Design and Development of Wireless Sensor based Vehicle Positioning and Monitoring System using Micro-controller

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ABSTRACT

Design of Vehicular monitoring and tracking system based on ARM using GSM and GPS is proposed. The vehicular module is used to track, monitor, and surveillance and finds the accident spot and intimate to the monitoring station. The proposed design provides information regarding vehicle Identity, speed, and position on real time basis. This information are collected by the ARM7 TDMI-S core processor LPC2148 by using different modules in the system and dispatch it to the monitoring station where it stores the information in database and display it on graphical user interface (GUI) that is user friendly. GUI is built on Microsoft Visual Basics. The system consists of cooperative components of MEMS accelerometer, microcontroller unit, GPS receiver and GSM module. In the event of accident, this wireless device can send SMS indicating the position of vehicle by GPS system to family member, emergency medical service (EMS) and nearest hospital. The monitoring system based on wireless camera and Wireless security cameras are closed-circuit tele-vision (CCTV) cameras that transmit a video and audio signal to a wireless receiver through a radio band and it is used to monitoring driver behavior and drowsiness and position of the vehicle. The threshold algorithm and speed of motorcycle are used to determine fall or accident in real-time.

Index Terms: GSM Module, GPS Module, Temperature Sensor, MEMS Sensor, ARM, Wireless Camera.

1. INTRODUCTION:

In today's world as the population increases day by day the numbers of vehicles also increases on the roads and highways. This result in more accident that interns leads to the traffic jams and public get help instantaneously. This module provides information about the accident to the hospital and police station. As a result sudden help public life may save and the traffic jams are reduced. To improve the level of supervision and management for cargo transport vehicles, especially trucks carrying coal it is important to develop transport vehicles remote monitoring module .A server computer at the (remote) monitoring station that is continuously waiting for data from the system, should record the actions of the vehicle into a database. This contains the information regarding Vehicle velocity, position, identity and temperature in two fashions. The information given to monitoring station is in continuous manner and when the accident occurs. The development of vehicular design brings public many convenience in life but also brings many problems at the same time, for example, traffic congestion, difficulty in monitoring dispersive vehicle, theft and other series of problems[4].We are intended to made this monitoring wireless using ARM7 hardware platform ported with real time operating system μc/OS-II.

2. OBJECTIVE:

In this urban life transportation is very common. A lot of misappenings occur on the road every day. Various problems that we may face include, in critical condition, when vehicle meets with an accident or vehicle is stolen, one is confused what to do. The motorcycle accident is a major public problem in many countries. Despite awareness campaign, this problem is still increasing due to rider's poor behaviors such as speed driving, drunk driving, riding with no helmet protection, riding without sufficient sleep, etc. The numbers of death and disability are very high because of late assistance to people who got the accident. These cause huge social and economic burdens to people involved. Therefore, several research group and major motorcycle manufacturers including Honda have developed safety devices to protect riders from accidental injuries. However, good safety device for motorcycle is difficult to implement and very expensive.

Therefore the need of tracking, security and monitoring is increased. The system is developed using GPS and GSM technologies and an application is introduced in my work which is for accidental monitoring. Global Positioning System (GPS) which will receive the coordinates from the satellites among other critical information.

Tracking system is very important in modern world. This can be useful in soldier monitoring, tracking of the theft vehicle and various other applications. The system is microcontroller based that consists of a global positioning system (GPS) and global system for mobile communication (GSM). This project uses only one GPS device and a two way communication process is achieved using a GSM modem. GSM modem, provided with a SIM card uses the same communication process as we are using in regular phone.

3. SYSTEM DESIGN:
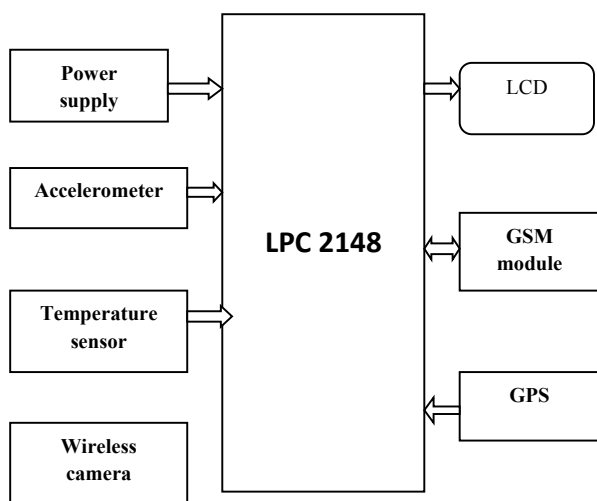
Fig.1 system design

The system consists of cooperative components of an accelerometer, microcontroller unit (MCU), GPS device and GSM module for sending a short massage. An accelerometer is applied for awareness and fall detection indicating an accident. The speed of motorcycle and threshold algorithm are used to decide a fall or accident in real-time. Mobile short massage containing position from GPS (latitude, longitude)

will be sent when motorcycle accident is detected. The robust package design is implemented so that it is safe from water's spray and dust in environment. The module is aimed to be installed under the motorcycle seat. A high performance 16 bits MCU is used to process and store real-time signal from the accelerometer. Thus, this device is analogous to a black box in airplane. The police and insurance examiner can obtain accident history to investigate accident situation from data-logger in this device. The device keeps data log of track and acceleration data for 1 minute before and after an accident. Moreover, this device can be used to track motorcycle after it was stolen in real-time by the use of Google Map in a terminal used in the remote control location.

4. HARDWARE DESIGN:

The proposed system has the following hardware modules GSM module, GPS module, MEMS sensor, Temperature sensor, ARM (LPC2128).

4.1. GPS Module:

Global Position System (GPS) is a space-based satellite navigation that provides location and time information in all weather conditions, anywhere on or near the Earth. GPS Receiver MT3318 Module is used that have a active patch antenna from Ciro comm. The GPS receiver tracks 51 satellites simultaneously. The module is mounted on the PCB along with the 3.3V low drop voltage regulator, transmit, receive and power indication LEDs, Schmitt trigger based buffer for 5V to 3.3V logic level conversion. This GPS receiver gives data output in standard National marine electronics association (NMEA) format. The GPS receiver gives -157dBm tracking sensitivity. The module is configured at 9600 baud rate. Module requires a 5V supply and can be interfaced with the 5V TTL / CMOS logic.

Fig .2 GPS module

4.2. GSM Module

Global System for Mobile communications (GSM) is the almost popular wireless standard f for mobile phones in the world. GSM module allows transmission of Short message service (SMS) in TEXT mode and PDU mode. The proposed design uses SIM 300 GSM module in text mode. This design uses SIM300 GSM module that provide 900/1800/1900MHz Tri-band for r VOICE, SMS, DATA, and FAX. This module operates on AT command over TTL interface. AT command is an abbreviation for Attention command that is recognized by GSM Module. This abbreviation is always used to start a command line to be send from TE (Terminal Equipment) to TA (Terminal Adaptor).

Fig 3: GSM Module

4.3. ARM (LPC2148):

The LPC2148 microcontrollers are focused around a 16-bit or 32-bit ARM7TDMI-S CPU with constant imitating and implanted follow help, which consolidate microcontroller with inserted high velocity streak memory extending. A 128-bit wide memory interface and one of a kind quickening agent building design empower 32-bit code execution at the most extreme clock rate. For discriminating code size applications, the option 16-bit Thumb mode decreases code by more than 30 percent with negligible execution punishment. Because of their little size and low power utilization, LPC2148 are perfect for applications where scaling down is a key prerequisite, for example, access control and purpose of-offer.

4.4. MEMS SENSOR:

A MEMS IMU consists of multiple axes MEMS accelerometers and gyroscopes. A common type of MEMS accelerometer is based on the piezo resistive effect. In these accelerometers, cantilevers are attached to a piezo resistor base. As the cantilever experiences acceleration, stress is applied to the piezo resistor base causing a change in the resistance of the base that can be measured. Three important performance factors for the accelerometer are the amount of noise of the sensor—which defines the resolution of the sensor, the maximum Gs it can withstand, and the limits of the range in which the sensor can measure acceleration.
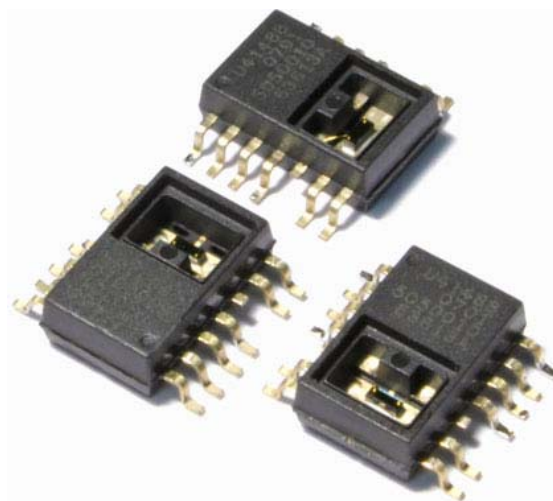

Fig 4: MEMS sensor

4.5. TEMPERATURE SENSOR:

The LM35 sensor series are integrated-circuit temperature sensors, whose output voltage is linearly comparative to the Celsius temperature. The LM35 arrangement are exactness incorporated circuit LM35 temperature sensors, whose yield voltage is directly corresponding to the Celsius temperature. The LM35 sensor consequently has leverage over straight temperature sensors adjusted in ° Kelvin, as the client is not needed to subtract an extensive steady voltage from its yield to get advantageous Centigrade scaling.

Fig 5: Temperature sensor

4.6. WIRELESS CAMERA

Wireless security cameras are closed-circuit television (CCTV) cameras that transmit a video and audio signal to a wireless receiver through a radio band. Many wireless security cameras require at least one cable or wire for power; "wireless" refers to the transmission of video/audio. However, some wireless security cameras are battery-powered, making the cameras truly wireless from top to bottom.

Wireless cameras are proving very popular among modern security consumers due to their low installation costs (there is no need to run expensive video extension cables) and flexible mounting options; wireless cameras can be mounted/installed in locations previously unavailable to standard wired cameras. In addition to the ease of use and convenience of access, wireless security camera allows users to leverage broadband wireless internet to provide seamless video streaming over internet.

Fig 6: Wireless Camera

5. RESULTS

Fig 7: Vehicle monitoring system without power supply

Fig 8: Vehicle monitoring tracking system display on LCD

Fig 9: Temperature values display on LCD

6. CONCLUSION

The Vehicular System provides information of a vehicle like velocity, position, through a GPS module and identity of a vehicle to a monitoring station and to a mobile phone according to a definite event stored in a program or a query from a monitoring station. 760 Accelerometer senses the collision of the vehicle and sends this information in real time to a hospital/police station. The monitoring station display these information on GUI also stored these information in database for further process according to a program. Monitoring system based on Wireless camera. The system is useful in much application such as surveillance, security, tracking, which may be installed in cargo trucks, cars, motorcycle, and boat. The system can be used in many applications.

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