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Crash Detection and Rescue System for Vehicles

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***Abstract*:**

Most of the survey in healthcare industries says that nearly sixty percent of deaths caused by accidents in remote areas are due to a delay in rescue. This delay is higher in rural areas due to inadequate means for emergency systems to intimate accident. Therefore, healthcare companies need a proper network to communicate the incident to ambulance in remote areas as soon as the accident happens. This issue can be minimized to a full extent in our project by a framework in which the intimation is conducted as soon as an accident happens successful information processing technology. In rural areas only strangers intimate the accidents. The strangers do not show personal interest nowadays in helping victims. But there is no need to rely on stranger in this project and intimation is provided directly from our computer. And you will stop the inevitable loss of life.

Keywords: *Accident, Arduino, Battery, Crash, GPS, GSM, Sensors, Vehicle, Web application.*

1. Introduction

In this system, "I am ok" switch is provided for the purpose of withdrawing the Save Our Souls (SOS) signal if the victim is correct. Then also the "emergency" switch provided for manually activating the SOS signal. The warning triggers sound and emergency lighting to switch local people's attention for support before rescue team arrives and also it is useful to find the victim inside the bushes and mountain slopes. A web application is delivered to the centralized command center for efficient and automated rescue, and local rescue team receives mobile applications.

2. Proposed System

Bike crash may cause serious injury or death, the rider can become unconscious in remote areas or riding at night and there will be no people to support and alert the rescue team. This project will identify the bike accident reliably and intimate the centralized command center. The Centralized Command Center will assign local ambulance and police service to the exact location of the crash site. This project detects unconquerable incidents such as, Slippery side swipe, drops on track holes, canals, ditches, Blind corner crash & Distracted drive and [1] intersection crash. Detection of crashes is accurately detected by sensing a bike's location (tilt angle) and vibration effect while riding. For accuracy this system uses certain time delays and other enabling sensors. The crash is detected by gyroscope and the vibration sensors [2]. Due to time delays, the confirmation of crash and avoidance of erroneous detection was achieved by side-stand sensor and temperature sensors. When crash is detected, the GPS can locate the point of crash and send victim data location via GSM module to a centralized command center. By using our developed web application [3], the crash is located in a centralized command center and it will identify the ambulances near the crash site and intimate them through our mobile application [4] which is provided to ambulance driver.

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2.1 Crash Detection Technology

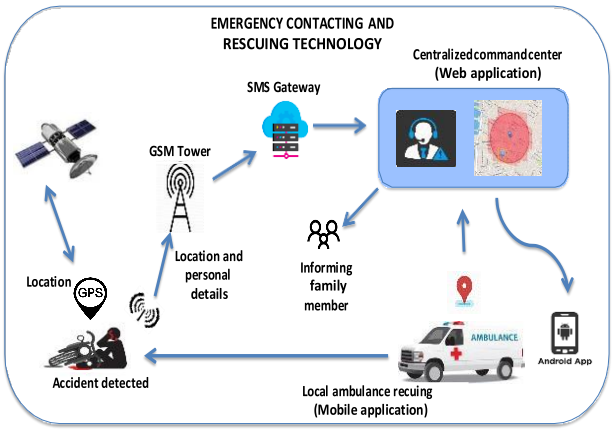

Fig 2.1 Crash Detection Technology

The gyroscope sensor tests the vibrational effect by measuring [5] the angle and location of bike and vibration sensor. The gyroscope sensor has pre-determined value. If the amount reaches, after 10 seconds of delay in time it is called an accident. The vibration sensor has a pre-set range rating, too. If the impact of the [6] vibrational sensor is more than that pre-set value it is immediately considered an accident. The side-stand sensor is provided to allow total system operation and to check whether the bike is active in order to avoid unwanted sending of information, [7] ignition may be used but when crash occurs the ignition may get turned off. So, this problem can be avoided by sensing the temperature through temperature sensor.

2.2 Rescuing Technology

Fig 2.2 Rescuing Technology

When crash is observed, the GPS gathers satellites in the form of latitude and longitude where the victim's crash point is located. The microcontroller composes the message that will be sent to the centralized command center using GSM module consisting of personal details, vehicle details, and location details. Internet can be used for sending information, but it may not be effective in remote areas and therefore information is sent as SMS requiring minimum coverage of the network. The SMS gateway is used to accept the SMS to the web applications sent to the central command centre. The crash location is located in the Centralized Command Center utilizing web applications and the nearest ambulance is located with the aid of mobile applications and the crash location is shared with them, and the measurement process is initiated and continuously controlled by a centralized command center.

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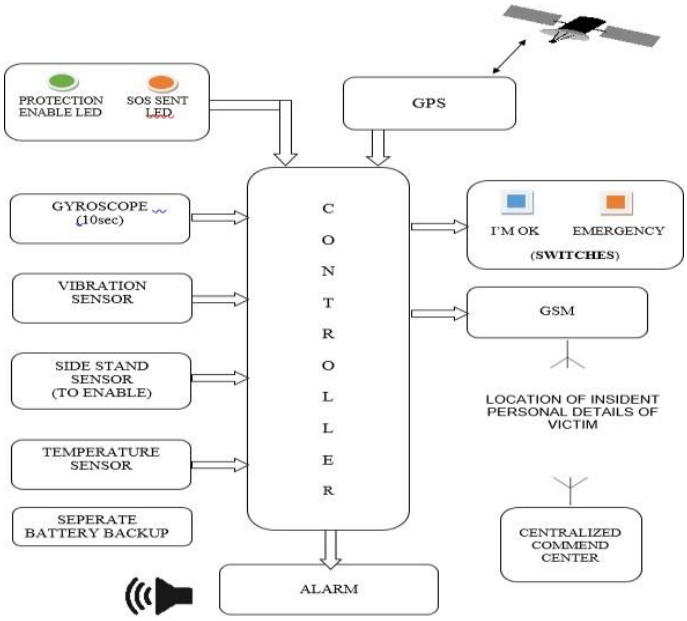

Fig 2.3 Block Diagram

3. Hardware Description

3.1 Arduino Mega

The Arduino Mega 2560 is based on the ATmega2560 microcontroller board. It has 54 digital input/output pins (of which 14 can be used as PWM output), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB interface, 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 serves as the heart of the project and it governs all other tools and operations used in this project. It acts as a decision maker that takes input and gives output to external devices when necessary. If the entire device fails the microcontroller would collapse, Arduino mega2650 is chosen for its durability and accuracy. High specification is also low in cost. Another reason to choose Arduino Mega2560 is that arduino controller programming is pretty simple and needs little space compared to other microcontrollers.

3.2 Gyroscope Sensor

MPU-6050 is a single-chip, 8-pin 6-axis gyroscope. This module works by default on I2C serial communication but can be configured for the SPI interface by configuring the register. The bike angle and orientation are measured by the gyroscope sensor. The gyroscope sensor has pre-determined value. If the amount reaches, after 10 seconds of delay in time it is called an accident. The main reason the gyroscope sensor is chosen is to detect the accident more easily and accurately. While we have temperature and vibration sensors for detection, the use of a gyroscope sensor strengthens the crash detection system because it only confirms accident when the vehicle's location angle reaches those limits otherwise it does not find it an accident. Previous current systems use accelerometer to detect crashes but do not have high precision and the chances of having incorrect data are small, hence gyroscope is chosen for its small accuracy and sensitivity. The angular velocity of all the three axes of gyro are calculated as follows for algorithm analysis,

Angular velocity along the X axis = (Gyroscope X axis raw data/131) °/s.

Angular velocity along the Y axis = (Gyroscope Y axis raw data/131) °/s.

Angular velocity along the Z axis = (Gyroscope Z axis raw data/131) °/

3.3 Vibration Sensor

The Vibration Sensor (SW-420) is a non-directional vibration sensor with a high sensitivity. The circuit is switched on when the module is stable, and the performance is high. If the motion or vibration occurs,

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the circuit will be disconnected momentarily and the output low. You may also tailor the sensitivity to your own needs, at the same time. Vibration sensor measures the impact of the vibrations. Only the vibration sensor has pre-set range value. When the effect of the vibrational sensor is greater than the pre-set value it is automatically considered an accident. In this project the Vibration Sensor is used to detect one of the parameters which confirms the crash. It normally detects the vibrational effect that the vehicle produces for every 50ms and the value that it will produce when an accident happens is noted in various circumstances and a certain set of values is considered to trigger accident set and is fed into the microcontroller. While the temperature sensor and gyroscope are also used for the detection of injuries, the importance of the vibration sensor is the first thing the microcontroller tests for accident confirmation. Vibration may be expressed in metric units (m / s2) or gravitational constant units "g" Where, **1 g = 9.81 m / s2**

3.4 Temperature Sensor

This is a sealed (waterproof) and pre-wired digital temperature probe based on Maxim IC's DS18B20, 1-wire digital temperature sensor, which offers 9 to 12-bit precision over the operating range (-55C to125C) in degree Centigrade. This probe helps you to test temperatures accurately in humid conditions with a simple 1- Wire interface. Since they are wireless, you don't even get any signal loss over long distances.

3.5 GPS Module

The Neo-6 m GPS provides the best positioning information possible and includes a larger built-in 25 x 25 mm active GPS antenna with UART TTL socket. Also included is a battery, so you can get a GPS lock quicker. This is a modified GPS module that is ideal for use with Arduino super v2. This GPS module provides the best possible location information, enabling your Arduino or other Multirotor control device to perform better. When crash is observed, the GPS gathers satellites in the form of latitude and longitude where the victim's crash point is located. In this project the GPS plays a vital role as it is the main source for finding the location of the accident. There are no other tools for accessing the location data other than GPS. It receives for every second the latitude and the longitudinal data.

3.6 GSM Module

The SIM900A is a [8] GSM / GPRS module that is readily available, used in many cell phones and PDAs. Usually the module is connected to regular +4.0V power supply. It will operate on +4.5V controlled electricity, and the module can be affected by any higher voltage. The micro controller composes the message that will be sent to the centralized command center using GSM module, consisting of personal information, vehicle details, and location details. In this project, the SIM900A gsm module is used to send sms to the centralize control centre. The previous current program uses GPRS to send accident site, but it has a downside that if the internet facility is not available, it does not send data. But to get the location delivered as sms, the GSM requires very less network amount. compared to other gsm it also sends the details really quickly. It is considered for delivery of message at first SIM800l but it takes more time to deliver the message. Each second is accountable in the accident intimation framework, and there can be no delays in time for transmission of messages, hence Sim900a is chosen over it.

3.7 Battery

Using a 9v DC supply supplied by a 9v battery provides the entire basis for the [9] device. The device has its own separate backup battery. The device does not rely on battery of the vehicle.

3.8 DC to DC Step Down Converter

For converting the battery's 9v to 5v DC to DC step down converter is used. From [10] the circuit of the dc to dc stepdown converter is analyzed, Where Switch S1 Resistance R is used for stepdown process. The output voltage of the converter is given by the following equation,

D = Vo/Vi & Vo = D x Vi

Where,

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D is the duty cycle of the converter

Vo is the output voltage of the converter

Vi id the input voltage of the converter

4. Result

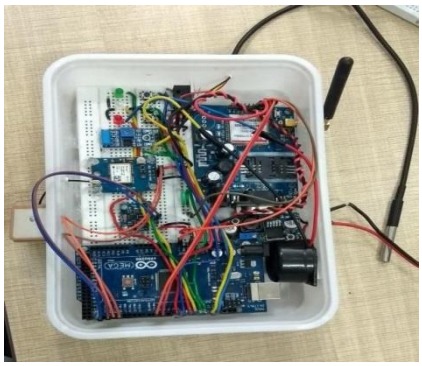

Fig 4.1 Hardware Setup

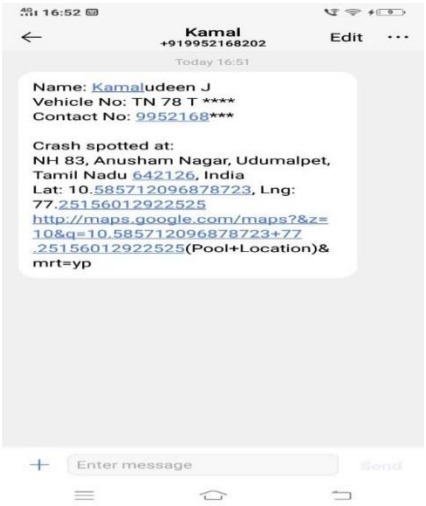

Fig 4.2 GSM sent message to rescue team

The hardware setup was developed as shown in Fig 4.1 and the results are obtained from the setup. The information is given to the emergency contacts and it contains the victim's name, vehicle number, contact number with accurate location. The location data is sent with latitude and longitude of the accident zone. This information is useful for effective recovery operation of the victim. Fig 4.2 represents the screenshot of received information about the victim to the emergency contacts and command centre.

5. Conclusion

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 it 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.

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