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RESEARCH ARTICLE

Wireless Black Box Using MEMS Accelerometer and GPS Tracking for Accidental Monitoring of Vehicles

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Abstract-- In this work, wireless black box using MEMS accelerometer and GPS tracking system is developed for accidental monitoring. The system consists of cooperative components of an accelerometer, microcontroller unit, GPS device and GSM module, Zigbee. In the event of accident, this wireless device will send mobile phone short message indicating the position of vehicle by GPS system to family member, emergency medical service (EMS) and nearest hospital. The threshold algorithm and speed of motorcycle are used to determine fall or accident in real-time. The system is compact and easy to install under rider seat. The available Existing system won't work if any accident happens in non-network coverage area using Zigbee. MEMS inertial sensors are designed to sense a change in an object's inertia, and then convert or transducer inertial force into a measurable signal. They measure changes in acceleration, vibration, orientation and inclination. This deflection of the mass is converted to an electrical signal as the sensor's output. The simplest MEMS accelerometer sensor is an inertial mass suspended by springs. The mass is deflected from its nominal position as a result of acceleration. This deflection of the mass is converted to an electrical signal as the sensor's output.

Keywords— MEMS ACCERLOMETER, GSM, GPS, ZIGBEE

1. INTRODUCTION

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. Alternatively, intelligence schemes such as fall or incident detection with tracking system have also recently been devised to notify the accident to related people so that quickest assistance can reach people who got the accident. Presently, tracking system is only installed in some high end motorcycles because these systems are still too expensive for most motorcycle's riders. Thus, fall detection and accident alarm system for motorcycle has recently gained attention because these systems are expected to save life by helping riders to get medical treatment on time. In this work, wireless black box using MEMS accelerometer and GPS tracking system is developed for accidental monitoring. In the event of accident, this wireless device will send mobile phone short message indicating the position of vehicle by GPS system to family member, emergency medical service (EMS) and nearest hospital so that they can provide ambulance and prepare treatment for the patients.

2. PROJECT TECHNIQUES

Alternatively, intelligence schemes such as fall or incident detection with tracking system have also recently been devised to notify the accident to related people so that quickest assistance can reach people who got the accident. Presently, tracking system is only installed in some high end motorcycles because these systems are still too expensive for most motorcycle's riders. Thus, fall detection and accident alarm system for motorcycle has recently gained attention because these systems are expected to save life by helping riders to get medical treatment on time. In this work, wireless black box using MEMS accelerometer and GPS tracking system is developed for accidental monitoring. In the event of accident, this wireless device will send mobile phone short message indicating the position of vehicle by GPS system to family member, emergency medical service (EMS) and nearest hospital so that they can provide ambulance and prepare treatment for the patients. The system consists

of cooperative components of an accelerometer, microcontroller unit (MCU), GPS device and GSM module for sending a short message.

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 message 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 accelerometer data for 1 minute before and after an accident. Moreover, this device can be used to track motor cycle after it was stolen but it can't operate in real time in this case. In this case, user can send request command with alphabet "!" to device and the device will return the position with some basic information.

3. SYSTEM ANALYSIS

3.1 Introduction

In this section over view of Existing system and proposed system has explained. Various methods are used in existing system for GPS n GSM module. In the event of accident, this wireless device will send mobile phone short message indicating the position of vehicle by GPS system to family member, emergency medical service (EMS) and nearest hospital. So to avoid these limitations a system is proposed using Zigbee.

3.2 Overview of the Existing System

The system consists of cooperative components of an accelerometer, microcontroller unit (MCU), GPS device and GSM module for sending a short message. 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 message 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 surface. The noise is filtered by averaging acceleration data all of three axes over five time frames.

3.3 Limitations in the Existing System

- In the event of accidents by using GSM will send the message to the nearest ambulance.
- By using GPS will find the exact location to the accident person.
- In case due to signal problem message won't receive.
- The available Existing system won't work if any accident happens in Non-Network coverage area.
- It couldn't find where the accident happens.

4. PROPOSED METHOD

We have devised key feature after reviewing the problems from the existing system and some works related to accident happens which will provide the required solutions to these problems.

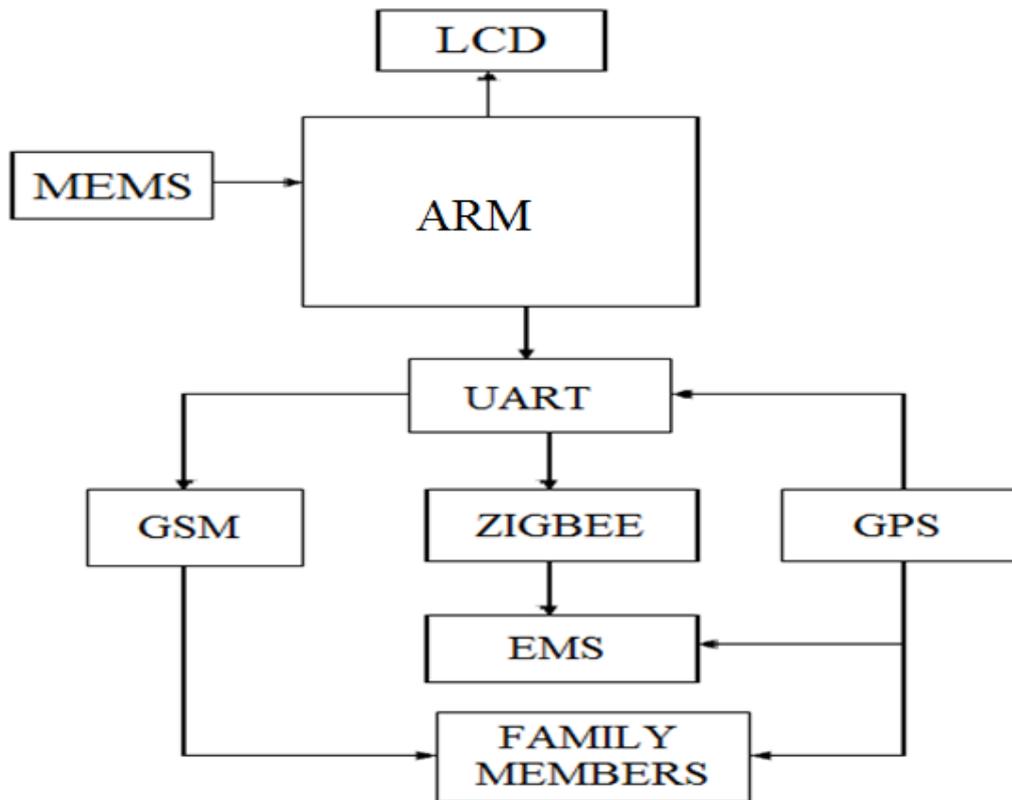
The key features are:

- 1) Maintenance of Database System.

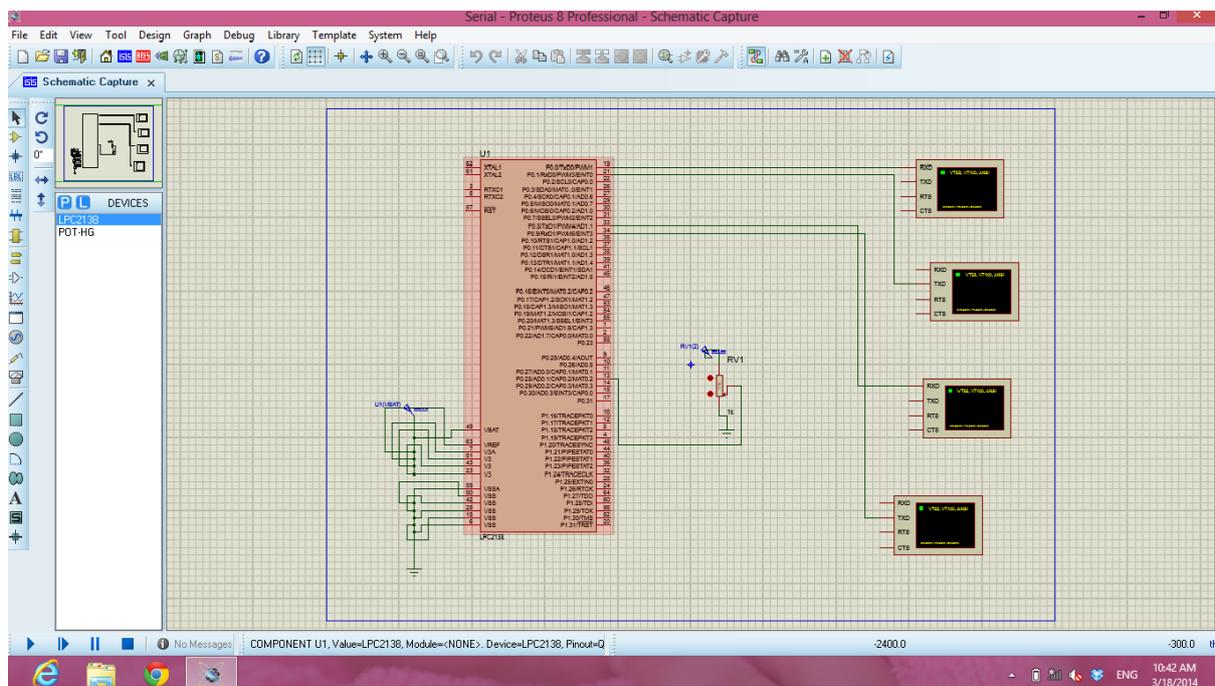
MAINTENANCE OF ZIGBEE SYSTEM

- ❖ In this project, the proposed system contains the black box which was fixed under the car seat to know the information about an accident.
- ❖ The available existing system won't work if any accident happens in Non-Network coverage area.
- ❖ The new system has positive enhancement to that existing system which will work in Non-Network coverage area by using Zigbee.

4.1 BLOCK DIAGRAM



4.2 SIMULATION



5. CONCLUSION AND FUTURE WORK

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 (linear and nonlinear fall) from accelerometer signal using threshold algorithm, posture after crashing of motorcycle and GPS ground speed. After accident is detected, short alarm message data (alarm message 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 nonnal ride with no false alarm. The safety and rescue are the primary concern in every part of fast moving world. There are many accidental event occur due to an unavoidable reasons. Though the occurrence of accident is quite unavoidable, this innovative project is challengingly undertaken to make the change in worst scenario by providing importance to alerting, monitoring and tracking the location of an event. Which would in turn provides efficient quick response for rescue process to be carried out without any latency.

Limitation/Constraints of the System

- Event of accidents GSM will send the message to the nearest ambulance, if message won't send due to signal problem the acknowledgment message will come back to the black box.
- Again another message will send to the nearest ambulance.

Future Enhancement

This project can be further enhanced and can be used to monitor vehicles by defining a boundary for them and the system will notify the owner when the vehicle crosses that boundary and several other applications. The display is installed by storing the video information about the first aid and the video is shown regarding the accidents by scanning either fracture or scratches.

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