



e-ISSN: 2319-8753 | p-ISSN: 2320-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 3, March 2021

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.512



IoT Based Automatic Rescue System for Tracking Road Accident Using MEMS Sensor and Ultrasonic Sensor.

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ABSTRACT: As cities across the world grow and the mobility of populations increases, there has also been a corresponding increase in the number of vehicles on roads, which leads to the accidents and so many hazards. People's lives are under high risk. This situation prevails, just because there is a lack of emergency facilities in our country. By proposing an efficient system for solving this issue will reduce the loss of lives as much as possible. In our theory, the design of the system help us to detect accidents insignificantly less time and transfer the fundamental information to the application within a few seconds covering the geographical coordinates, where the vehicle had met with an accident. An alert message is sent to the rescue team using GSM and GPS with help of MEMS sensor and ultrasonic sensor.

KEYWORDS: MEMS – Micro-Electro-Mechanical System, GSM – Global System For Mobile Communication, GPS – Global Positioning System.

I. INTRODUCTION

Over the past few year IoT has become one of the most important technologies of the 21st century. IoT facilitates to communicate from a system or any other devices over the internet via software and any other technologies or with embedded sensors. In today's world road and transport has become an integral part of every human being. The present transport system has minimized the distances but it has on the other hand increased the life risk. In a critical situation many vehicles faces accident, due to this lot of person lost their lives. Some people can save their lives at that time, but because of lack of information, time and place it may not be possible. Hence it is essential to have an IMMEDIATE RESCUE SYSTEM to the people.

If an accident is detected, the IoT based application automatically passes information to the rescue team. For this purpose it uses MEMS sensor and ultrasonic sensor. MEMS device consist of mechanical microstructures, micro sensors, micro actuators and micro electronics, all integrated on to the same silicon chip. Micro sensors detect changes in the systems environment by measuring mechanical, thermal, magnetic, chemical or electromagnetic information of phenomena. Microelectronics processes this information and signals the micro actuators to react and create some form of changes to the environment.

The GPS and GSM are connected to this system. The communication for the GPS and GSM can be done through serial communication. The serial communication creates an interface through which it covert CMOS to TTL logic. The GPS is used to locate the position (longitude and latitude) of the vehicle. The GSM in the black box can sent a message to the ambulance section and GSM of the family member. The message includes the location, time and other details regarding the accident. This message helps the ambulance section to rescue the patient from the accident spot to the hospital.

II. RELATED WORK

MEMS SENSOR:

MEMS are microscopic integrated devices that are a combination of electronics, electrical and mechanical elements, all working together for a single functional requirement using a technology called Microsystems Technology (MST).The MEMS technology is considered to be an extended form of traditional integrated circuit (IC) manufacturing [1]. A Sensor is a device that contains basic sensing elements which sense the physical quantity like temperature or humidity and convert it into an electrical signal. A sensor also consists of a signal processing unit like an amplifier, filter or ADC

or a combination of these elements. If a Sensor is designed and manufactured using the MEMS Technology [2], then it is called a Micro machined Micro sensor or simply a MEMS Sensor. MEMS devices generally overlap several domains or do not even belong in any one category. These energy domains include:

- Mechanical - force, pressure, velocity, acceleration, position
- Thermal - temperature, entropy, heat, heat flow
- Chemical - concentration, composition, reaction rate
- Radiant - electromagnetic wave intensity, phase, wavelength, polarization reflectance, refractive index, transmittance
- Magnetic - field intensity, flux density, magnetic moment, permeability
- Electrical - voltage, current, charge, resistance, capacitance, polarization

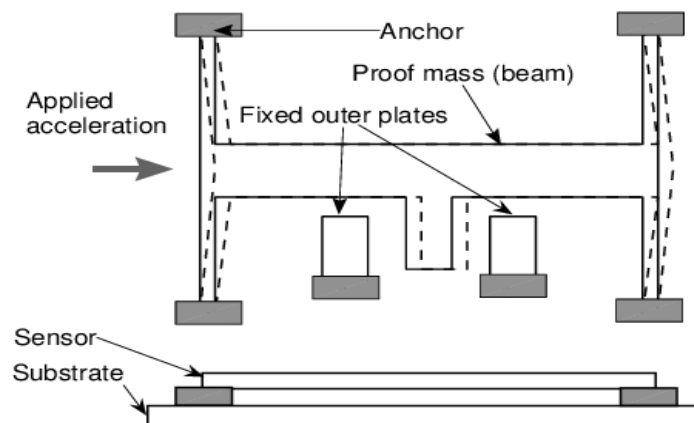


Fig 1: Internal Architecture of MEMS Sensor [1]

GSM

GSM stands for Global System for Mobile Communication. It is a digital cellular technology used for transmitting mobile voice and data services. GSM is the most widely accepted standard in telecommunications and it is implemented globally. GSM operates on the mobile communication bands 900 MHz and 1800 MHz in most parts of the world [3].

The features of GSM that account for its popularity and wide acceptance.

- Improved spectrum efficiency
- International roaming
- Low-cost mobile sets and base stations (BSs)
- High-quality speech
- Compatibility with Integrated Services Digital Network (ISDN) and other telephone company services.

A GSM network comprises of many functional units.

- The Mobile Station (MS)



- The Base Station Subsystem(BSS)
- The Network Switching Subsystem(NSS)
- The Operation Support Subsystem(OSS)

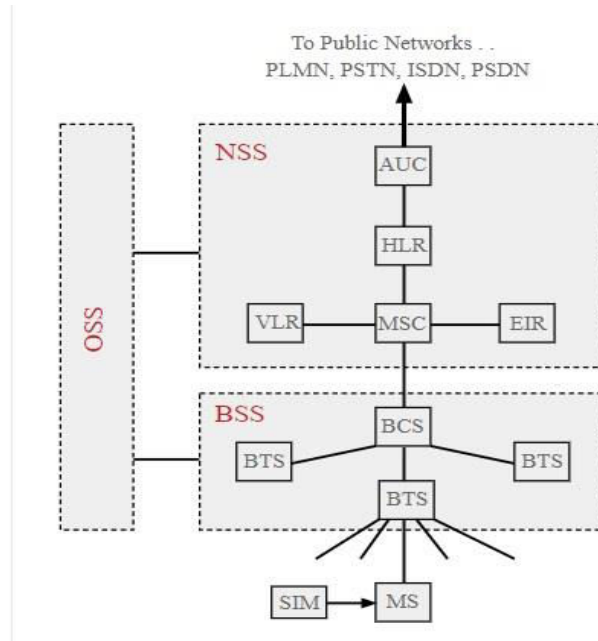


Fig 2: Simplified GSM Network Architecture Diagram [3]

GPS Device

GPS Tracking refers to a Global Positioning System. It entails a network of 24 satellites in orbit and devices on the ground that can establish a person or object's location on Earth with astonishing precision. GPS Tracking tracks three separate data sets: positioning, navigation, and timing. GPS has become an integral part of a vehicle system which provides speed, time, direction etc besides the navigation data. GPS works through a technique called trilateration. Used to calculate location, velocity and elevation, trilateration collects signals from satellites to output location information [3][4].

Speed is one of the primary attributes of vehicle accident. Many lives could have been saved if emergency service could receive accident information timely.

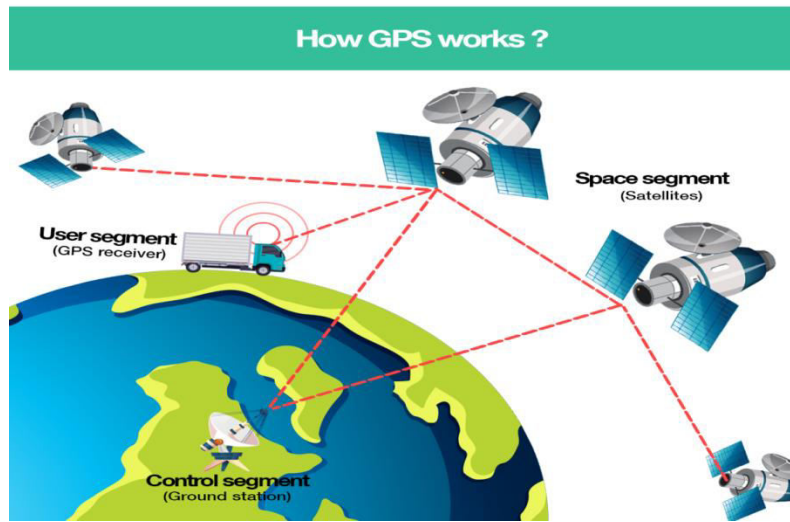


Fig 3: Architecture of GPS [4]

III. METHODOLOGY

The application includes many phases such as registration, monitoring accidents and alert messages to rescue team and family members. When a vehicle met with an accident, at that time a vibration occurs on the chip connected to that vehicle .That will detect by MEMS sensor. The MEMS sensor composed of a suspended mass between a pair of capacitive plates. When vibration occurs the suspended mass creates a difference in electric potential which is measured as a change in capacitance [5][6].

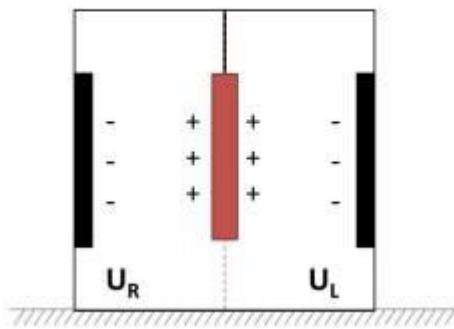


Fig 4: Suspended mass between a pair of capacitive plates

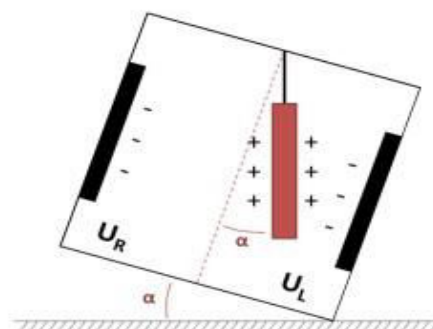


Fig 5: Suspended mass creates a difference

That signal is then amplified to produce a stable output signal in digital form then it send to Micro controller. The GSM and GPS system connected to the microcontroller to become active. The GPS module collect the current position co-ordinates values which contains longitude [N or S], latitude [E or W],time and date. After that the microcontroller sends the alert message to family member and rescue team through GSM modem which contains GPS parameter values.



IV. EXPERIMENTAL RESULTS

The flowchart explains about the IoT based rescue system application. The application starts when an accident is met. At that time MEMS sensor connected to the vehicle will vibrates and passes information to the rescue team through the GSM and GPS.

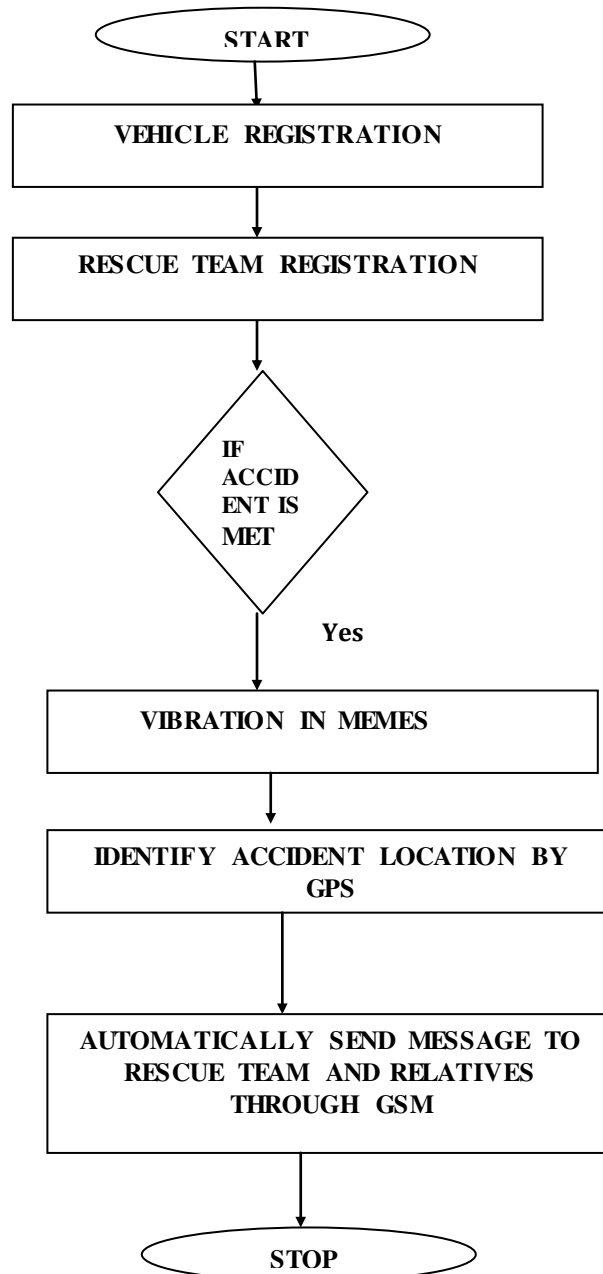


Fig 6: Flow chart of Rescue System

V. CONCLUSION

The IoT based rescue system provides immediate medical care at accident location and victim can get treatment as fast as possible. If an accident is detected, It facilitates an automatic connectivity to the rescue team through this application using MEMS, GPS and GSM technology. The nearby rescue team can receive the information about accident location.



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