

# Two-Wheeler Accident Detection and Alert System with Anti-Theft Control

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**Abstract:** Road accidents are very frequent all around the world and many lives are lost due to the fact that required medical help fail to reach the patient on time due to various reasons. An automatic accident detection system process that initiates itself and alerts the medical teams whenever an accident occurs and also provides the live location of the vehicle. This system will be making a decision of whether an accident has occurred or not on the basis of very strict conditions to reduce false alarms. An android application is developed that detects and sends alerts message to the concerned authorities and relatives. External pressure change, sudden tilt of the vehicle, sudden change in speed will be observed using pressure sensor, accelerometer and GPS respectively. Application will also share the exact location of the vehicle in alert message that can help in saving time.

**Keywords:** Accelerometer, GPS, Pressure sensor, accident detection, alert message

## 1. Introduction

The automobile industry is growing rapidly in terms of technology and also the number of vehicles on road. With this the number of accidents are also increasing at an alarming rate. Over 1,37,000 people were killed in 2013 alone, of which two wheelers account for 25% of the total road crash deaths. In many cases the victims suffer serious injuries where time plays a very crucial role in saving lives. This device will be a blessing to the victims of Hit-n-Run accidents, also those who meet with an accident in early mornings or late night, when there is nobody around to witness and call for help. We need a rescue process that initiates itself as soon as an accident occurs and so minimum time is wasted, as every second in wait of medical help can be fatal. An automatic electronic system will be more efficient and reliable than any eye witness calling for help. This device is solely focusing on motorcycles as riders are more prone to more body damage in accidents as compared to cars drivers in most cases. Smartphone's have become an integral part of our life and almost all of us carry it with at all times, so it is best that we use them for such emergencies. The application is connected to the hardware system through Bluetooth. The system detects the change in vibrations via vibration sensor, sudden change in the tilt of the vehicle. By verifying these changes along with our developed algorithm it will decide whether accident has occurred or not. In case of a confirmed accident the system sends alert messages to the nearest medical teams and also the nearest police stations. An option will also be provided on the application that will enable the user to cancel any messages from being sent for help in case he is not that hurt or not in any immediate need of medical care. This feature will help save time of the concerned authorities. For Anti-Theft purpose, the user will get an alert message whenever the engine of the vehicle is start and he can start or stop the engine on his command in case of theft. He will also get the location of the vehicle on his mobile phone.

## 2. Related Work

[1]In this paper they have determined a two-way identification step to determine whether the accident has occurred or not. First is through accelerometer which will identify any sudden tilt of the vehicle in case of any accident. then the heartbeat sensor will sense the heartbeat rate of the user and determine the seriousness of the accidents or fall, based on the changes in the heartbeat, a message is sent along with the location map to the control room and emergency contacts. The android application will send a text message to the nearest medical help centre along with the location with the help of GPS which helps in saving crucial time. The heart beat sensor very effectively eliminates the false alarms like in the case of a standing fall of the two-wheeler which the accelerometer would assume as an accident. [2]In this paper they have used a vibration sensor along an accelerometer for precise detection of an accident. the vibration sensor will detect the signals and send them to the accelerometer, the accelerometer will detect the signals and send it to the ARM controller. Microcontroller sends message using GSM modem along with the location of the vehicle. Here they have also provided a switch which will terminate the whole process in case of a small accident, where the person is not hurt and does not require any immediate medical assistance. This is a very smart way to avoid wasting time of the medical rescue team. [3]In this paper they have paid very high interest in finding whether the accident has occurred or not. They have used sheet like flexible piezo film sensor for measuring the physical impact on the motorcycle during accidents. It is very small and sheet like and weighs only 3 grams. It has a good sensitivity of 10mV/g. It has a frequency range of 1Hz to 20 kHz and can survive a shock up to 1000g (where g is acceleration due to gravity = 9.8 m/s<sup>2</sup>) which make sure that it'll not get damaged during the accidents. A simple pendulum tilt meter made using simplest of the materials and can be replaced using a mercury tilt meter which will be smaller than a thumb. For simple calculation a tilt beyond 60° will trigger the micro switch, providing a digital pulse signal. A triple axis accelerometer is used to measure the

deceleration as the braking done in normal cases is different from when done in case of an accident. They have also provided a switch which when pressed manually will also send the message for help and can be used in cases other than accident.[6] This paper includes study on a smart phone-based pocket fall accident detection system. The fall detection algorithm is a method of investigating and arranging the features in a sequential manner. Electronic signals and waveform in the smart phones were used as the input signal. The obtained signals are used to generate an ordered feature sequence and then verified in a sequential manner by the classifier for recognition purpose. Once a fall accident is detected then the user's position can be easily noticed by the global positioning system or the assisted GPS and the signals are sent to the rescue center through the 3G communication network followed by medical treatment. By proposing this task of cascaded classification architecture, the issues like computational pressure and power consumption on the smart phone system can be upraised.

### 3. System Features

#### 3.1 Proposed System

The system consists of an accident detection and alerting system along with an Android application. A hardware device will be mounted on the motorcycle at all times, which consists of an Arduino, accelerometer, two vibration sensors, a motor, a GPS module and GSM module. The decision of whether an accident has occurred or not will be done on the basis of an algorithm. In case of an accident the accident detection system will send an alert message to the nearby medical center stating that an accident has occurred along with the message the current location of the vehicle. For Anti-Theft purpose, the user will get an alert message whenever the engine of the vehicle is start and he can start or stop the engine on his command in case o theft.

#### 3.2. Working of Accident Detection System

The system consists of 3 main working modules. The first module consists of an Arduino Atmega 2560, accelerometer, vibration sensor. This module is focused on detecting whether the accident has occurred or not. First the system observes the tilt of the vehicle, then checks the value sensed by the vibration sensor. If both of these observed values are greater than the maximum value set by us. Then an accident is confirmed. Then the android application sends an alert message to nearby medical teams and police station along with the location of the accident. The hospital longitudes and latitudes must be updated in the application database so the nearest hospital can be alerted. An alert message can also be sent to family or relatives of your choice.

#### 3.3 Working of the Theft Control System

Two-wheelers are easier to steal for as compared to cars. Although this system application can work in equally good ways for a car but new technology in cars is giving inbuilt features for anti-theft safety. The system sends an alert message to the user's registered mobile number informing him that the vehicle engine has been started. If the user

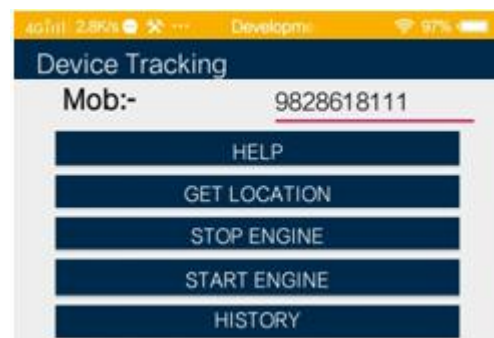
himself is riding the bike he can ignore the message otherwise he can send the message on the hardware device mounted on the bike to get the location of the vehicle. The GPS module fitted on the vehicle are used for tracking the vehicle and GSM module will send the message from the device the user's mobile. This module allows the user to check the current location of the vehicle at any times by sending a message "@X@" or directly by the application.

### 4. Design of the System

#### 4.1 Android Application

The application will enable us to use features of the system such as -

- 1) Help-this feature will enable us to get help whenever needed, it need not be an accident emergency. A "cancel" option is also active for ten seconds in case we need to stop the message from being sent.
- 2) Get location- This feature will get the location of our vehicle on our mobile at any time anywhere.
- 3) Start-This button will stop the engine directly by application in case the vehicle is stolen.
- 4) Start- this feature will start the engine from the application directly only via user's mobile.



#### 4.2 Change in vibration sensor values

We have used two vibration sensors, one is mounted alone and other is fitted close to the engine (motor). The threshold of the first vibration sensor is kept high to detect accidents. When vibration sensors detect vibrations on the vehicle. The threshold value is kept higher than normal value as we want to ignore the vibrations made by engine while riding. The threshold of the second sensor is kept relatively lower to detect vibrations produced by the engine an alert the user that the engine has been started.

#### 4.3 Change in Tilt of Accelerometer

Normally the vehicle is always upright and perpendicular to the road, accelerometer is used to detect any extreme changes in the angle of the vehicle. The accelerometer takes values from -100 to +100 so we have set the threshold values at <-50 and >+50. These are extreme tilt angles and mostly vehicle will fall down in these ranges.

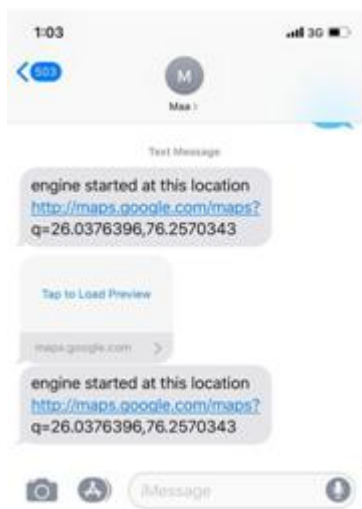
#### 4.4 Decision Making

The main functions of the system are to detect an accident and deliver the message to the medical rescue teams, alert

the user whenever the engine of the vehicle is turned on and provide the location o demand and in case of an accident. In case of accident detection , the values picked up by both the sensors must exceed the threshold values set by us , only in that case it is considered as an accident otherwise not. For the anti-theft alert message the vibration sensor attached to close to the engine picks up vibrations and notifies the user the engine has been start along with the location.

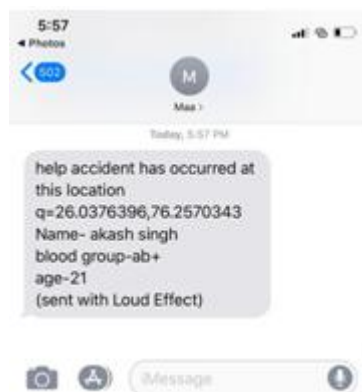
**4.5 Anti-Theft Control**

The system will work in two ways . First it will notify the user with an alert message whenever the engine is started along with the location of the vehicle. If the user himself is riding the bike then he can ignore the message and if not , then he can send a message via android phone to the system which will stop the engine. Then the user can send another message to get the location of the vehicle to track it in real time.

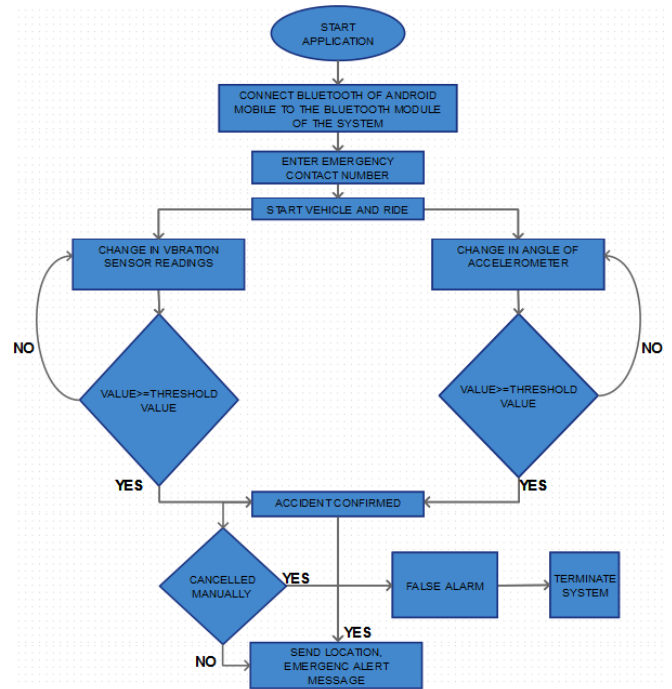


**4.6 Message Alert to Medical Assistance Teams**

Once the accident is detected the Android application will alert the medical assist center with the basic victim details such as name, age and blood group together with the location of the accident.

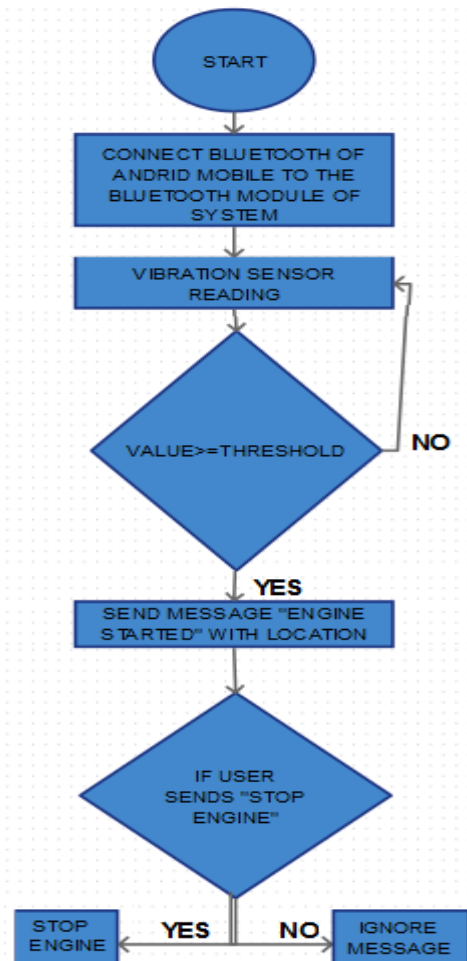


**5. Algorithm for Accident Detection**



This algorithm makes decision by checking the values of the sensor values obtained. An accident is supposed to have occurred only if value of the both ,the vibration sensor and accelerometer are greater than the threshold values.

**6. Algorithm for Anti-Theft Module**



This algorithm works on alerting the user by sending him a notification that the vehicle engine has been started along with the location of the vehicle. It does so by checking the values obtained by the vibration sensor whose threshold is kept so low, that it picks up the vibrations of the engine.

## 7. Conclusion

This system provides accident information to the medical rescue teams within seconds of the accident which can be very helpful and life saving. It can significantly reduce the response time of medical teams and save lives of the victims. This is only a technical part but the real implementation of this on large scale needs more resources. This System effectively detects an accident via accelerometer and vibration sensor's data and sends the alert message via GSM along with the location using GPS. The alert message is send to the nearest medical center using GPS. A "cancel" option is also provided in the application which is active for 10 seconds only in case of false alarms or the user is not in need of any help immediately , it can be cancelled through the user's phone via the Android Application. The Android Application can be used to get vehicle location in order to track the vehicle for Anti-Theft purposes. The user is alerted when and where the vehicle is started and in case of theft the user can stop the engine on command through application. Accident detection and alert systems are highly relevant in these days and this project aims at developing a low cost solution for the same for the benefit of the society.

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