPS and monitored by using android application via communication module.

Vehicle function monitored by using sensor-actuator modules. If any emergencies module will send the alert signal to the android application and alert the user.

By using android application user can control the vehicle engine, side mirror and doors via communication module and sensor-actuator module.

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