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Wireless Black Box for Cars Using Sensors & GPS Module

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Abstract: Our project is regarding "Wireless recorder for Cars Using Sensors &GPS Module". The main purpose of making this project is to develop a vehicle black box system that can be installed into any vehicle all over the world. This paradigm is often designed with a minimum range of circuits. A Wireless black box is basically a device that will indicate all the parameters of a vehicle crash and will also store and display its parameters of every three second such as date, time, temperature, location, vibration, Ultra sonic sensors etc.

Whenever the accident held the message will sent from the system built inside the car to the registered mobile numbers such as emergency numbers of police stations, hospitals, family members, owner etc. We have used various types of sensors like temperature sensor (DTH11), which is used to measure temperature and humidity.Vibration sensor measures vibrations felt by the car during accident. Alcohol sensors are located on the steering wheel which will indicate whether the driver is drunk. A gyroscopic sensor is used to indicate tilt during the accident. All the parameters sensed by the sensors will send the signal to Arduino UNO . GSM module, Sim card module, GPS module are some of the devices used in our project which helped in accomplishing the output.

Key Words

- Arduino UNO
- GPS/Gsm module
- Temperature Scanner / Fire Sensor
- Vibration sensor
- LCD
- Power supply
- Buzzer
- LED

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- Switch
- Push Buttons
- Capacitors
- Resistors
- Sim card
- Ultra Sonic Sensor
- Humidity Sensor

I. Introduction

Most of the accidents happened with the motor-vehicles. Nowadays this problem is still increasing due to poor rider's like speed driving, drunk driving, riding with no helmet protection, riding without sufficient sleep, etc. The numbers of death because of late assistance to people who got the accident. Therefore, the research group and major motorcycle manufacturers including Honda have developed safety devices to protect riders from accidental injuries.

The good safety device for a motorcycle is difficult to implement and very expensive. Accident detection with a tracking system only. In this project black box using a MEMS accelerometer sensor and GPS location tracking system is developed for accidental monitoring. When the accident will happen at the same time GSM will send the authorized mobile phone. The Location of the vehicle sends a short message using a GPS device to a family member. The system consists of an accelerometer sensor, Arduino Uno microcontroller, GPS device and GSM module for sending a short message. An accelerometer sensor is applied X, Y, Z direction fall detection of an accident.

The speed of the motorcycle and threshold algorithm is used to decide a fall or accident in real-time. A mobile short message containing position from GPS (latitude, longitude) will be sent when a motorcycle accident is detected. The robust package design is implemented so that it is safe from water's spray and dust in the environment. This system is installed under the motorcycle seat.

A high-performance microcontroller is used to process and store real-time signals from an accelerometer sensor. Thus, this device is analogous to a black box in an airplane. The police and insurance examiner can obtain accident history using a black box to investigate accident situations from data-logger in this device.

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The device keeps a data log of track and acceleration data for 1 minute before and after an accident. Moreover, this device can be used to track a motorcycle after it was stolen but it can't operate in real-time in this case. In this case, the user can send request command with the alphabet to the device and the device will return the position with some basic information

II. Literature Survey

a prototype of Black Box For vehicle diagnosis that can be installed into any vehicle. This prototype can be designed with minimum number of circuits. This can contribute to construct safer vehicles, improving the treatment for crash victims, helping insurance companies with their vehicle crash investigations, and enhancing road status in order to decrease the death rate.[8] This paper presents a low cost system which provides solution to the existing automotive control issues. This system has two main principle components namely Vehicle to Vehicle Collision Avoidance Unit (VVCAU) is used to avoid crashing between vehicles and Black Box (BB) records the relevant details about a vehicle such as Engine Temperature, Distance from obstacle, Speed of vehicle, Brake status, CO2 Content, Alcohol content, Accident Direction, trip Time and Date. The design selects ARM 7 (LPC 2148) as embedded controller, UART (Universal Asynchronous Receiver Transmitter) is the common peripheral found on microcontrollers widely used for communication with the external devices and systems, I2C (Inter-Integrated Circuit) for on-board communication, Real Time Clock, Electrically Erasable Programmable Read Only Memory and GSM module.[9] In this paper, a new framework for conducting controlled driving behavior studies based on multiuser networked 3- D virtual environments. We report on the results of our study from two viewpoints: 1) the reproducibility of the traffic accident situation (i.e., state variables of interest are recreated successfully in 78% of the cases); and 2) the interactive car-following behavior of human subjects embedded in the traffic situation of the virtual environment. [1] In this paper, a process to collect critical video clips from car black boxes using smart phones. Critical video clips in the black box are hashed to provide data integrity before

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being transmitted to the police server. Without VANET infrastructure, smart phones are very useful communication media for car black boxes vehicle safety system which would not only record the video and audio, but also try to prevent a possible collision by limiting the speed of the vehicle in accident-prone areas. In case of an accident, the time and location (co-ordinates) is sent through GSM to a preset number for immediate rescue and treatment. Recorded data can also be used for forensics, revealing the problems that caused the accident and give manufacturer an idea for improvement. So the motto is to develop an embedded integrated system consisting of a microcontroller, a power supply unit, sensors, memory, a motor driver unit and a GPS/GSM modem.

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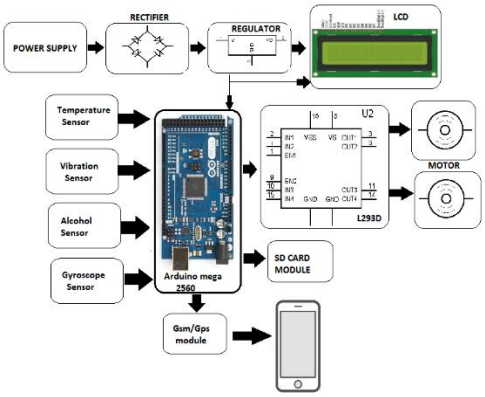
III. Proposed System

I. Block Diagram



A) What is Arduino?

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide

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community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

B)Arduino IDE (Software)

Versions of the Arduino Software (IDE) prior to 1.0 saved sketches with the extension .pde. It is possible to open these files with version 1.0, you will be prompted to save the sketch with the .ino extension on save.

Verify Checks your code for errors compiling it.

Upload Compiles your code and uploads it to the configured board. See uploading below for details.

Note: If you are using an external programmer with your board, you can hold down the "shift" key on your computer when using this icon. The text will change to "Upload using Programmer"

New Creates a new sketch.

Open Presents a menu of all the sketches in your sketchbook. Clicking one will open it within the current window overwriting its content.

Note: due to a bug in Java, this menu doesn't scroll; if you need to open a sketch late in the list, use the File | Sketchbook menu instead.

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Save Saves your sketch.

Serial Monitor Opens the serial monitor.

Additional commands are found within the five menus: File, Edit, Sketch, Tools, Help. The menus are context sensitive, which means only those items relevant to the work currently being carried out are available.

C)GPS & GSM Module

The GPS consists of satellites that orbit the earth. These satellites are geosynchronous with an orbital period that is the same as the Earth's rotation period. So they maintain exactly the same position with respect to the earth below them. All the GPS satellites transmit radio signals, which are then captured by a GPS receiver and used to calculate its geographical position. A minimum of four satellites may be required to compute the four dimensions of X, Y, Z (latitude, longitude and elevation) and time. GPS receiver converts the received signals into position and estimates time and some other useful information depending on the application and requirements.GSM is a standard set developed by the European Telecommunications Standards Institute (ETSI) to describe technologies for second-generation (2G) digital cellular networks.A GSM modem is a specialised type of modem that accepts a SIM card and operates over a subscription to a mobile operator just like a mobile phone.

D)Vibration Sensor

The vibration sensor detects the accident and the beat rate sensor checks the heartbeat of the driver. At the point when the vibration happens and the heartbeat level is high, it will be expected that accident has been happened and message revealing the driver's heartbeat rate and his area will be sent to his relative.

E)Humidity Sensor

Humidity sensors are capacitance sensors that measure the amount of moisture in the air. The information from the sensor both regulates the volume of air projected onto the windows to reduce misting, and manages

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the humidity levels inside the car to enhance climate comfort.

F)Ultra Sonic Sensor

Ultrasonic sensors can be used to complement other vehicle sensors, including radar, cameras, and lidar, to get a full picture of the immediate surroundings of a vehicle. While ultrasonic sensors necessitate close proximity and slow speeds, advantages include the ability to be accurately used in situations with low visibility, such as in inclement weather conditions and dim areas.

II. Working & Operations

The vehicle section is the most important section of this entire project. The vehicle section includes

The MCU controls the entire operation of this section. Arduino is the controller that we are using in this ambulance section. The vibration sensors fixed on the vehicle to collects the vibration to the amplifying circuit. The amplifying circuit will amplify the obtaining vibrations and given to the MEMS.

A microcontroller as able to store factors such as vibration, and mems value It is connected with the accelerometer sensor hence if the speed of the vehicle is at a high rate speed it will give a warning alarm (indicator) to the driver. If the driver continues the driving with the same speed and accident occurs, the MEMS can detect whether it is a linear (only x-axis) or nonlinear (x, y, z directions). Also, it can store all the data of the vehicle with the cause of the accident. GPS and GSM are connected to this system. The communication for GPS and GSM can be done through serial communication.

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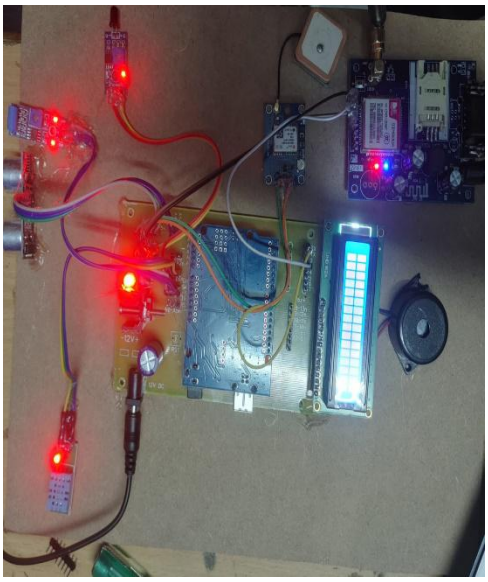
The serial communication is creating an interface through which it covert CMOS to TTL logic. The GPS is used to locate the position (longitude and latitude) of the vehicle.The GSM in the black box can send a message to the ambulance section and GSM of the family member.

The message includes the location, time and other details regarding the accident. This message helps the ambulance section and the family member about the accident and the ambulance section can collect the patient from the accident spot to the hospital. The indicator for warning alarm can be done with the help of a buzzer. This section has a direct power supply for the entire unit will get from the battery fixed in the vehicle. The power supply can be given directly to the microcontroller unit since it controls the entire unit

III. Applications

a) Safety for vehicle on the roads
b) Fast Tracking and Rescuing the Hostages
c) Can save more Lives and Reduces Victims

Experimental Result



IV. Conclusion

The scenarios of fall or accident in motorcycle are mainly divided into two groups including fall by themselves and crash by other objects. Thus, the device may be tested with a limited number of situations of accidents. The motorcycle fall detection using MEMS accelerometer has been implemented and tested by using bicycle instead of motorcycle because it is less dangerous and the basic structure is like motorcycle. However, some parameters such

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as mass of rider and motorcycle were ignored in this experiment.

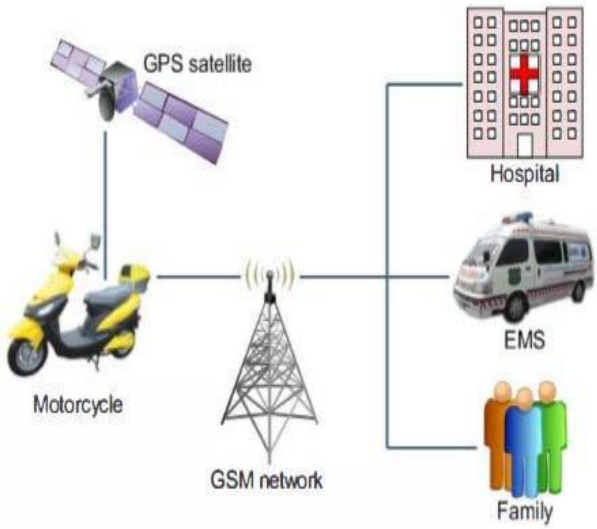

Fig. 1. System architecture.

In conclusion, an innovative wireless black box using MEMS accelerometer and GPS tracking system has been developed for motorcycle accidental monitoring. The system can detect type of accident from accelerometer signal using threshold algorithm, posture after crashing of motorcycle and GPS ground speed. After accident is detected, short alarm massage data (alarm massage and position of accident) will be sent via GSM network. The system has been tested in real world applications using bicycles. The test results show that it can detect linear fall, non-linear fall and normal ride with no false alarm

V. Future scope: •

> Development of smarter vehicles applications.

> By applying ultrasonic sensors features we can detect the distance of a vehicles moving nearby our vehicles.

> This system can be interfaced with vehicle airbag system that prevents vehicle occupants from striking interior objects such as steering wheel or window.

> This can also be developed by interconnecting a camera to the controller module that takes the photograph of the accident spot that makes tracking easier

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