Accident Detection & Rescue System Using IoT

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***Abstract*— Infrastructure and technological advancements have made life simpler for people, resulting in huge demand for autos. This leads to an increase in road accidents. An accident is an unpredicted and unintentional event, and it can also occur due to the carelessness of the drivers. In this project will offer the best solution for this problem. Once a car is involved in an accident, the MPU-6050 sensor receives the message and communicates to the micro controller unit, according to this project. The NODEMCU ESP-8266 transmits an alarm message to the police control center, the rescue crew, and the family via GSM MODEM. After obtaining the information, the police may quickly trace the position using the GPS module. Then later conforming to the position necessary action will be taken. All data from the devices are sent to cloud platforms available for example ThingSpeak IoT using an internet connection connected to the Wi-Fi model, by this each vehicle's data will be easily available for family, police, and hospitals.**

***Keywords*— *IoT(Internet of Things); GPS(Global Positioning System); GSM(Global System for Mobile); IDE(Integrated Development Environment)*.**

I. INTRODUCTION

Nowadays, with the world's population continually rising, finding someone or anything is getting more difficult. The growing demand for autos, on the other side, has aggravated traffic hazards and road coincidences. Public,s be alive are at grave danger [1]. Road accidents account for the majority of accident fatalities worldwide.

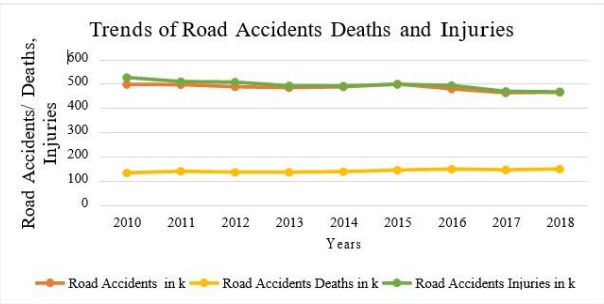

Fig.1. Road Accidents Deaths and Injuries year to year data

India has the world's highest mortality rate. Speeding, not getting enough sleep, and drinking and driving were all factors in collision. Between 2000 and 2015, there was a 50 percent rise in the number of unintentional deaths, compared to 2000. According to the Planning Commission of India, the growing number of traffic deaths costs India 2.5 percent of its GDP each year. "Delay in rescue" is the leading cause of accident fatalities. The issue is that determining whether or not an accident has occurred and locating the location where it occurred is challenging. Another key factor is ineffective medical assistance. According to a study, every minute that an injured crash victim does not receive immediate medical treatment might result in death. The majority of victims die as a result of such circumstances. As a result, the concept of saving lives through solving the problem emerges. In this project, develop an autonomous automobile accident detection system. This system can identify automobile accidents in a much shorter time, and it will send a collision alert signal to the built cellphone digit (saving squad, household participants, and so on...), which can assist in protecting important life [8]. These consist of an MPU- 6050 module that detects sudden angle changes that might indicate an accident. The signal is sent using the GSM system, and the accident position can find using the GPS module. Vehicle tracking is possible in any weather condition [9]. This technology is designed to provide the best solution to bad emergency services for traffic accidents in the most efficient manner possible.

II. PROPOSED METHOD

When accidents occur, no one would get know what happened and where it happened. Thus, resulting in a huge loss of life. Air bags and Automatic Breaking System (ABS) safety are available in vehicles but having all these safety systems also there is a chance of getting hurt and person's dies by delay and none gets to know the accident locations.

To overcome all such problem Accidental detection and rescue system has following proposed solutions:

1. Detects and reports the accidents that occurs in vehicles through sending message to family and also send data to cloud using IoT.

2. The GPS module in this system assists in locating and analysing the latitude and longitudinal coordinates of the accident site.

III. METHODOLOGY

The system alerts authoritative individual when an accident takes place. The most recent execution methods focus on delivering assistance to the driver even if he is confined in a faraway area and unable to reply.

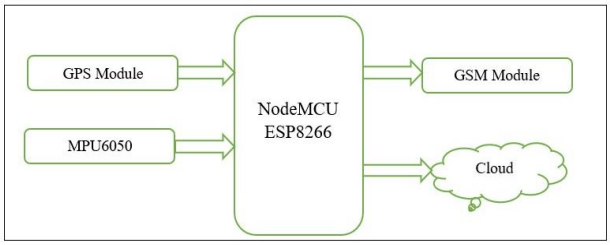

Fig.2. Block Diagram

It monitors the vehicle to gather information regarding the distance between two vehicles. The function of ultrasonic sensors is to measure the distance. This measurement gets updated each second. The system has some parts that have to be installed in a car properly. We can track the value in ThingSpeak. Accelerometer is used to sense crash or turning upside of the of the vehicle by comparing the angle of an automobile with sample values if the angle is not equal to sample value after some delay also angle is not equal to sample values it identifies accident occurred, the GPS module acquires the coordinates of the vehicle's location from the satellite; this data is in the shape of a latitude and longitude scale. Encoding is completed, and the data is sent to the GSM modem [9]. NodeMCU send's the signal to the GSM modem for sending accident message to preinstalled numbers in it gathers the location data by GPS receiver module and then sends the data to the cell phone in Text format SMS and also uploads data of longitude and latitude other information to cloud.

IV. HARDWARE REQUIREMENTS

A. NodeMCU-ESP8266

In the world of technology, the Internet of Things (IoT) has become a hot topic. It has altered how we work. ESP8266, a cute, microcontroller allows the bite-sized WiFi from Espressif Systems, can observe and regulate things from wherever in the globe, making it ideal for just about any IoT project.

In addition, there's 128 KB of RAM and 4MB of Flash memory (for programme and data storage). There is an 802.11b/g/n HT40 Wi-Fi transceiver in the ESP8266, permitting it to link to a WiFi network and cooperate with the Internet, moreover it produce its private network for additional devices to link to.

Specifications:

- Tensilica1Xtensa132-bit LX106
- 801to11601MHz Clock Frequency.
- 128kB1Internal1RAM
- 4MB1External Flash
- 802.11b/g/n1Wi-Fi1Transceiver
- Operating Voltage: 2.5V1to13.6V
- On-board 3.3V1600mA Regulator
- CP21021USB-to-UART Converter
- 4.5 Mbps1Communication1Speed

B. Neo – 6m GPS (Global Positioning System)

NEO-6M GPS detects location anywhere in the world. Although the measures less than the postage stamp, the Neo – 6m GP is called heart of the module. It is from u-blox. It has the capability to track about 22 satellites on fifty channels and can achieve the -161 dB tracking which is the highest level of the sensitivity to achieve. And all this is achieved by only the supply current of 45mA.

Its performance is dominating to other GPS modules because it has the capability to update 5 locations a1second with precession of 2.5m horizontal spot accuracy. The u-blox 6 locating engine also brag a Time- To-First-Fix (TTFF) and it is done under 1 second.

The vital data pins of NEO-6M GPS chip are came out to 0.1″ pitch headers. Over UART these pins mandatory for communication with the microcontroller. with default baud of 9600 this segment upholds baud rate from14800bps to1230400bps.

The NEO-6M GPS Unit specifies the condition of Position Fix by the blinking of an LED at numerous rates liable upon the condition which it is in and it is installed on the module.

- If it's not blinking specifies it's looking for satellites.
- If it's blinking then it means Position Fix is located (The unit can see sufficient satellites).

Working Principle of Neo – 6m GPS Module

The working of GPS receivers is literally like by calculating how faraway they are from a certain number of satellites. Their pre-programming enables them to recognize where they are located from GPS satellites are at any specified time.

The satellites communicate or inform about their position using the radio signals on the for the receivers on Earth by satellites. The receivers get informed about the satellite's location are identified by these signals.

The distance between each satellite is calculated by the receiver based on the time taken for the arrival of the signals. The GPS after acquiring the data about its position from 3 satellites and where their location is, then it can locate its module. This procedure is recognized as Trilateration.

Specifications:

- Type of Receiver: 508channels, GPS L1 (1575.42MHz)
- Position accuracy in horizontal: 2.5meter
- Update Rate in navigation: 1Hz(min) and 5Hz(max)
- Baud Rate in serial: 4800 – 230400 (default state 9600)
- Temperature operating range: -40℃ to 85℃
- Voltage operating range: 2.7V to 3.6V

- Current operating rate: 45mAmps
- Impedance TXS/XD: 510Ω
- Sensitivity navigation: -161dBm

C. MPU-6050 Sensor:

It is sensor module consist of 6- axis motion tracking. In that 3 axis Gyroscope and 3-axis is accelerometer and in small package have a digital motion processor and temperature sensor too. By the help of the 12C bus it can communicate to microcontroller and additional feature of the 12C bus it can communicate with sensors like 3-axis magnetometer and pressure sensor etc the auxiliary 12C bus is connected to the 3-axis magnetometer. The complete of axis motion is given by the MPU-6050 module.

3-Axis Accelerometer

The MPU-6050 consists of the advance technology like micro electro mechanical and 3-axis accelerometer. It helps to find out the angle while inclination at any angle like X Y Z axes.

a) The Acceleration deflects along the axes and the movable mass.
b) The unbalance in the distinctive capacitor slightly changes in device production. It is relative to the acceleration.
c) 16-bit ADC is accustomed convert analogue to digital output by the help of the width we calculate the distance from the object
d) Acceleration has full-scale range +/- 2g, +/-4g, +/-8g, +/-16g.
e) The 0g is measured on the X and Y axis by device placed on the flat surface +1g on Z axis

On chip temperature sensor

By using ADC output is digitalised. The readings are taken from temperature sensor it with be read from the data register

Working of MPU-6050

Accelerometer is working based on principle of piezoelectric effect after the sensor is filtered respectively the ball is moved in the direction of the gravitational force acts. The wall is made up of the piezoelectric elements, whenever the ball touches to the wall and the current is produced will be interrupted from the value of the 3D space.

Specifications:

- The 16-bit built-in ADC provides high accuracy
- It is used to interface with other IIC devices like magnetometer
- IIC Address is configurable.

F. SIM800L GSM Mini Module:

The SIM800L Module is a tiny cellular unit that transmits for GPRS transmission, receiving and sending SMS, and making and receiving voice calls. This unit's small footprint, little cost, and quad band frequency capability succeed an perfect alternative for long-range communication project. Later powering up, the unit automatically searches for a cellular network and logs in. On-board LEDs show the status of the connection.

- Blink in every 1sec: The GSM module1is working but it didn't connect to the cellular network yet.
- Blink in every 2sec: The GPRS (General Pocket Radio Service) data connection demanded is activated.
- Blink in every 3sec: The module has finished connection with the cellular network and can receive/send SMS and voice.

GSM Mini module have two antennas comprised:

1. The first antenna is constructed of wire that solders directly to the NET pin on the PCB - especially critical in tight spaces.
2. Attach a pigtail cable with an IPX connection to the second PCB antenna with double sided tape. This one has the best performance and allows to put module inside a metal casing as long as the antenna is outside.

Specifications:

- Voltage supply:13.8V – 4.2V
- Suitable voltage supply:14V
- Consumption of power:
  - Sleep state < 2.0mA
  - Idle state < 7.0mA
  - Average transmission of GSM: 350mA
  - Peek transmission of GSM:12000mA
- Frequencies supported: Quad Band1850/950/180/1900 MHz
- Antenna connector: Internetwork Packet Exchange
- Signaling status: LED
- Temperature working range: -40℃ to +85 ℃

V. SOFTWARE BASED REQUIREMENTS

A. Arduino IDE

The Arduino IDE is a Java-based cross-system tool that works on Windows, Mac OS X, and Linux. It's used to programme and upload Arduino sketches. To provide the languages C and C++, the Arduino IDE offers determined code structure rules. The interconnected project, which is a software library that supports a large variety of common inputs and output procedures, is included with the Arduino IDE. User-written code is constructed and connected into a practicable cyclic executive programme with the GNU tool connection, which is also comprised with the IDE version, using only two easy functions to start the drawing and the main programme loop. A source editor for writing code, a message zone, a source terminal, a toolbar includes keys for basic function, and a sequence of1menus are entirely involved in the Arduino Software (IDE). It can communicate with Arduino and Genuino devices by linking to them and uploading code. Drawings are developed in conjunction through the Arduino Software (IDE). These drawings were made in a source editor and saved as '. ino' files. Also, cutting and pasting. The editor includes features such as text searching and replacement. Whereas storing and

transferring, the message segment shows faults and it provides feedback.

B. ThingSpeak IoT

IoT is a connecting multiple physical entities over internet, making the system interactive is known as IoT [11].

ThingSpeak is a cloud-based IoT analytics system for collecting, virtualizing, and analysing live data streams. We can see the real-time data given to ThingSpeak by your devices using ThingSpeak. It can execute MATLAB code in ThingSpeak, and the data may be analysed and handled as it arrives in actual time. ThingSpeak is commonly helpful for IoT system prototypes and proofs of idea that need analytics.

At any high level, lot of IoT systems can be explained by using the diagram below [12]:

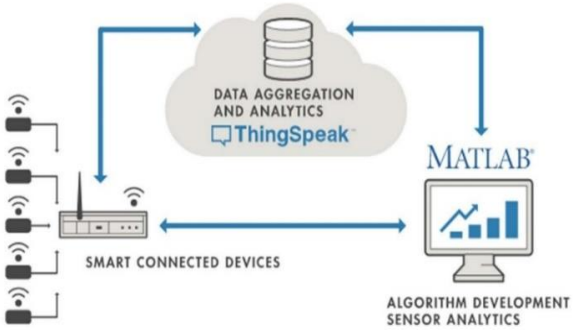

Fig.3. Data Flow Diagram of ThingSpeak

On leftward are the smart devices that reside at the network's edge are shown. Some of the examples of data collection devices are wearable gadgets, wireless temperature detctor, heart rate monitors, hydraulic pressure detector, and factory floor.

In the middle the cloud is situated, bringing data from various sources together which being analysed it in real time, generally for this purpose using an IoT analytics platform created.

On the right side of1the diagram the creation of algorithms for the IoT application is depicted. an engineer or data scientist by performing historical analysis on the data, attempts to acquire understanding into the data which is collected. The data is brought to a desktop software environment from the IoT platform in in this scenario, the algorithms are prototyped by the engineer or scientist to that could be work in the smart device or on the cloud itself.

All of them are part of an1IoT system. ThingSpeak is stored in the cloud server of the graphical representation, and it offers a platform for gathering and analyzing data from internet-connected microprocessor unit quickly.

VI. RESULT

If Accident occurred the acceleration of sensor changes according to vehicle position, it is detected by MPU-6050 Sensor and sends GPS Coordinates through GSM module to previously fed numbers and gives alert message to the respective authorities like hospitals, police and then family, friends whose numbers are previously fed. All the information about the occurred accident will be stored and be available at IoT from which police can access the information

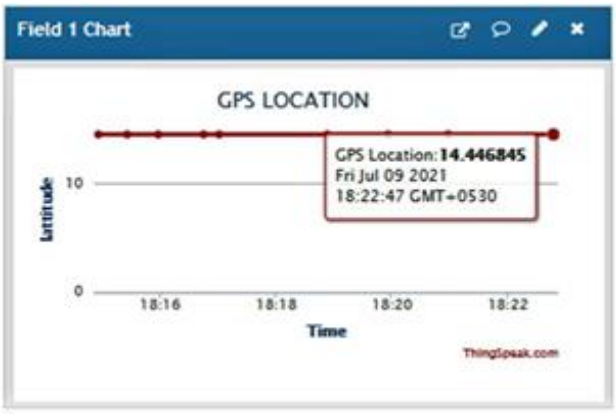

Fig.5. Latitude of Location.

Fig.6. Longitude of Location.

VII. CONCLUSION

This device main intention is to save human life and alert for crashing vehicle, also gives pre safety alert of fire or smoke occurs in vehicle. Alert message sent by device is helpful for hospitals to track accident location and also family can know about their safety. In this project we using IOT to know the safety of person in vehicle data of vehicle position. In future using software creating server to store all the hospitals, blood banks and police station locations and other information, by this we can easily locate nearest hospital.

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