A Microcontroller Based Smart Automobile Safety System Using Labview

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Abstract—Today automobile security is one of the challenging issues in our society. All these security systems are using many sensors, so the cost of implementation is high. This paper will deal with the design and development of an embedded system, which will be used to prevent/control accidents and theft. Also this paper is mainly about the safety of oil/gas tanker vehicles which use LABVIEW software for controlling number of vehicles. The development model will be based on embedded system with GSM technology. It is an embedded system which is used for tracking and positioning of any vehicle by using GPS and GSM. There are two sections in this smart automobile safety system, control unit and vehicle unit. Both units work based on a microcontroller. We use LABVIEW software for monitoring vehicle details obtained through GSM and giving commands to vehicle unit. Security informations like tilt of vehicle, temperature status, gas leakage, theft of fuel are obtained through respective sensors attached to the microcontroller in vehicle unit. This design will continuously monitor a moving vehicle and report the status of the vehicle on demand. For doing so a PIC microcontroller is interfaced serially to a GSM Modem and GPS Receiver.

Keywords—Global System for Mobile communication (GSM), Global Positioning System (GPS), Short Message Service (SMS), Peripheral Interrupt Controller (PIC), MCU(Microcontroller Unit),PCB(Printed Circuit Board).

I. INTRODUCTION

Automobile security has also attained many rapid changes, but the costs of all the security upgrades are so high and it is not affordable for all the vehicle owners. This project is aimed to give the best security solution for the automobiles at affordable cost. In this we have incorporated the GSM technology and the LABVIEW platform to design a more secure and user-friendly automobile security system. GSM modem is used to send the position (Latitude and Longitude) and sensor details of the vehicle from a remote place. The GPS modem will continuously give the data i.e. the latitude and longitude indicating the position of the vehicle.

There are two sections in this smart automobile safety system, one is vehicle unit and the other is control unit. Both of these works on the basis of microcontroller. In control unit we use LABVIEW software for monitoring vehicle details and giving commands to vehicle unit. LABVIEW provides powerful and flexible platform tight software hardware integration. LABVIEW also have the ability to solve and execute complex algorithms in real time using real world signals. Here the microcontroller used is PIC 16F877.

The PCB Layout of the entire system is done. GSM is used as link between vehicle unit and control unit to achieve communication between these two. PIC16F877 microcontroller is very cost effective and makes the system fully automated.

The already existing methods are electronic immobilizer, vehicle tracking system and car alarm. But the costs of manufacturing these systems are quite high when comparing to the proposed system. And we can easily deactivate the warning alarm present in car security system. In developing economies where the market for car is high the people are not able to get access to high cost security systems.

II. SYSTEM ARCHITECTURE

The entire system consists of the following main units:

A. Control unit

![Diagram of control unit](image)

Fig 1 shows the main blocks for the control unit. It has the following components,
Microcontroller: This unit contains the software components such as the home appliances control system through which the appliances are controlled and a security system. The PIC 16F877 have program memory capacity of 8Kb, RAM of 368 bytes and 256 bytes of EEPROM. They are working in clock speed range of 0 Hz to 20 MHz. They have 5 I/O ports named as PORTA, PORTB, PORTC, PORTD and PORT E.

GSM Module: GSM module is a plug and play device and is attached to the Microcontroller which then communicates with the Microcontroller via port. GSM module is responsible for enabling/ disabling of SMS capability.

GPS: The Global Positioning System (GPS) is a navigation system which is space-based satellite that provides location and time information in all weather conditions, anywhere on or near the earth. The system provides capabilities to military, civil and commercial users around the world. It is freely accessible to anyone with a GPS receiver and maintained by the United States government.

RS232 interface-MAX232: A line driver (voltage converter) to convert the RS232 levels to TTL voltage levels that will be acceptable to microcontrollers TXD and RXD pins. Such converter is MAX232 from Maxim Corp. On advantage of MAX232 chip is that it uses a +5V power source which is same as the source voltage for PIC. MAX232 converts TTL logic levels to RS232 logic levels and vice versa. In RS232, a 1 is represented by -3V to +25V, while a 0 bit is +3V to +25V, making -3 to +3 undefined.

Power supply unit: This unit is to provide the required power supply to MCU.

B. Vehicle unit

Fig 2. shows the main blocks for the vehicle unit. It has the components like microcontroller, sensors, display. Sensors are temperature sensor, theft sensor, gas sensor and tilt sensor. LCD display is used for displaying.

III. IMPLEMENTATION DETAILS

Implementation of the system includes implementing functional units of system.

A LABVIEW section:

The functions to be performed by LabVIEW are to give commands to the control unit and accept the data regarding the vehicle details send by the vehicle unit. This is achieved by reading and writing serial port. Reading and writing serial port is done by Instrument I/O VIs and functions. Instrument I/O VIs allows us to communicate with message based instruments and graphically parse the response. To communicate with an instrument we had used the Serial VIs and functions to access the VISA VI s and functions that communicate with devices connected to a serial port. Additional functions are also available on the VISA (virtual instrument software architecture). VIs used is explained below.

VISA Configure:

Initializes the serial port specified by VISA resource name to the specified settings. Wire data to the VISA resource name input to determine the polymorphic instance to use or manually select the instance.

VISA Read Function

Reads the specified number of bytes from the device or interface specified by VISA resource name and returns the data in read buffer. VISA resource name specifies the resource to be opened. Byte count is the number of bytes to be read. Error in describes error conditions that occur before this node runs. This input provides standard error in functionality. Return count contains the number of bytes actually read.

VISA write Function

Writes the data from write buffer to the device or interface specified by VISA resource name. VISA resource name specifies the resource to be opened.

Append True/False String Function

Selects either a FALSE or TRUE string according to a Boolean selector and appends that string to string String is the input string. The default is an empty string. True string is the string to append if selector is TRUE. False string is the string to append if selector is FALSE.

Match Pattern Function

Searches for regular expression in string beginning at offset, and if it finds a match, splits string into three substrings. A regular expression requires a specific combination of characters for pattern matching. Regular expression is the pattern for which you want to search in string.
String Subset Function
Returns the substring of the input string beginning at offset and containing length number of characters.

Decimal String To Number Function
Converts the numeric characters in string, starting at offset, to a decimal integer and returns it in number.

Algorithm for implementation of Labview section are,
Step 1: Start.
Step 2: Configure serial port using VISA configuration.
Step 3: Read serial port using VISA real.
Step 4: Sort strings using match pattern VI.
Step 5: Extract required numerical using string subset function.
Step 6: Convert to decimal indicate using instruments.
Step 7: If send switch is pressed go to step 9.
Step 8: Write vehicle ID to serial port using VISA write.
Step 10: Stop.

B. Control unit:
Algorithm for control unit is,
Step1: Start.
Step2: Configure ADC and initialize ports.
Step3: Configure serial port and set baud rate.
Step4: Enable interrupts.
Step 5: Rout to GSM.
Step6: If RCIF=1 read RCREG.
Step7: If Vehicle data =received go to step 8.Else go to step 9.
Step8: Format it to single message.
Step9: If LabVIEW command=received go to step 10.Else go to step 11.
Step10: send it to vehicle unit
Step11: Go to step 6.

C. Vehicle unit:
Algorithm for vehicle unit is,
Step1: Start.
Step 2: Configure ADC and initialize ports.
Step 3: Configure serial port and set baud rate.

Step 4: Enable interrupts.
Step 5: Display welcome screen.
Step 6: Read temperature and tilt.
Step 7: Display tilt and temperature.
Step 8: If tilt normal go to step 9.
Step9: Rout to GPS and read position.
Step 10: Rout to GSM.
Step 11: Send vehicle ID and position to control unit.
Step 12: If RCIF=1 go to step 13.
Step 13: Read RCREG.
Step 14: If inform message=received go to step 15.
Step 15: Rout to GPS, read sensors and read position.
Step 16: Rout to GSM, send sensor status and send position.
Step 17: Stop.

IV. RESULTS
The complete set up is shown in fig 3 and found working. The microcontroller senses the output of different sensors and manipulates the values according to the requirements. PCB Layout for the entire circuit is given in fig 4. The results are summarized below.
When heat sensor senses temperature rise of car, indicator thermometer will show the temperature. So the remote controller can understand and take remedial measures.

![Fig 4. PCB Layout.](image)

IV. MERITS AND DEMERITS

LabVIEW software used here provides powerful and flexible platform for tight software hardware integration. LabVIEW also have the ability to solve and execute complex algorithms in real time using real world signals. Tracking and positioning is done by GSM and GPS which add a huge for the rapid growth of technology.

The microcontroller used is a PIC16F877 microcontroller which is very cost efficient and very easy to implement. Also it is fully automated. Present system cant be used to control a number of vehicles.

V. CONCLUSION

This paper has been successfully implemented for the automobile safety. It can be seen that total number of large oil/gas tankers involved in fatal accidents have been doubled between 2010 and 2013. This paper is mainly aimed at the safety of these tanker vehicles and we used variety of electronic sensors that help to prevent accident and theft. It is also possible to control a large number of vehicles under some authority. It is accomplished in LabVIEW platform.

REFERENCES

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