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Smart Automatic Accident Detection And Messaging System

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Abstract— The traffic hazards and road accidents take place frequently which causes huge loss of life and property because of the poor emergency facilities. This paper provides an optimum solution, for crash or rollover detectors of the vehicle during and after a crash. With signals from an accelerometer, a severe accident can be recognized. According to this paper, when a vehicle meets with an accident immediately, Accelerometer sensor will detect the signal or if a car rolls over, will detect the signal and send it to Microcontroller. The Microcontroller sends the alert message through the Global System for Mobile Communications (GSM) Modem including the location to a police control room or a rescue team. So the police can immediately trace the location through the Global Position System (GPS) Module, after receiving the information. Then, after confirming the location, necessary action will be taken. If the person is met with a small accident or if there is no serious threat to anyone`s life, then the alert message can be terminated by the driver by a switch provided in order to avoid wasting the valuable time of the medical rescue team.

Keywords— Accelerometer sensor, GPS, GSM, Microcontrollers

I. INTRODUCTION

The high demand for automobiles has also increased traffic hazards and road accidents. Life of the people is under high risk. This is because of the lack of the best emergency facilities available in our country. An automatic alarm device for vehicle accidents is introduced in this paper. A Road Traffic Accident (RTA) can be defined as, ‗An event that occurs on a way or street open to public traffic; resulting in one or more persons being injured or killed, where at least one moving vehicles involved. Thus, RTA is a collision between vehicles; between vehicles and pedestrians; between vehicles and animals; or between vehicles and geographical or architectural obstacles.‘ Road traffic accidents area human tragedy.

Iyyapapan et al. [1] introduced a scheme called ITLS (Intelligent Traffic Light System). Traffic congestion and tidal flow are major factors that cause delays for ambulance. Mustafa Sabah Taha et al. [2] presented a method to use remote server through TCP (Connection Protocol and Internet) to be viewed on multiple web maps that are partiallyembedded in the web-based application.

D.Narendar Singh [3] discussed about the methods to intimate the driver about the speed limit at zones and to detect crashes automatically. They are done by means of using MEMS, RF, GPS, GSM technology. we lost our valuable life by making small mistake while driving (zone wise, hills area, highways). So in order to avoid such kind of accidents and to alert the drivers about the speed limits in such kind of places the highway department have placed the signboards.

Manisha Ruikar [4] presented a survey about National statistics of road traffic accidents in India. This tells about thenational reports published annually by Transport Research Wing of the Ministry of Road Transport &Highways and National Crimes Records Bureau of Ministry of Home Affairs, Government of India describe national statistical trends andnormalized indicators of road accidents, injuries & fatalities. NeetiBisht et al. [5] explained about the detection of an accident in which immediately help is required to driver and driver is not in position to inform any medical rescue team.

Huayun Chen et al. [6] discussed about the location of traffic accidents as an address with text, so they are difficult to display on the map. The paper discusses how to utilize the geocoding technology and VRS-GPS positioning technology to record traffic accidents with Geo-spatial information. R.Ramani et al. [7] explained that the theft is happening in parking and sometimes driving insecure places. Vehicle tracking and locking system installed in the vehicle, to track the place and locking engine motor.

V Praveena et al. [8] proposed a system that automatically notifies these services about the accident and also guides them to the spot. They Employed Vehicular AD-Hocnetwork (VANET) to deliver this message to the rescue services. Devyani Bajaj et al. [9] designed a remote control vehicle having the facility of tracking location through GPS tracking & detection of object to avoid collision. SowjanyaKotte et al. [10] explained the Vehicle navigation which is mostly used by drivers.

The surge in motorization coupled with expansion of theroad network has brought with it the challenge of addressing adverse factors such as the increase in road accidents. According to the World Health Organization (WHO), road traffic injuries are

the sixth leading cause of death in India with a greater share of hospitalization, deaths, disabilities andsocio-economic losses in the young and middle-aged

population. Road traffic injuries also place a huge burden on the health sector in terms of pre-hospital and acute care and rehabilitation[11].

The objective of this paper is to detect an accident usingan accelerometer and send the geographical information through GSM modem using ATMEGA 328p. The information is processed by the Emergency Control Centre and a team will be sent to the accident zone. The purpose of the paper is to find the vehicle location. Most of the times we may not be able to find accident location, in order to give treatment for injured people, first we need to know where the accident happened through location tracking and sending a message to their relatives of the victims or to the emergency services.

Hence, in this work, we have developed real time model using the basic microcontroller AT89C52. It is cost effective and also it can be for easily programmed. In this paper we have used an assembly programming for better accuracy and GPS and GSM modules which helps to trace the vehicleanywhere on the globe. The exact location of the vehicle is sent to our remote devices (mobile phones) using GSM modem.

Paper is organized is as follows, Section 1 gives the Introduction of the paper. Section 2 describes proposed Automatic Accident Detection system. Section 3 deals with Programming of Microcontroller. Section 4 enumerates the results and discussion of the case study. Section 5 concludes the paper.

II. PROPOSED ACCIDENT DETECTION SYSTEM

This design is a system which can detect accidents in significantly less time and sends the basic information to first aid centre within a few seconds covering geographical coordinates, the time and angle in which a vehicle accident had occurred.This alert message is sent to the rescue team ina short time, which will help in saving the valuable lives. A Switch is also provided in order to terminate the sending of a message in rare case where there is no casualty, this can save the precious time of the medical rescue team. When the accident occurs the alert message is sent automatically to the rescue team and to the police station. The message is sent through the GSM module and the location of the accident is detected with the help of the GPS module.

Complete Block diagram of the proposed model is shown in Fig.1. Power Supply is the device that transfers electric Power from a source to a load using electronic circuits. Some of the requirements of Power supplies are small size, light weight, low cost, and high Power conversion efficiency. The output voltage is regulated by dropping the extra input voltage across a series transistor (therefore, also referred to as a series regulator).

They have very small outputripple, theoretically zero noise, large hold-up time (typically 1–2 ms), and fast response. The action of a transformer is such that a time-varying (AC) voltage or current is transformed to a higher or lower value, as set by thetransformer turns ratio.

The GPS module is Global Positioning System satellites transmit signals to equipment on the ground. Each GPS satellite transmits data that indicates its location and the current time. All GPS satellites synchronize operations so that these repeating signals are transmitted at the same instant.

The signals, moving at the speed of light, arrive at a GPS receiver at slightly different times because some satellites are further away than others. The distance to the GPS satellites can be determined by estimating the amount of time it takes for their signals to reach the receiver. When the receiver estimates the distance to at least four GPS satellites, it can calculate its position in three dimensions.

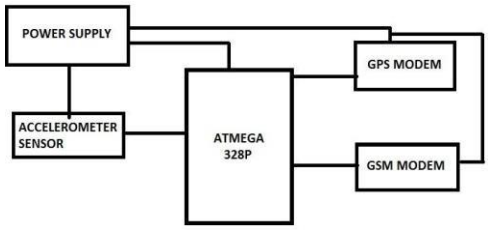

Fig. 1. Block diagram of smart accident detection and messaging system

The acceleration sensor measures changes in velocity. It can also be used to determine orientation. The acceleration sensor measures the device's acceleration vector in 3 axes relative to its body frame. Acceleration shift always exists due to gravity. We must compensate for the gravitational pull of the Earth to detect device movement by subtracting the gravity offset. If the device is at rest, or the device is falling and has reached terminal velocity, the sensor data reads 1g (the gravity offset).

III. PROGRAMMING FOR ATMEGA328P

The ATmega328 on the ATMEGA328p comes pre- burned with a boot loader that allows us to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files). The ATmega328P is a low-Power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture.

By executing Powerful instructions in a single clock cycle, theATmega328P achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize Power consumption versus processing speed. Therefore, we have chosen this microcontroller in this proposed real time model. Program code for Automatic detection of accident is written as follows.

PROGRAM CODE:

```
#include <SoftwareSerial.h> #include <TinyGPS.h>TinyGPSgps; SoftwareSerialss(2,
3);
intsens = A0; int led =13;intwled =11; void setup()
{
analogReference(DEFAULT); pinMode(sens,INPUT); pinMode(led,OUTPUT);
pinMode(wled,OUTPUT); Serial.begin(9600); ss.begin(9600);
}
void loop()
{
fir:

if((analogRead(sens)>550) || (analogRead(sens)<300))
{
digitalWrite(led, HIGH); for(int j=0;j<=10;j++)
{
digitalWrite(led, HIGH); delay(1000); if((analogRead(sens)<550) &&
(analogRead(sens)>300))
{
digitalWrite(led, LOW); goto fir;
}
}
if((analogRead(sens)>550) || (analogRead(sens)<300))
{
digitalWrite(wled, HIGH); sms0();digitalWrite(wled, LOW);
}
}
}
void sms0()
{
String bike_no = String("PY 01 MK 4554\n");
```

```
String all = String(String (bike_no) + "Position:\nlat- " +"\nlong-");
delay(1000); Serial.println("AT+CMGF=1"); delay(200);
Serial.println("AT+CMGS=\"9600916194\""); //Number to which we want to send the
sms delay(500); Serial.print(all); //The text of the message to be sent delay(500);
Serial.write(0x1A); delay(1000);

}
voidsms()
{
boolnewData = false; unsigned long chars;unsigned short sentences, failed;
for (unsigned long start = millis(); millis() - start < 1000;)
{
while (ss.available())
{
char c = ss.read();


if (gps.encode(c)) // Did a new valid sentence come innewData = true;
}
}
if (newData)
{
float flat, flon; int year;
byte month, day, hour, minute, second, hundredths; unsignedlong age;
String bike_no = String("PY 01 MK 4554\n");gps.f_get_position(&flat, &flon,
&age);
String pos = String("Position:\nlat-" + String(flat,DEC) + "\nlong-" +
String(flon,DEC)); gps.crack_datetime(&year, &month, &day, &hour, &minute,
&second, &hundredths,&age);
String date = String("\nDate - " + String(day) + "/" + String(month) + "/" + String(year));
String time = String("\nTime - " + String(hour) + ":" + String(minute) + ":"
+ String(second));
String all = String(String(bike_no) + String(pos) +String(date) + String(time));
delay(1000); Serial.println("AT+CMGF=1");

delay(200);
Serial.println("AT+CMGS=\"9600916194\""); //Number to which we want to send
the sms delay(500); Serial.print(all); //The text of the message to be sent
delay(500);
```

```
Serial.write(0x1A); delay(1000);
}
}
```

The program code for the ATMEGA328pMicrocontroller for the accident sensing, detection and messaging has been coded. Therefore, the sensor values range from 300 to 550 units, between these ranges, the accelerometer sensor senses the value then the microcontroller sends the signal to the GPS and GSM modem will be activated. Then a message will be sent to the mobile number provided in the program coded in the ATMEGA328p microcontroller. Then the message will be received by the rescue team and the safety measures. Typically receivers provide two different formats.

1. NMEA (Nation Marine Electronics Association)
ASCII Format (American Standard Code for Information Interchange) defines a set of standard messages.

2. Proprietary Format, Typically Binary, No limit on, information transmitted, Receiver output is related to position, velocity and time. The output pattern is displayed asfollows.

Position:
Latitude: degrees: minutes: seconds Longitude: degrees:minutes: seconds Altitude (m)

Velocity:
Speed knots Heading degrees

Time (UTC):
Date dd/mm/yy Time hh/mm/ss.sss
GPS receiver gives the latitude, longitude, date, time, speed of the satellite, no of satellites on view etc…

IV. CASE STUDY RESULTS AND DISCUSSION

We have developed real time working model. Fig.2. shows the output of the proposed model for the accident detection and messaging system

Fig. 2. The sample output messaging of the proposed model

Fig. 3 shows the real time project model. It is practically tested in the two wheeler. It comprises of accelerometer sensor, GPS and GSM modem which is fitted in the toolkit box of the vehicle and the accelerometer sensor is fitted on the handle bar of the vehicle.

Fig. 3. Real time Project kit developed

Fig. 4 shows the output message of the proposed model.When the accident occurs, the accelerometer senses the vehicle‘s position and sends the signal to a microcontroller. When the GPS modem is locked the above shown message will be sent to the

subscriber with the registration number, date and time, latitude and longitude values of the location. The values can easily find the accident location using Google earth or Google maps.

The acceleration sensor outputs 4 values: the 3 Cartesian axis values and a timestamp. The acceleration sensor measures and returns axes values in "g" (gravity). When a device is accelerated in the ±X, ±Y, or ±Z direction, the corresponding output increases (+) or decreases (-).User- driven acceleration shows acceleration output in the same direction as the user-driven force. It is detected when the device is moving dynamically.This mode is used to detect or analyze the user's motion profile.We must compensate for theshift in gravity to extract user acceleration.

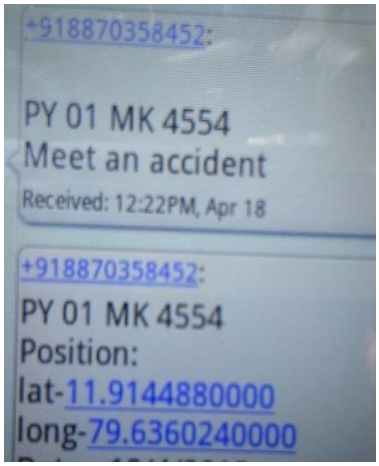

Fig. 4. Output message of the proposed model

Gravity **s**hows acceleration output in the opposite direction of the gravity. It is detected when the device is at rest or moving slowly. This mode is applicable with the game control using tilting motion. Table I provides accelerations generated by user-driven force and gravity that are sensed in opposite directions

TABLE. I. ACCELERATIONS GENERATED BY USER-DRIVEN FORCE AND GRAVITY ARE SENSED IN OPPOSITE DIRECTIONS.

Measurement	**Type**	**Range**	**Unit**
Timestamp	Long	-	Milliseconds
X	Flo	Min	G

	at	Value=-2g Max Value=2g	
Y	Flo at	Min Value=-2g Max Value=2g	G
Z	Flo at	Min Value=-2g Max Value=2g	G

The tested values and its details of the accelerometer sensorhave been shown in the Table II. As there is a scope for

improvement and as a future implementation we can add a wireless webcam for capturing the images which will help in providing driver`s assistance.

TABLE. II. TESTED VALUES AND IT DETAILS OF THE ACCELEROMETER SENSOR

Position	**Axis**	**Voltage(V)**
Stable	X	1.427
	Y	1.54
	Z	2.18
Towards X	X	1.05
	Y	1.66
	Z	2.07
Towards Y	X	1.57
	Y	1.21
	Z	2.06
Towards Z	X	1.40
	Y	1.15
	Z	1.50

v. CONCLUSION

A working model of Automatic vehicle accident detection and messaging system using a GPS and GSM modems has been implemented successfully. This proposed work sends the position of the vehicle in terms of latitude and longitude when there is any accident happened. It doesn_t tell the exact nature of the accident, whether it is severe or just a mild one. With the help of an accelerometer sensor, we can tell the exact position of the vehicle. We can predict whether the vehicle is in normal position or upside down. The advantage is given as follows: The biggest advantage of our paper is, whenever the sensor is activated we will be immediately getting the acknowledgement from the GSM modem to our mobile numbers which are stored in EEPROM, without any delay. This proposed model locates the accident spot effectively.

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