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Vehicle Crash Detection and Information System for Two Wheeler in Remote Areas

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***Abstract*: In health care industries, most of the survey says that almost sixty percentage of deaths caused due to accident in remote areas are because of a delay in rescuing. This delay is higher in rural areas because of improper medium for intimation of accident to rescue systems. Thus health care industries need a proper system that intimate the accident in remote areas to ambulance as soon as the accident occurs. In our project this problem can be reduced to a maximum extent by a system in which the intimation is done as soon as an accident occur effective information transfer technology. In rural areas the accidents are only intimated by strangers. Nowadays the strangers don't show personal interest in helping victims. Though this project there is no need to depend on stranger and intimation is directly given from our device. Thus the unwanted life losses can be avoided.**

***Keywords*: Arduino Mega, Battery, GPS Module, GSM Module, Sensors.**

1. Introduction

Bike crash may cause heavy injuries or death, in remote areas or at night time riding, the victim may get unconscious and there will be no people for helping and to alert the rescue team. This project can exactly detect the bike crash and intimate the centralized command center. The local ambulance and police service can be sent to the exact location of crash point by the centralized command center. Unconquerable accidents are detected by this project such as, Slippery side swipe, Fall on path holes, canals, ditches, Blind corner crash & Distracted drive and Intersection crash. Crash detection is accurately detected by sensing the position (tilt angle) and vibration impact of a bike while riding. For accuracy some time delays and other enabling sensors are used in this device. Gyroscope and vibration sensors detect the crash. The confirmation of crash and avoiding of wrong detection was done by side stand sensor and temperature sensors according to time delays. If crash was detected, the GPS will locate the crash point and it send the location of data of victim to centralized command center by GSM module. In centralized command center by utilizing our developed web application the crash is located and it will identify the ambulances which is nearby the crash location and intimate them through our mobile application provided to the ambulance driver. "I am ok" switch is provided in this system for purpose to withdraw the Save our Souls (SOS) signal if the victim is alright. And "emergency" switch also provided to activate SOS signal manually. The alarm produces sound and emergency lighting to turn the attention of local people for help before arrival of rescue team. And also it is useful to find the victim inside the bushes and mountain slopes. For reliable and optimized rescuing a web application is provided to the centralized command center and mobile applications are provided to local rescue team.

2. Proposed System

A. Crash Detection Technology

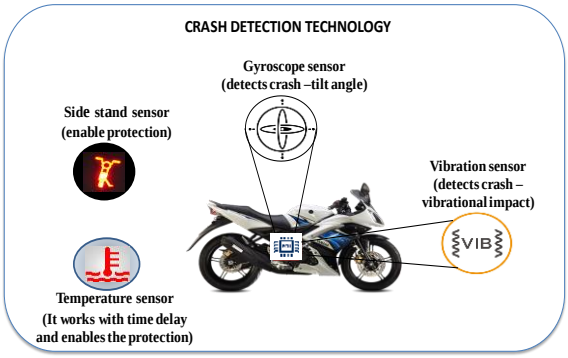

Fig. 1. Crash detection technology

The gyroscope sensor detects the angle and position of bike and vibration sensor measures the vibrational impact. The gyroscope sensor is having pre-set value. If the value exceeds, it is considered as an accident after 10 seconds of time delay. The vibration sensor also having a pre-set value of range. If vibrational sensor impact is more than that pre-set value it is considered as accident immediately. The side stand sensor is provided to enable the total operation of the system and to check whether the bike is active to avoid unwanted sending of information, ignition can be used but when crash occurs the ignition may get turned off hence to avoid this problem can be

avoided by sensing the temperature through temperature sensor.

B. Rescuing technology

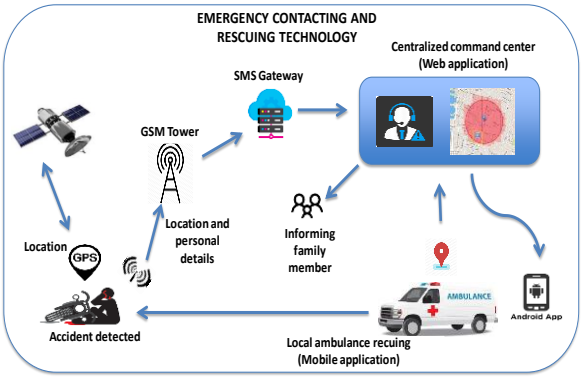

Fig. 2. Rescuing technology

If crash is detected, the GPS gathers the location of the victim's crash point by satellites in the form of latitude and longitude. The microcontroller composes the message which consist of personal details, vehicle details and location details which will be sent to the centralized command center by using GSM module. For sending information, Internet can be used but it may not be effective in remote areas hence information is send as SMS which require minimum network coverage. The SMS gateway is used for receiving the SMS to the web applications provided to the centralized command center. In the Centralized command center using web applications the crash location is located and with the help of mobile applications the nearby applications the nearby ambulance is located and crash location is shared to them and the measuring operation will be initiated and continuously monitored by centralized command center.

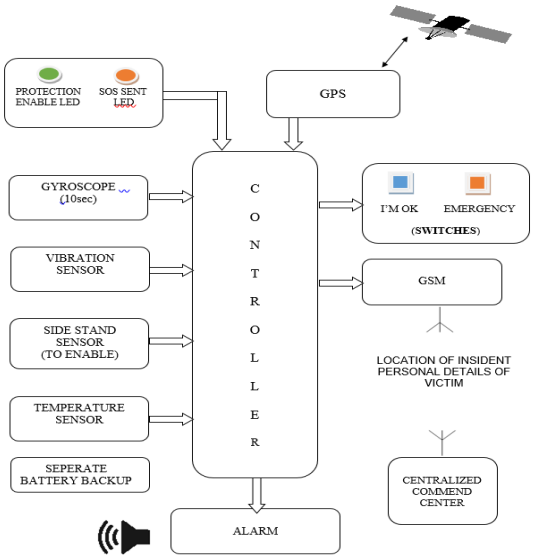

Fig. 3. Block diagram

3. Hardware Description

A. Arduino Mega

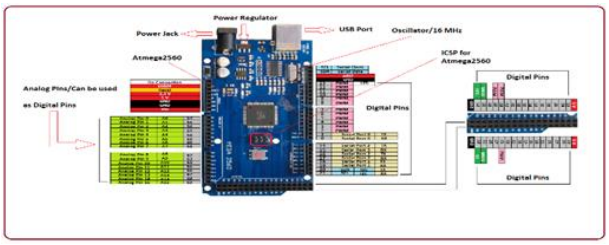

Fig. 4. Arduino Mega

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. The Arduino is the major control unit to detect or alert when an accident occurs.

The Arduino Mega2560 act as heart of the project and it controls all the other devices used in this project and their operations. It acts as a decision maker which takes input and gives output to external devices at appropriate time. If the microcontroller fails entire system will collapse, hence Arduino mega2650 is chosen for its reliability and accuracy. It is also low in cost with high specification. Other reason for choosing Arduino Mega2560 is that programming Arduino controller is quite easy and does not require much space compared to other microcontrollers.

B. Gyroscope Sensor

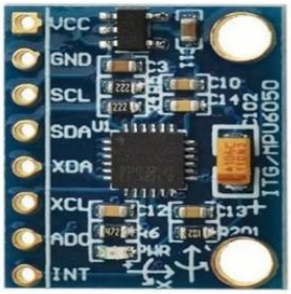

Fig. 5. Gyroscope Sensor

MPU-6050 is an 8 pin 6 axis gyroscope in a single chip. This module works on I2C serial communication by default but it can be configured for SPI interface by configuring it register. The gyroscope sensor detects the angle and position of bike. The gyroscope sensor is having pre-set value. If the value exceeds, it is considered as an accident after 10 seconds of time delay. The main reason for choosing the gyroscope sensor is to detect the accident more effectively and accurately. Though we have temperature and vibration sensors for detection, the usage of gyroscope sensor enhances the crash detection system as it only confirms accident when the position angle of vehicle cross certain limit otherwise it won't consider it as an accident. The previous existing systems uses accelerometer for crash

detection but it does not have high accuracy and chances of getting wrong data is high hence gyroscope is chosen for its high accuracy and high sensitivity.

C. Vibration Sensor

Fig. 6. Vibration Sensor

The Vibration Sensor (SW-420) is a high sensitivity non-directional vibration sensor. When the module is stable, the circuit is turned on and the output is high. When the movement or vibration occurs, the circuit will be briefly disconnected and output low. At the same time, you can also adjust the sensitivity according to your own needs. vibration sensor measures the vibrational impact. The vibration sensor also having a pre-set value of range. If vibrational sensor impact is more than that pre-set value it is considered as accident immediately. The Vibration Sensor is used in this project for sensing one of the parameters that confirms the crash. It generally senses the vibrational impact created by vehicle for every 50ms and The value it will generate while an accident occur are noted at various situations and a certain range of value is considered as accident causing range and it is fed into the microcontroller. Though temperature sensor and gyroscope are also used for accident detection the vibration sensor value is the first thing checked for accident confirmation by the microcontroller.

D. Temperature Sensor

Fig. 7. Temperature Sensor

This is a sealed (waterproof) and pre-wired digital temperature probe, based on DS18B20, 1-wire digital temperature sensor from Maxim IC, providing data in degree Centigrade with 9 to 12-bit precision over the range of operation (-55C to125C). This probe lets you precisely measure temperatures in wet environments with a simple 1-Wire interface. Because they are digital, you don't get any signal degradation even over long distances.

E. GPS Module

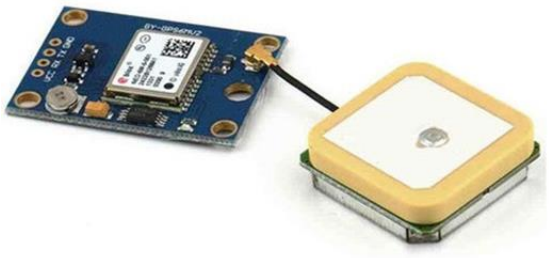

Fig. 8. GPS module

The Neo-6m GPS gives the best possible positioning information and includes a larger built-in 25 x 25mm active GPS antenna with a UART TTL socket. A battery is also included so that you can obtain a GPS lock faster. This is an updated GPS module that can be used with Arduino mega v2. This GPS module gives the best possible position information, allowing for better performance with your Arduino or other Multirotor control platform. If crash is detected, the GPS gathers the location of the victim's crash point by satellites in the form of latitude and longitude. The GPS plays a vital role in this project as it is the main source for finding the crash location. Other than GPS there is no other devices are there for getting the location data. It receives the latitude and longitudinal data for every second.

F. GSM Module

Fig. 9. GSM module

The SIM900A is a readily available GSM/GPRS module**,** used in many mobile phones and PDA. The module is typically connected to +4.0V standard power supply. It can work on +4.5V regulated power and any higher voltage may damage the module. The micro controller composes the message which consist of personal details, vehicle details and location details which will be sent to the centralized command center by using GSM module. The SIM900A gsm module is used in this project to send SMS to the centralise command centre. The previous existing system uses GPRS for sending accident location but it has a disadvantage that it won't send data if the internet facility is not available. But the GSM requires very less amount of network to get the location delivered as SMS.

It also sends the information very quickly compared to other gsm. At First SIM800l is considered for message delivery but it takes more time for delivering the message. In accident intimation system every seconds are accountable hence there shouldn't be any excuses in time for message delivery hence Sim900a is chosen over it.

G. Battery

Fig. 10. Battery

The entire source for the system is provided by using a 5v DC source provided from a 5v battery. The system has its own separate battery backup. The system does not depend on bike's battery.

4. Result and Conclusion

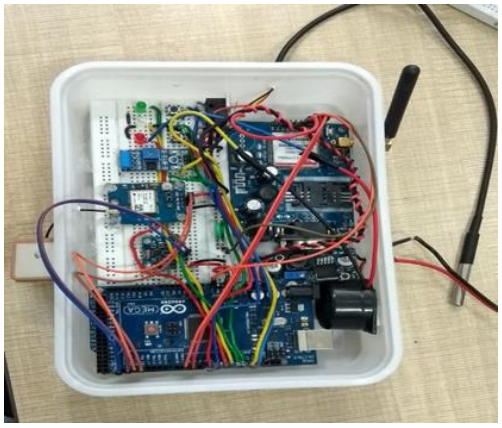

Fig. 11. Hardware setup

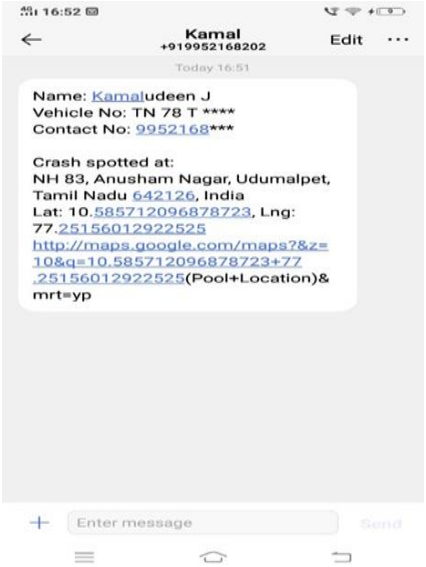

Fig. 12. Message received screenshot obtained from mobile

Thus the hardware setup was successfully developed, tested and the figure 11 represent the of Hardware Module and results are successfully obtained for sending an Information to the given Emergency contacts such as victims' Names, Vehicle number, Contact number with accurate location of a victim's with the data of latitude and longitude by the operation of an accurately sensing modules with speed and effective operation and figure 12 represents the screenshot of received information about the victim to the Emergency contacts and command centre. Basically bike crash identification is very much complicated compared to car crash. By using this system identification of bike crash is found effectively. In this system sending of wrong information about crash is avoided. It will detect any types of crashes accurately and its send the emergency SOS (Save our soul) signal to centralized command center. The ultimate aim is to save lives can be achieved by this system.

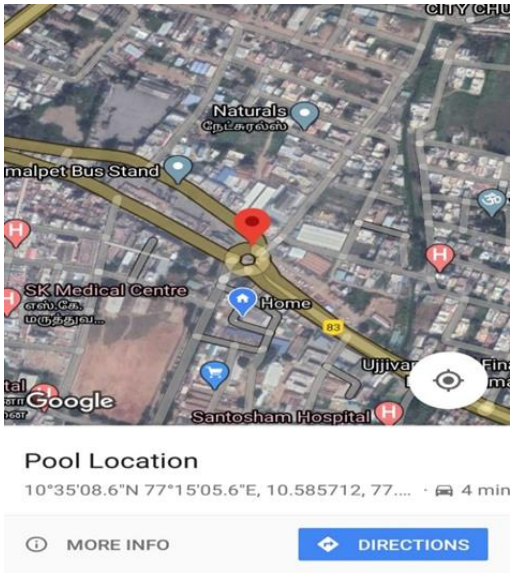

Fig. 13. Location of accident detected

5. Conclusion

This paper presented an overview on vehicle crash detection and information system for two wheeler in remote areas.

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