

Design and Development of accelerometer based System for driver safety

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ABSTRACT:

This paper presents a design of driver assistance and vehicle surveillance by using GSM (Global System for Mobile Communication) and MEMS tri-accelerometer for tracking the location of vehicle position and GPS (Global Positioning System) to monitor accidents. At the time of accidents if the passenger is injured, immediately with the help of wireless network an SMS (Short Message Service) will be send to the predefined numbers to save lives. Objective of this project is to detect the vibration of vehicle with MEMS accelerometersensing and alert the driver through speakers if driver takes aggressive turns. If the vibration is high the web camera will be turned on automatically and captured image will be sent to registered email address, thus situation can be handled accordingly.

Key Words: MEMS accelerometer, GSM, GPS, Raspberry Pi.

I. INTRODUCTION

Generally, the black box will be used in airplanes to record the video of plane condition and update it to the control room. This information can be used to identify the problem simply by analyzing the video accurately. Same concept can be used in four wheelers to avoid accidents. Sometimes the driver may be in drunken state or unexpected speed breakers may appear, at that time vehicles becomes uncontrollable and accident may occur. So to overcome these problems this paper presents a new design and development of accelerometer

based system for driver and passenger's safety. And also this system is integrated with web-cam to records the images if any vibration is observed by using MEMS (MMA7660) accelerometer and those captured images will be sent as an email through the Wi-Fi module to a registered email address.

This driver safety system records video and hence can be used in case of car accident or related crime problems. The video records are useful for investigating vehicle related accidents or crimes. The designed systemuses MEMS accelerometer, Global System for Mobile (GSM-900A) and Global Positioning System (GPS) for monitoring or identifying the vehicle easily. This systemalso has congestive modules of an MMA7660-accelerometer, Raspberry Pi, GSM, and GPS. If anyaccident occurs this wireless device will send SMS (Short Message Service) to the mobile phones regarding condition of vehicle and the family members.

In the present situation there is no automatic service available, if any accidents occur either driver or passengers may lose their lives due to the delay in communication for medical help. To overcome this problem this paper presents a new system which itself intimates precautions to the driver in terms of voice signal if it finds any aggressive steering movements.

II. RELATED WORK

N.Watthanawisuth, T.Lomasand and A.Tuantranont proposed wireless vehicle tracking system using the MEMS accelerometer, GSM, and GPS for monitoring accidental vehicles. Designed system can detect accident as small or high from the accelerometer and GPS. After which short message service information will sent via GSM network.

The second one detects the change of driver's physiological characteristics such as brain waves, heart rate and pulse rate. In spite of the good accuracy it causes annoyance to the driver as some additional devices must be attached to the driver's body.

The Third one detects the fatigue of a driver irrespective of their facial features, Accelerometer sensor is fixed on vehicle, steering abrupt movements are monitored and also the threshold limits of acceleration are compared. If the values exceed the threshold, warning message is displayed on the LCD and audio prompts are generated to warn the driver. In this method drowsiness and rash driving is also detected.

An accelerometer measures speed variations of anything that it's mounted on it. The tri-axis accelerometers measures acceleration in three directions perpendicular to each other. The Micro Electro Mechanical Sensor (MEMS) is a high sensitive sensor which is capable of detecting the tilt is used to detect the extreme right and extreme left turns to detect the accident.

In India so many traffic accidents are reported and there are no means to monitor or control the speed of vehicles running on road. The proposed system is effective in detection of rash driving and accidents location and is also use to control the vehicle

speed. If the driving is reckless the designed system will detect the vibrations from the vehicle and then automatically control the vehicles speed thus keeping people in safe mode and reducing accidents. Some peoples will participate in the races on the road and suddenly at some turning position they may get confused and it may turn into an accident. This system simply identifies and then passes the information to some predefined numbers thus saving human lives within short time.

III. PROPOSED METHOD

This proposed system has another advantage of tracking or identifying vehicles location just by sending a SMS or email to the authorized person. In India day to day road accidents are increasing, many times they are helpless and need someone assistant all the times which is not possible and on a long trip unexpectedly the vehicles caught in critical condition. Another condition is that the vehicle is stolen.

Now days the technology is improving to overcome many problems in real time scenario to provide some artificial intelligent based human assist. For example a car had an accident the vibration detected by sensors will activate automatically and start its surveillance activities. In that vehicle if all the peoples are in active state then they will stop the surveillance activities within time otherwise the system will start capturing the vehicle position and then send the snapshot through Wi-Fi network to mail and send message to the predefined numbers. In the critical care system having a camera captures the situation of vehicle and its position to pass or send image to the vehicle owner to reach at the location to save lives.

Figure1 shows the architecture of the designed system monitoring. This system includes mainly four modules Raspberry Pi (ARM11), MEMS (I2C-MMA7660) accelerometer sensor, GSM-900A, Web camera, and audio speaker, Wi-Fi router (net server). This paper present a Raspberry Pi (ARM11) is to choose the complete system control. And this MEMS accelerometer sensor is used to detect or measure the vibration values are calibrated to the driver fatigue state measurement. And the speaker is used to deliver the audio prompts like warnings to the driver either drive slowly or about aggressive turns.

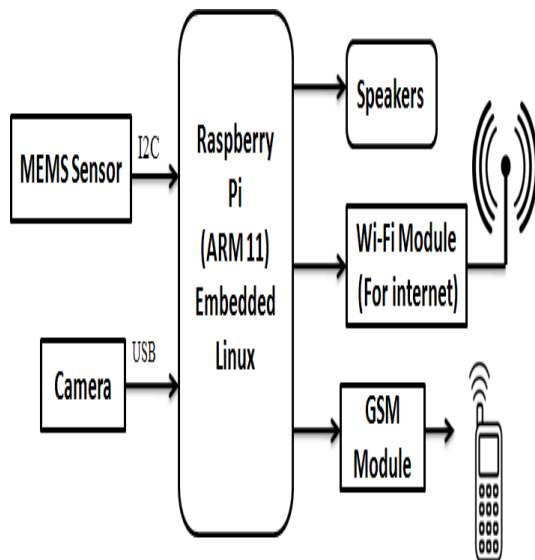


Fig.1. Block diagram of accelerometer based driver safety system.

The GSM modem SIM900 will send message vehicle activity to authorized person. When the vibrations are detected by MEMS then the webcam will enable and captured car inside activity image then it will send email to the authorized peoples with the integration of Wi-Fine work server.



Fig2.Hard ware setup for Driver safety system

a. Raspberry Pi Processor:

Figure2 shows complete hard ware setup for Driver safety system. In this proposed driver safety system used Raspberry Pi is a credit card sized single board computer developed in UK by the Raspberry Pi foundation. This Raspberry Pi has a Broadcom BCM2835 system on chip, which includes an sARM1176JZF-S 700 MHz processor, video core IV GPU, and originally shipped with 512 megabytes of RAM. It used only SD card for booting and longtime storage.



Fig3. Raspberry Pi Processor

b. USB camera:

A USB web camera is feeds its image in real time to computer network. Unlike an IP camera which uses a direct connection using Wi-Fi, basically the USB camera is connected by USB cable. Other popular uses include the security in real time video surveillance, like computer vision application, and for recording social videos. This web camera is for low manufacturing cost and flexible making either video or image telephony. In this paper presented a source of security and privacy issues in some built cameras are remotely activate via spyware.

c. Wi-Fi:

This wireless technology uses a radio frequency to transmit data through the air. The initial speed of Wi-Fi is 1mbps to 2mbps. It can transmit data in frequency band of 2.4 GHz. And also it implements the concept of frequency division multiplexing technology.

d. GSM:

GSM, which stands for Global System for Mobile communications, reigns (important) as the world’s most widely used cell phone technology. Cell phones use a cell phone service carrier’s GSM network by searching for cell phone towers in the nearby area. Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz. It is estimated that many countries outside of Europe will join the GSM partnership.

The Raspberry Pi processor reads the data from MEMS sensor continuously and

depending on preset threshold limit it takes decision of action whether to take snapshot or to give warning to driver. This system uses Wi-Fi connectivity to get internet connection and to send snapshots to email. Also this system will take help of GSM module to send this accident message to some predefined number. The Raspberry Pi processor is programmed using embedded Linux.

ALGORITHM:

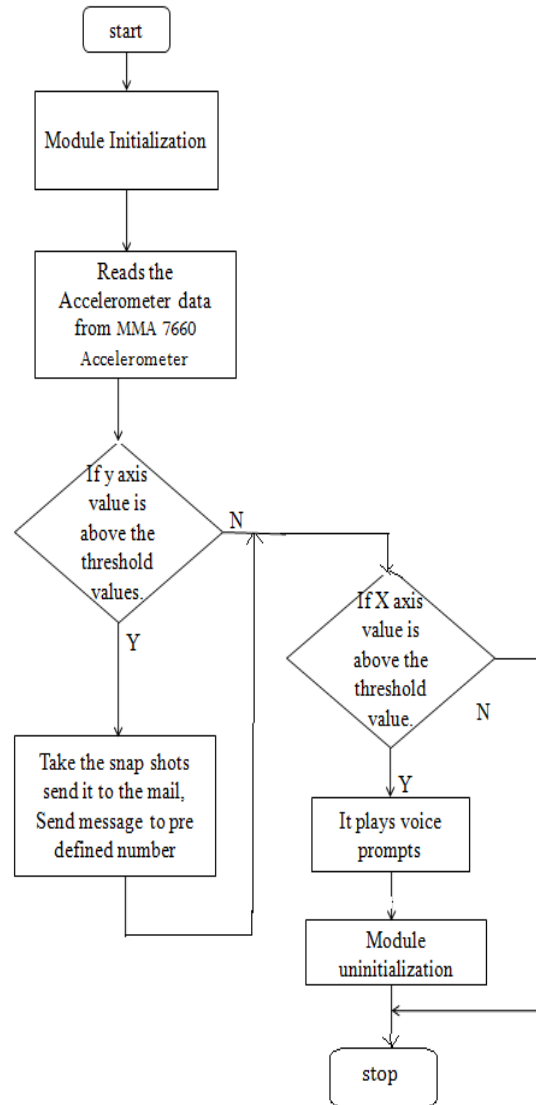


Fig.4. Flowchart of designed system.

IV. RESULTS:

When we designed this system into vehicle detected accelerometers values based to compare both X and Y axes value to the threshold value if the value is greater than the threshold value then send a snap shot to the predefined email id. Parallel send message to predefine number to the mobile as shown in fig.5 & 6.

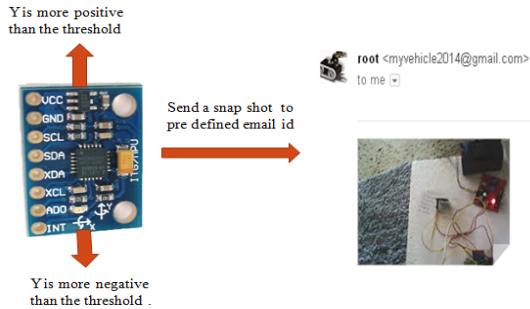


Fig.5. result of send email to the authorized person

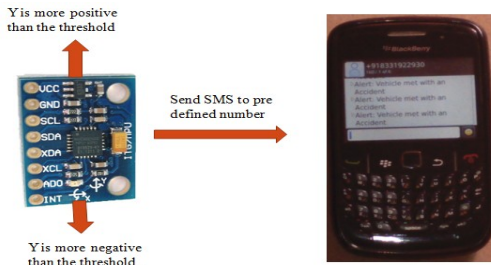


Fig.6. send SMS to the authorized person

V. CONCLUSION AND FUTURE SCOPE

This paper presents a new design of commodity hardware with cheap and it consumes very less power designed oriented product for getting information from accident location of driver drowsiness and indicating be alert to the driver in the prevent of accident. This system is designed by using Raspberry Pi (ARM11) for fast accessing to control and accelerometer for event detection. Is there any event is occurs the message sent to the authorized person so they can take immediate action to save the lives and reduce the damages. And at the

same time send captured image email to the owner situation of vehicle and also it notice the accident types and at what time it happens.

In future you can extend by using MEMS accelerometer, web-camera, and driving style detection by developing suitable algorithm on accelerometer data with in single a system can simultaneously monitor driver activity and to provide best results.

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