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Vehicular Monitoring and Tracking System

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Abstract: The rapid growth in the transport industry has led to the increase in accidents and vehicle theft. This paper explains about design of Vehicular Monitoring and tracking System based on ARM combinative with Global System for Mobile (GSM) and Global Positioning System (GPS). This System uses ARM processor LPC1768 that is interfaced with the temperature sensor and SIM908 (GSM and GPS). SIM908 gives latitude, longitude and other information to the monitoring station such as Police station or Hospitals in case of accidents and also to the owner of vehicle in case of vehicle theft.

Keywords: Global System for Mobile (GSM), Global Positioning System (GPS), Advanced RISC Machine(ARM), Controller Area Network (CAN), Universal Asynchronous transmitter receiver (UART), Vehicular Monitoring and Tracking System (VMTS), Protocol Description Unit (PDU).

I. INTRODUCTION

Public's life is merely dependent on the transport industry [1]. The advancement and increase in the vehicle public are forced to undergo some of the major problem such as accident, traffic jam, vehicle theft etc. Hence there is the need to monitor and track the vehicle continuously. The trucks carrying dangerous chemicals may damage if the temperature exceeds above its limit. Hence it is necessary to continuously monitor the temperature of the chemicals [3]. It is also necessary to know the location of the vehicle in case of vehicle theft.

The project aims at providing information to the monitoring station such as Police station or Hospitals and to the owner of the vehicle in case of accidents and vehicle theft. This is achieved by using ARM controller with GSM and GPS. The programming is done through Kiel µvision 4 IDE. System Hardware is explained in section II. Flowchart of the system is explained in section III. Hardware result of the above system is shown in section IV followed by Conclusion in section V.

II. SYSTEM HARDWARE

The VMTS can be represented by block diagram as shown in fig. 1. It consists of an ARM processor, LCD, SIM908, LM35, power supply.

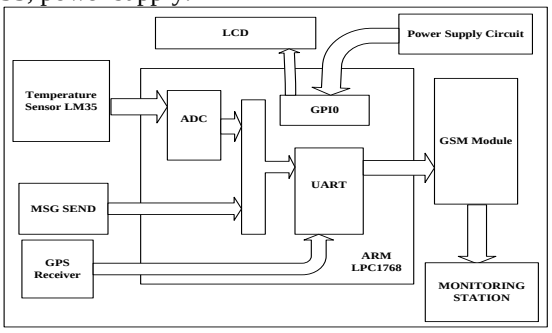

Fig. 1. Block diagram of the Vehicular Monitoring and Tracking System

The system works with 5V DC regulated power supply. Temperature sensor is used to monitor the temperature of the goods in the vehicle. Monitoring station has an access to get real time position of the vehicle using GPS receiver which is interfaced with UART of LPC1768. All the information regarding vehicle position is sent to the monitoring station using GSM module.

A. LM35

The temperature sensor used in this project is LM35 which gives temperature in degree Celsius and operates from 4 to 20V. It can operate over nominal temperature range from -55˚C to150˚C and gives output of 10mV per degree Celsius. Temperature can be sensed through direct contact with the heat source, or without direct contact with using radiated energy. Temperature sensor Fig. 2 shows LM35.

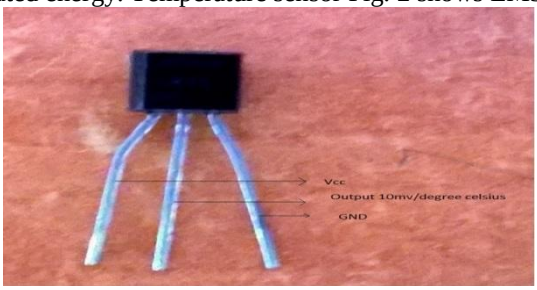

Fig. 2. LM35

B. Controller

LPC1768 is the ARM cortex-M3 based Microcontroller used for embedded application. It is featured with high level of integration and low power consumption. It uses 3.3V power supply. The Peripheral complement of ARM includes up to 4 UARTs, 4 timers, CPU frequency of 100 MHz, Crystal frequency up to 1 MHz to 25 MHz, Four external interrupt, 8 channel 12 bit ADC, 10 bit DAC, 70 general purpose I/O pins, 2 CAN channels and it is built up with Nested Vectored Interrupt.

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C. SIM908

SIM908 is integrated with GSM and GPS.GSM operates with 850MHz frequency. It is designed with power saving techniques with current consumption less than 1.0mA in sleep mode. Some of the features of SIM908 are it has a RF connector interface, Serial and debug port, Charging interface, Programmable general purpose input and output. Fig. 3 below shows the LPC1768 and SIM908 incorporated on the same PCB.

Fig. 3. LPC1768 and SIM908

1) GPS

Global Positioning system is a satellite based navigation which gives information about the position anywhere on the earth. Fig. 4 shows interfacing of GPS with the UART of LPC1768. Here the TxD pin of UART is connected to the RxD pin of GPS module and vice versa.

The information regarding vehicle location, date, time is received by the UART of LPC1768 which can be displayed in the termite.

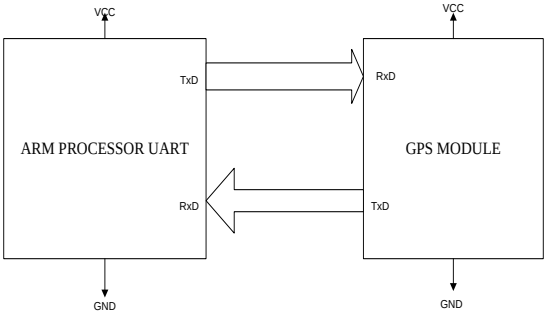

Fig. 4. GPS interfaced with UART of ARM processor

2) GSM

Global system for mobile is the wireless standard for mobile communication. GSM module transmits Short Term Messages (SMS) in TEXT mode and PDU [4]. Fig. 5 shows interfacing of GSM with the UART of LPC1768. Here the TxD pin of UART is connected to RxD pin of GSM module and vice versa.

The transmitted data from UART of LPC1768 contains information regarding vehicle location, time and date that can be checked using termite and the same data is sent to the user's mobile.

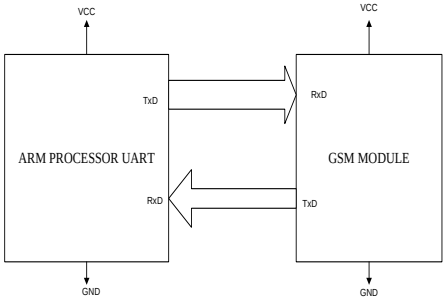

Fig. 5. GSM interfaced with UART of ARM processor

III. FLOWCHART

The flowchart for VMTS is as shown in Fig. 6. As in flowchart, the 2 tasks are to be monitored simultaneously and the GPS information is retrieved if any of the condition is satisfied.

The proposed flowchart is designed to work as follows:

1) First initialize UART0, UART3 & ADC i.e. configure TxD and RxD pin of UART0 and UART3 and ADC pin.
2) Initialize SIM908 i.e. check for call ready.
3) Once the GSM replies call ready, then perform two tasks:
   a) Keep monitoring temperature of the chemical or other goods in the vehicle, if temperature exceeds then go to next step.
   b) Wait until message is received from the monitoring station. Once the message is received it checks the received mobile number with the stored number, if it matches then go to next step.
4) Acquire longitude and latitude information by tracking the vehicle through GPS
5) Send all the information through GSM to the Monitoring station and repeat checking for message and temperature.

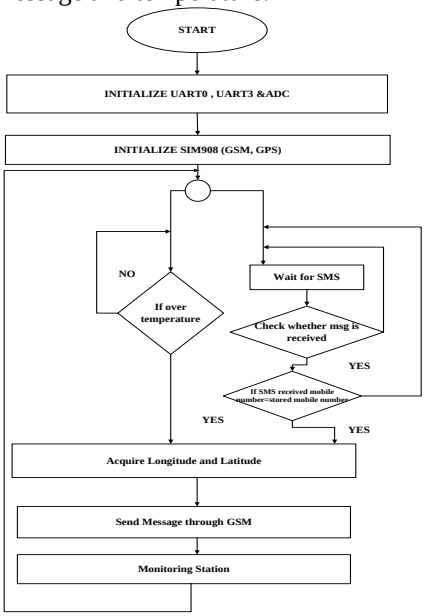

Fig. 6. Flowchart of Vehicular Monitoring and Tracking System

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IV. HARWARE RESULTS

1) LM35: The output pin of LM35 is connected to ADC port of ARM. Fig. 7 shows the temperature sensor LM35 test set up. The program is written in such a way that if temperature becomes greater than 35˚C, the longitude and latitude is sent to the monitoring station through GSM and is displayed in the termite as shown in the Fig. 8 shows the output obtained at termite Fig. 9 shows the location of vehicle received at monitoring station from VMTS.

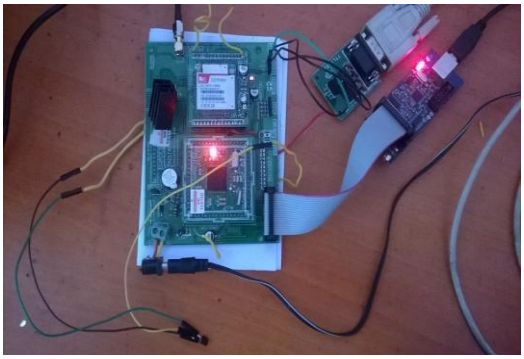

Fig. 7. LM35 test set up

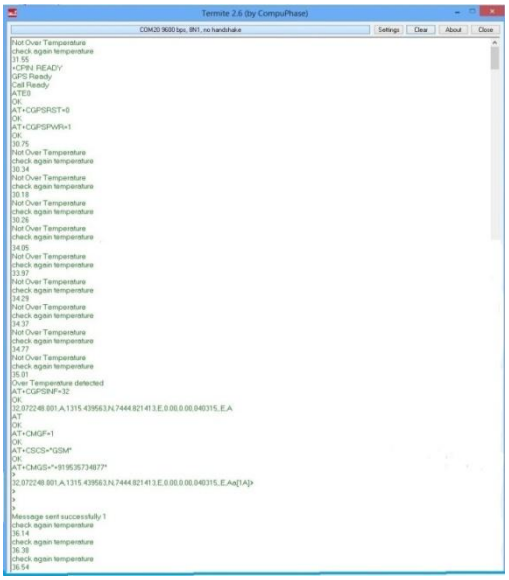

Fig. 8. Output of LM35

Fig. 9. Location of the vehicle received at the monitoring station

2) When message is received by SIM908: This task is performed in order to get the position of vehicle during vehicle theft. The program is written in such a way that, when GSM receives message from monitoring station, it compares this mobile number with the stored mobile number, if the number matches then the information regarding vehicle position is sent to the same mobile number. Fig. 10 shows the hardware set up.

Fig. 11 shows the output displayed in the termite and fig. 12 shows the location of vehicle received at monitoring station from VMTS.

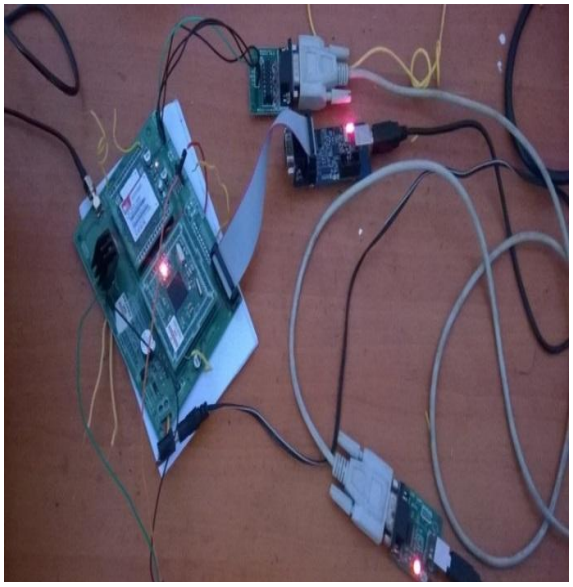

Fig. 10. Hardware set up

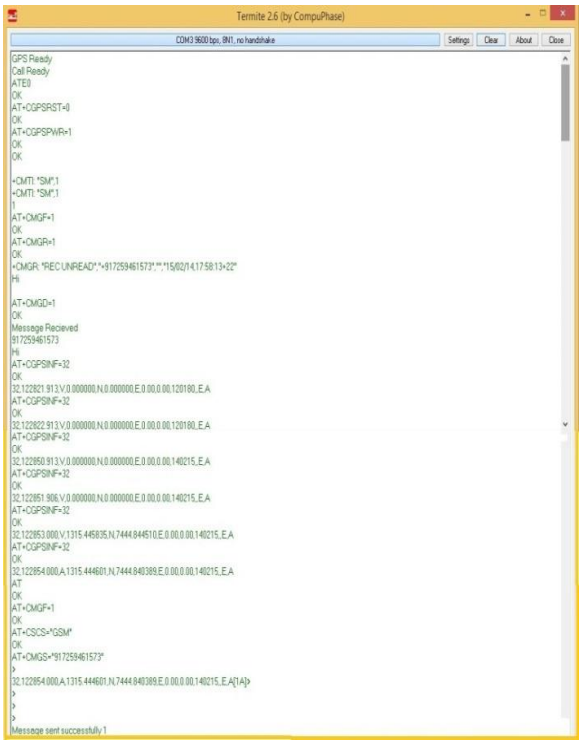

Fig. 11. Output of task 2

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Fig. 12. Location of the vehicle received at monitoring station

3) Overall set up: Fig. 13 shows the hardware set up when 2 tasks are combined together. It is performed using timer. Fig. 14 shows the output of 2 tasks displayed in the termite. Fig. 15 shows the location of vehicle received at monitoring station from VMTS.

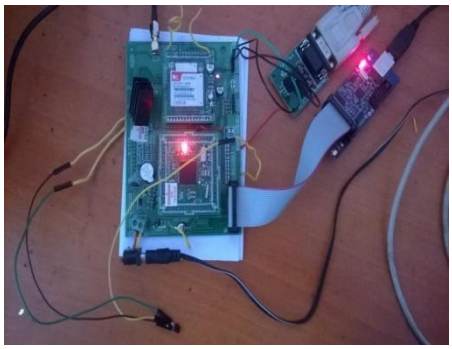

Fig. 13. Hardware set up of the 2 tasks when combined together

Fig. 14. Output of 2 tasks

Fig. 15. Location of the vehicle received at the monitoring station

V. CONCLUSION

From the results obtained above, it can be concluded that the VMTS can be used to avoid accident and to reduce vehicle theft. This system can be used in trucks, cars etc. The above system gives real time access to the user.

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