Life Safety Air Bag System for Two-Wheeler

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ABSTRACT - Automotive airbag systems have augmented occupant safety through the incorporation of increasingly sophisticated features. An airbag is an automotive safety restraint system consisting of a cushion, designed to inflate rapidly during collision. It absorbs the shock and reduces the number the casualty rate. The success of this safety system heavily depends on its correct implementation and timing of its inflation. The objective of this study is to present front air bag defects and its adverse effects on the occupants. It is important to understand how failures occur and which mechanism is responsible for injuries. This project shows the importance of using seat belts along with airbag to provide adequate safety to the occupants. The Airbag system was first introduced in 4- wheeled vehicles but this research gives information about the introduction of the airbag system that can be used in the two wheelers (bikes). The concept of airbag system is: "To reduce the injuries to a rider when impacting with an opposing vehicle and/or opposing object in frontal collisions by absorbing rider kinetic energy and by reducing rider separation velocity from motorcycle in the forward direction." This can be done with the help of ANGLE sensor, an angle indicator and sense of the collision and the large frequency vibration for to open the air bag. The material of bag will be optimized, and calculation will be done accordingly. The research will also include the working, construction, installation and the problems regarding airbags. Some of the limitations perceived in deploying airbags are that two-wheeler riders are less likely to be in a fixed location with respect to the airbag at the point of impact and the lack of supporting surface.

KEYWORDS: Airbag, collision, failure and automobile

I.INTRODUCTION

A car becomes an essential feature for any service class as well as businessman to meet with the stringent demand of hectic lifestyle. Safety of the driver as well as passengers becomes an important feature along with comfort and performance of any family car. Airbags have even been suggested from the beginning of the motor vehicle safety. It has been used for the protection of head, knees and legs. Rear passenger airbags and side airbags in addition to driver air bag (Fig.1.1) are developed for providing protection in rollover accidents by shielding the occupants and passengers from side window glass and protecting the head.

This project aims to present a technology automatically detecting the accident and a hardware tracking device based on GSM/GPS technology informing at the occurrence of accident with sufficient details like exact location and time at which accident happened. This project will establish a communication between the control station and the unit installed in vehicles. Vehicles will have GPS/GSM enabled tracking modules and will be tracked in real time using cellular networks. The software embedded in the microcontroller will control the various operations of the device by monitoring waveform from the vibration sensor. In case of accident the device will send an alert message along with location data from GPS module to control station using GSM network. It is a comprehensive and effective solution to the poor rescue response in case of accident. The accident reporting can automatically find a traffic accident, search for the spot and then send the basic information to the rescue agency covering geographical coordinates and the time and circumstances in which a traffic accident took place. At the server end, a control function will extract relevant data and store it in a database, to which accident information from prototypes will be polled in real time. This system combines advanced hardware design and sophisticated control technology into a compact, reliable package.

LITERATURE SURVEY

The advantage of technology has also increased the traffic hazards and the road accident take place frequently which causes huge loss of life and property because of the poor emergency facilities. This project will provide an optimum solution to this draw back. An integrated Cell phone GPS-GSM system is proposed to track vehicles using Google Earth application develop in

Android application for mobile system. The remote module has a Bluetooth mounted on the moving vehicle with attached accident detecting sensor to identify if accidents happens. Here Bluetooth will be the medium of

communication with the user mobile for activating the GPS position of the cell phone. In this case cell phone will get activated its application and track the current position of the vehicle and send it to the remote located predefined phone for tracking the real time position of the situation. After data processing, Google Earth application can be used to view the current location and status of each vehicle. To detect the real time localization of the vehicle using Bluetooth technology with GPS locator in cell phone using android application.

The Rapid growth of technology has made our life easier. This advancement in technology also increased the traffic hazards. Hence the ratio of road accidents which take place frequently increases causing immense loss of life due to poor emergency facilities. Main causes behind these road accidents include: lack of training institutes, unskilled drivers, poor road conditions, use of cell phone during driving, over loading and poor governmental plans in this regard. This research provides a solution for accident detection and prevention for human life safety. It enables intelligent detection of an accident at any place and reports about the accident on predefined numbers. This system consists of two parts, alarming part and messaging part. The hardware includes SONAR ranging modules, vibration sensor, three modules GPS receiver (NMEA), Microcontroller (AT89S51), GSM modem (SIM 900D) and an Alarm. When distance is too short between the vehicles and obstacle then alarm will be "ON" as an indicator to move vehicle in other direction which is safer but when a vehicle faces accident despite of alarm, immediately vibration sensor will detect the signal and then Microcontroller sends the alert message through the GSM modem including the location to predefined numbers that can be reserved for a rescue team. This designed system has been tested at different locations and found to be effectively working by sending alert messages to mobile phone user.

The ability of EMS personnel to quickly reach crash sites is a critical determinant of final crash outcome. Response times are closely linked to the locations of EMS facilities in relation to the locations of crashes. GIS can be used to assess existing service areas, to identify potentially underserved areas, and to evaluate the implications of potential changes in EMS systems. The case study pre presented here illustrates that changing the location of EMS services, such as through the pre-deployment of vehicles, can result in improved response times. The benefits, in terms of improved outcomes, and costs associated with this strategy is an issue for future research.

Improving global road safety

Much more needs to be done as evidenced by the Global status report on road safety, and levels of funding remain a major challenge, particularly for low- to middle-income countries to implement, sustain and scale up measures that can lead to reduced fatalities and injuries. Road safety continues to be an area that is not addressed systematically. Lack of national lead agencies, comprehensive and effective legislation, and inadequate road infrastructure are also major challenges that need to be addressed systematically in order to achieve meaningful results. Lack of data and local capacity for monitoring and evaluating road safety projects remains a challenge, and more needs to be done to strengthen efforts to collect appropriate data for analysis and decision-making on road safety, including the health, social and economic impact, and cost-effectiveness of interventions. To support actions on the ground during the Decade, more funds will be needed for United Nations activities and activities in Governments, sub national authorities and civil societies.

EXISTING SYSTEM

This device is completely independent. It does not use the internal satellite navigation of the car. It has its own GPS module and antenna. The device is designed for plug-and-play, low power consumption and will be compatible with the vast number of vehicles regardless of make and model at the same time be very reasonably priced so that it can be widely deployed. Physical Damage to the car is one of the trigger events. In the likelihood that a vehicle has damaged key areas of the car it will act as a trigger. It is simply a push button that gets pressed. It is placed with some protection between the chassis and the frame of the car.

If an impact is strong enough to go up to the chassis bending panels and body, it is definitely a valid crash. This will also avoid triggering in the event of minor nonlife threatening collisions that happens more often. Since it is only a push button trigger it can be placed in many places of the vehicle so that angular, roof collapse and side-impacts are covered as shown in and shows possible impact switch (red) placements inside the car frame (green). Device contains two Maxim DS18B20 Digital Temperature sensors.

A trigger occurs if cabin temperature exceeds 80°C and engine temperature trigger is at 120°C. This is different for different vehicle and regions and therefore can be adjusted accordingly in the programming.

• Temperature for both cabin and engine bay is also recorded in a file to figure out events such as a blown engine that resulted in fire is actually an instant occurrence or did it gradually came to that condition.

• Lastly the have Acceleration and Tilt data to be recorded on a file at 100Hz, because a speed bump may last only a fraction of a second. Sensor used is a single unit MPU6050, which is a combination of accelerometer and gyroscope. Data saved are Yaw, Pitch, Roll in degrees and Vertical, Horizontal and Lateral G-Forces. This will allow crash investigators find out how the vehicle was being driven and what road surface conditions it was being driven over.

PROPOSED SYSTEM

The provision of air bags on motorcycles is more complex than installation in cars, because the dynamics of a motorcycle crash are more difficult to predict . But we discussed the following points on accident. These characteristics leads to act with very short reaction time and fast inflation but only if the motorcycle is involved in the accident . Limitation of this system is that they work properly only under particular conditions , especially the rider must remain on the motorcycle during the accident and the impact dynamics must lead him to hit exactly the part of his vehicle protected by airbags.[2] Normally, following kinds of bodily harms occur in the accident -Hand/leg Cracks or fractures -Head injury -Bleeding from body parts -Getting thrown from bike

To build an integrated system for emergency rescue services in the event of road accidents by air bag system. The project focuses on building an infrastructure which vehicle safety authorities can enhance the crash reports post-crash analysis, record of the event and reduces the time to arrive at the crash location.

In the event of an accident it is reported to the police or a hospital by the locals in the area if they have discovered the wreckage or the incident happened on sight. Usually the caller is uncertain of the injuries and according to a research in delay of ambulance to crash location reveals that even with emergency services in place it can take up to 5 minutes or more in the developed countries for an ambulance to arrive

Techniques

- Vehicle to vehicle communication has been implemented instead of GSM.
- Panic switch use to control the sending information.
- The information sent from one vehicle to another network station.
- The information has been sent to nearby base station or police station or hospital or home.

Design of Two-Wheeler Airbag

There are following instruments used for the two-wheeler Airbag system Air bag (leather material with grip technology) Chemical cylinders for releasing the air or gas Sensors (angle sensor and crash sensor) Fitting cage Angle measurement instrument (angle indicator) Battery used (bike battery)

1) Air bag (leather material with grip technology): Airbags are stretchable fabrics or other materials that are tightly packed in various locations throughout the vehicle. These bags are compressed and kept in a small area. When there is an accident, the airbags fill up with air very quickly to provide a cushioning system for the people on the motorcycle so that they are not thrown around in the event of a crash. While this does not necessarily prevent total injury or death, it can be very helpful in cushioning the passengers in many cases.

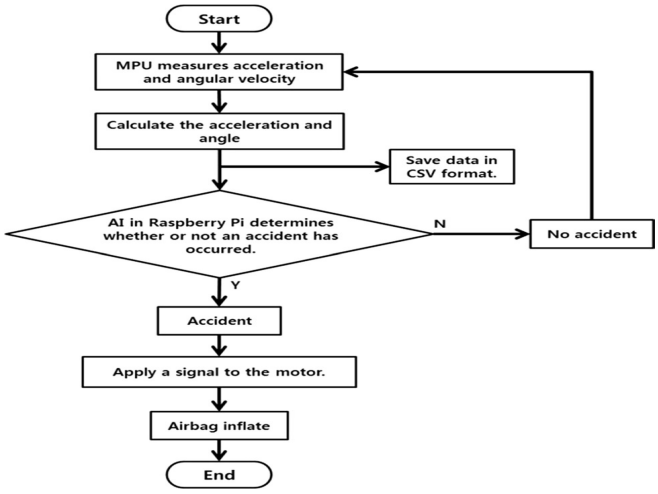

Figure 1 Overall Algorithm

2) Design of strong leather grip technology air bag: Strong leather with grips is used to construct the air bags. Especially as the lower surface of the air bags take the friction caused due to the road surface. The grip is used to avoid slipping or skidding of the bike on the oily or wet surface areas. The shape of the air bag is semi-circular "D" shape on both sides of the bike.

3) Chemical reaction behind opening of airbag: Actual opening of air bag is due to the chemical reaction occurred in between two chemical cylinders which are fitted at the bottom of bike. When an external force or collision of two objects with bike occur then those two chemical cylinders mixes with each other and the chemical reaction takes place inside the cylinder. At the outlet of the cylinder, the high-pressure exhaust gas (air) is expanded from exit valve. The pressure can be controlled by pressure valve in between air bag and chemical cylinder. This exhaust air or gas is used to fill the air bag and hence an air bag will open.

The signals from the various sensors are fed into the Airbag control unit, which determines from them the angle of impact, the severity, or force of the crash, along with other variables. Each restraint device is typically activated with one or more pyrotechnic devices, commonly called an initiator or electric match. The electric match, which consists of an electrical conductor wrapped in a combustible material, activates with a current pulse between 1 to 3 amperes in less than 2 milliseconds. When the conductor becomes hot enough, it ignites the combustible material, which initiates the gas generator.

In a seat belt pre-pensioner, this hot gas is used to drive a piston that pulls the slack out of the seat belt. In an airbag, the initiator is used to ignite solid propellant inside the airbag inflator. The burning propellant generates inert gas which rapidly inflates the airbag in approximately 20 to 30 milliseconds. An airbag must inflate quickly in order to be fully inflated by the time the forward traveling occupant reaches its outer surface. Typically, the decision to deploy an airbag in a frontal crash is made within 15 to 30 milliseconds after the onset of the crash, and both the driver and passenger airbags are fully inflated within approximately 60-80 milliseconds after the first moment of vehicle contact. If an airbag deploys too late or too slowly, the risk of occupant injury from contact with the inflating airbag may increase. Since more distance typically exists between the passenger and the instrument panel, the passenger airbag is larger and requires more gas to fill it.

Applications

- Road safety in roadways.
- In-vehicle monitoring.
- Accident detection.
- Information gathering.
- Rescue system.
- Location tracking.

system comprised of disparate parts where custom configurations and/or unique installations are the norm.

CIRCUIT DIAGRAM

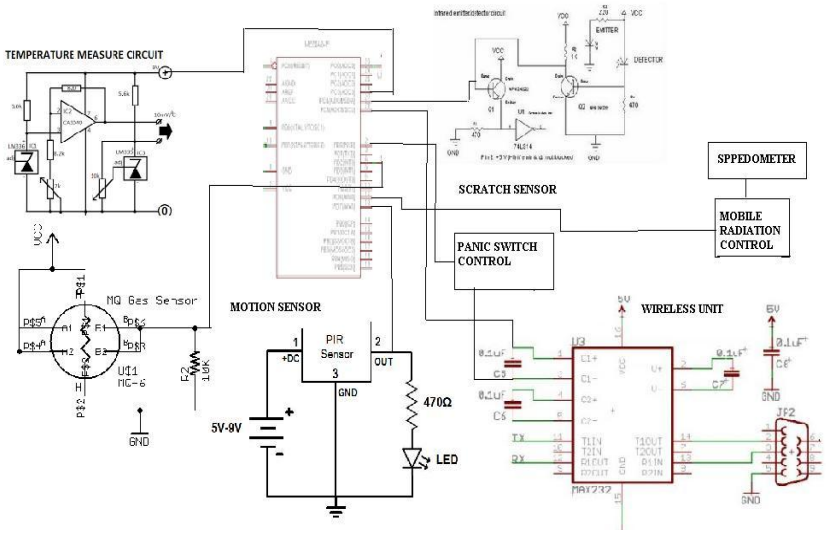

Figure 2 Circuit Diagram of Airbag System

FUNCTIONAL TESTING

Functional test can be defined as testing two or more modules together with the intent of finding defects, demonstrating that defects are not present, verifying that the module performs its intended functions as stated in the specification and establishing confidence that a program does what it is supposed to do.

INTEGRATION TESTING

Testing in which modules are combined and tested as a group. Modules are typically code modules, individual applications, source and destination applications on a network, etc. Integration Testing follows unit testing and precedes system testing. Testing after the product is code complete. Betas are often widely distributed or even distributed to the public at large in hopes that they will buy the final product when it is released.

WHITE BOX TESTING:

Testing based on an analysis of internal workings and structure of a piece of software. This testing can be done sing the percentage value of load and energy. The tester should know what exactly is done in the internal program. Includes techniques such as Branch Testing and Path Testing. Also known as Structural Testing and Glass Box Testing.

BLOCK DIAGRAM

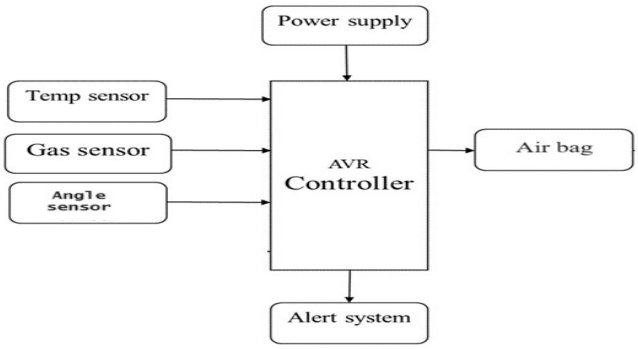

Figure 3 Block Diagram of Airbag System

AIR BAG TESTING:

Testing without knowledge of the internal workings of the item being tested. Tests are usually functional. This testing can be done by the user who has no knowledge of how the shortest path is found.

RESULT AND DISCUSSION

With the typical system dynamic response characteristics now identified; variations in each of these characteristics with varying drop heights, and their effect on the injury-risk level to the occupant can be investigated. These trends are summarized

Shown below is a comparison of the Test Session 1 and corresponding model-predicted acceleration responses

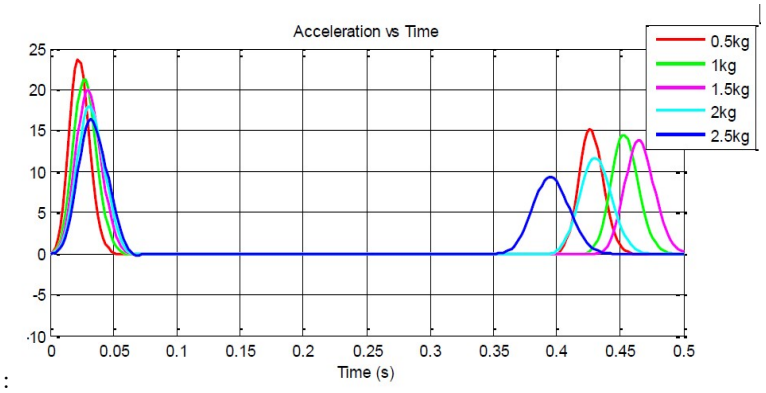

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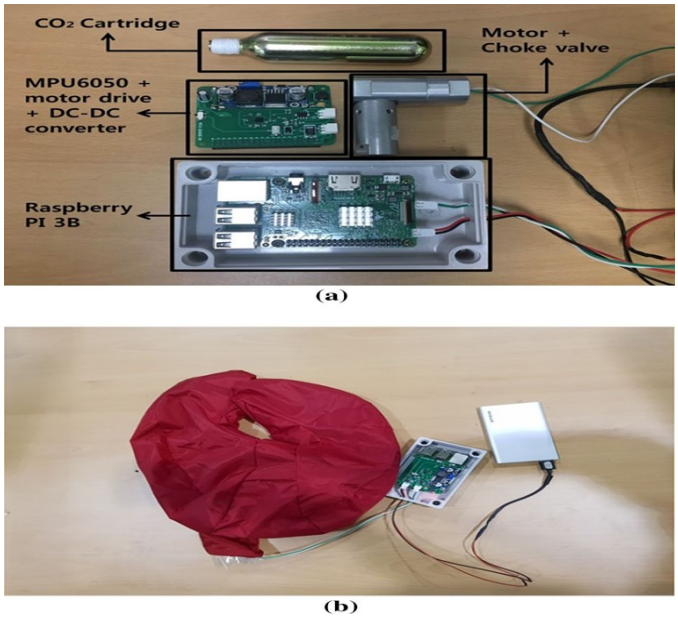
Figure 4 Comparison of the Test Session and corresponding model-predicted

In order to avoid this failure mode, a triple layer of fabric was proposed for the airbag seam construction to reduce the local stress accumulation by increasing the material thickness. The resultant stress through this triple layer seam was then limited to be less than 90MPa in order to provide some margin against this failure mode

Figure 5 a & b System Composition



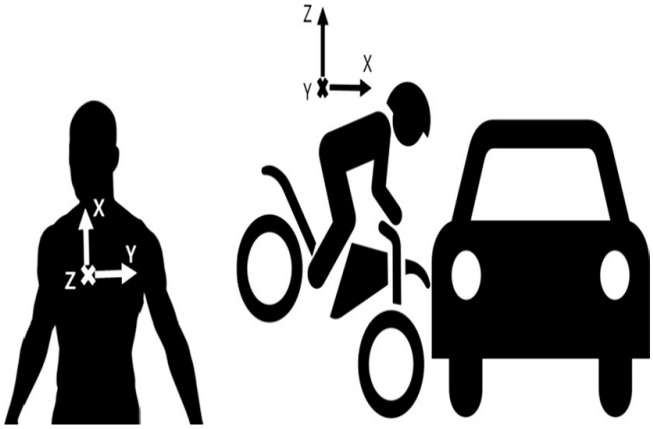


Figure 6 Accident situation and axis criteria

CONCLUSION

In this project, airbag is identified to work for development in two-wheeler with safety and reliable. It was reflected on different methodology likes respond surface method, meta-analysis and hearing problem. This project has proposed a system that measures the driver's motion status and determines accidents in real time through the use of one MPU sensor. It was confirmed that the driver's axis of motion has a specific shape in certain situations. The input data has different data types such as three-axis acceleration and 3-axis angle. It was found that the accuracy and stability of the test and the learning time were improved by 6.25% P and 1.70 ms, respectively. It is possible to judge the user's accident by using only one MPU module. In addition, it is believed that the technology proposed could be applied to bicycles and the fall accidents of the elderly in the future, and by increasing the type or number of sensors, accuracy and reliability are expected to increase.

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