

Mini Project 2A Report

On

**Vehicle Tracking and Accident Alert System using MSP430 Launchpad
and GPS Module**

By

Sahil Malvi TU2F1920037

Anwesh Biswas TU2F1920039

Esha Sangelkar TU2F1920053

Raj Ubale TU2F1920057

Under Guidance of

Prof. -Ravindra Shelkikar



Department of Electronics & Telecommunication Engineering

Terna Engineering College

Plot No. 12, Sector No. 22, Nerul, Navi Mumbai-400706

Affiliated to UNIVERSITY OF MUMBAI

2020-21

CERTIFICATE

This is to certify that the Mini Project stage 2A entitled "**Vehicle Tracking and Accident Alert System using MSP430 Launchpad and GPS Module**" is a bonafide work of

Sahil Malvi TU2F1920037

Anwesh Biswas TU2F1920039

Esha Sangelkar TU2F1920053

Raj Ubale TU2F1920057

Supervisor

(_____)

Mini Project Co-ordinator
(Mr. Vijaypal Yadav)

Head of Department
(Dr. Jyothi Digge)

Principal
(Dr. L. K.Ragha)

Project Report Approval

This is to certify that the Mini Project stage 2A entitled "**Vehicle Tracking and Accident Alert System using MSP430 Launchpad and GPS Module**" is a bonafide work done by Mr. SAHIL MALVI , Mr. ANWESH BISWAS, Ms. ESHA SANGELKAR and Mr. RAJ UBALE under the supervision of Prof Ravindra Shelkikar.

Examiners:

1.....
.....
.....
2.....
.....
.....

Supervisors:

1.....
.....

Principal:

.....
.....

Date: . . . / . . . /

Place:

Declaration

I declare that this written submission represents my ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Sahil Malvi TU2F1920037 _____

Anwesh Biswas TU2F1920039 _____

Esha Sangelkar TU2F1920053 _____

Raj Ubale TU2F1920057 _____

Date:

ABSTRACT

The rapid growth of technology and infrastructure has made our lives easier. The advent of technology has also increased the traffic hazards and the road accidents take place frequently, which causes huge loss of life and property because of the poor emergency facilities. Even with so many modern devices present in the field of vehicle design, road lane design and heavy traffic control accidents do occur at a large scale. Accidents threaten human lives more and mainly road accidents are common today. During an accident many people lose their life because medical services and family members do not get accidental information on time. Any kind of accident detected is automatically sent as an alert to the required destination. The main cause for accidents is high speed, drunk and drive, diverting minds, over stress and due to electronic gadgets. This deals with an accident detection system that occurs due to carelessness of the person who is driving the vehicle. This introduces an accident alerting system which alerts the person who is driving the vehicle. If the person is not in a position to control the vehicle then the accident occurs. Once the accident occurs to the vehicle this system will send information to the registered mobile number. Accident detection device installed in a vehicle when met with an accident will send SMS/ messages to the pre-install numbers of the drivers family members, police station, ambulance and nearest hospital. This embedded system is useful for tracking and retrieving the exact position of any vehicle, which has met with an accident by using Global Positioning System (GPS) and sensors.

CONTENTS

ABSTRACT	1
LIST OF FIGURES	2
1] INTRODUCTION	4-10
1.1 Exploring MSP430	5
1.1.1 MSP 430 Features	6
1.1.2 MSP 430 Pin Configuration	7
2] REQUIREMENTS	11-20
2.1 Hardware Components	11
2.2 Software Application	17
2.3 Diagram / Layout	18
2.3.0 Block Diagram	18
2.3.1 Circuit Diagram	19
2.4 Output/Results	20
3] PROBLEM STATEMENT	21
4] METHODOLOGY	22
5] LITERATURE REVIEW	24
6] CONCLUSION	26
7] FUTURE SCOPE	28
8] REFERENCES	29

LIST OF FIGURES

Fig 1.1.2 MSP430 PIN CONFIGURATION	7
Fig 2.1.1 MSP430 LAUNCHPAD	11
Fig 2.1.2 SIM 900 GSM MODULE	12
Fig 2.1.3 UBLOX NEO -6M GPS MODULE	13
Fig 2.1.4 VIBRATION SENSOR MODULE	14
Fig 2.1.5 POWER SUPPLY	15
Fig 2.1.6 MALE TO FEMALE JUMPER WIRES	15
Fig 2.1.7 LED	16
Fig 2.1.8 BREADBOARD	16
Fig 2.2.0 BLOCK DIAGRAM	18
Fig 2.2.1 CIRCUIT DIAGRAM	19
Fig 2.3.2 OUTPUT / RESULT	20

1. INTRODUCTION

Vehicle tracking systems and Accident alert system's main aim is to rescue people in accidents. This is to improve security systems for vehicles. The latest like GPS are highly useful nowadays, this system enables the owner to observe and track his vehicle and find out vehicle movement and its past activities of vehicle. This new technology, popularly called vehicle Tracking Systems which created many wonders in the security of the vehicle. This hardware is fitted onto the vehicle in such a manner that it is not visible to anyone who is inside or outside of the vehicle. Thus it is used as a covert unit which continuously or by any interruption to the system, sends the location data to the monitoring unit. When the vehicle is stolen, the location data from the tracking system can be used to find the location and can be informed to police for further action. Some Vehicle tracking Systems can even detect unauthorized movements of the vehicle and then alert the owner. This gives an edge over other pieces of technology for the same purpose. This accident alert system in it detects the accident and the location of the accident occurred and sends GPS coordinates to the specified mobile, computer etc.

1.1. EXPLORING MSP430:-

The MSP430 16-bit microcontroller platform of ultra-low power RISC mixed-signal microprocessors from Texas Instruments provides the ultimate solution for a wide range of low power and portable applications. TI provides robust design support for the MSP430 16-bit MCU, including technical documents, training, tools, and software.

MSP430 is a hardware development tool for the MSP430 Value Line series of microcontrollers and is popular among hobbyists for its low cost and features. It is an easy way to start developing on the MSP430 MCUs, with on-board emulation for programming and debugging as well as buttons and LEDs for a simple user interface.

MSP430 is a development board which can be used to design all Arduino based applications since both have similar capabilities and features. Similar to Arduino being developed on AVR controllers, the MSP430 launchpad is developed on TI MSP430 microcontrollers. This device can be used to develop low-end applications and not high-end applications, as it does not have high processing power like Raspberry pi.

The most common MSP430 micros are the

- MSP430FR series,
- MSP430F series,
- MSP430G series and the
- newly introduced MSP432 series

1.1.1 MSP430 FEATURES:-

- Dip socket for easy plug-in or removal of microcontroller
- Energy trace technology available for ultra-low-power debugging
- One button and two LEDs for user interaction
- USB debugging and programming interface featuring a driverless installation
- Available UART serial communication with up to 9600 Baud
- Supports MSP430G2xx2, MSP430G2xx3, and MSP430F20xx devices in PDIP14 or PDIP20 packages
- Hardware reset button available on board
- Operating voltage range: 5V

Applications:-

- TI microcontroller learning tool
- Prototyping
- Robotics
- Planes and Drones
- Building automation
- Access control and security
- Security systems and electronic locks
- Electronic and Electrical measuring instruments
- Health monitoring devices

1.1.2 MSP430 PIN CONFIGURATION

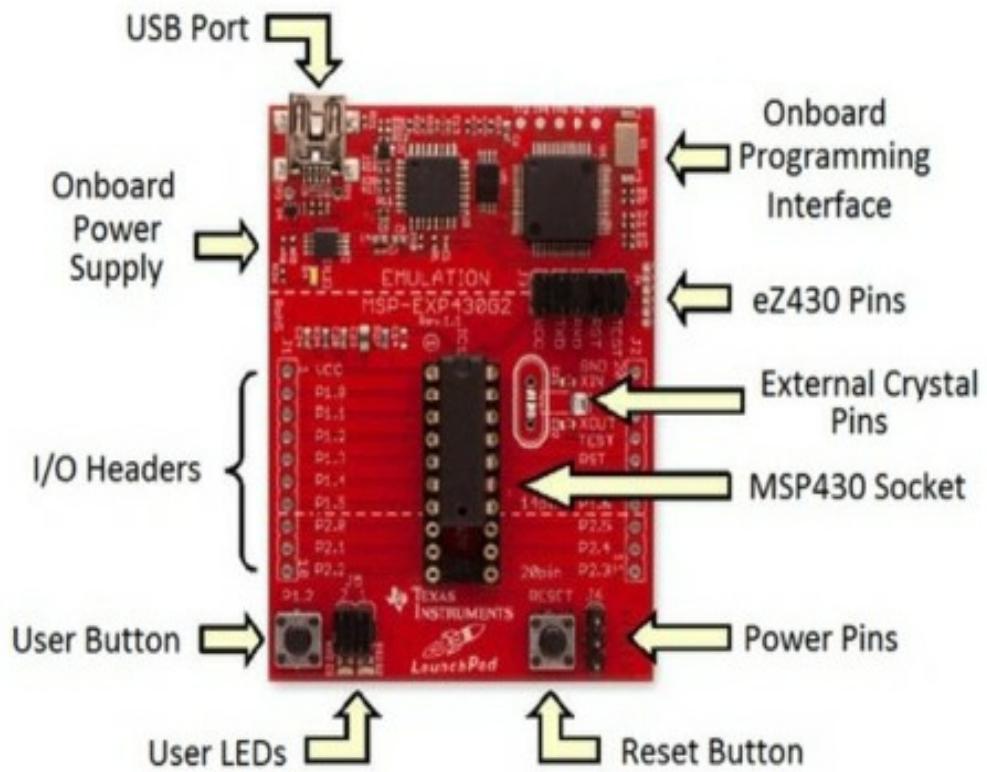


Fig 1.1.2: MSP430 Pin Configuration

MSP430 Pin Configuration:-

There are twenty main pinouts of MSP430, which are described below.

Pin#	Type	Parameters
		It is general-purpose digital I/O pin/Timer_A, clock signal
Pin#13	P1.0/TACLK	TACLK input. It is general-purpose digital I/O pin/Timer_A, Capture: CCI0A input, Compare: Out0
Pin#14	P1.1/TA0	output. It is general-purpose digital I/O pin/Timer_A, Capture: CCI1A input, Compare: Out1 output.
Pin#15	P1.2/TA1	It is general-purpose digital I/O pin/Timer_A, Capture: CCI2A input, Compare: Out2 output.
Pin#16	P1.3/TA2	It is general-purpose digital I/O pin/SMCLK signal output/Test clock, an input terminal for device programming and testing.
Pin#17	P1.4/SMCLK/TCK	It is general-purpose digital I/O pin/Timer_A, Compare: Out0 output/test mode select, an input terminal for device programming and test.

Pin#18	P1.5/TA0/TMS	It is general-purpose digital I/O pin/Timer_A, Compare: Out1 output/test data input terminal.
Pin#19	P1.6/TA1/TDI	It is general-purpose digital I/O pin/Timer_A, Compare: Out2 output/test data output terminal or data input during programming.
Pin#20	P1.7/TA2/TDO/TDI	It is general-purpose digital I/O pin/ACLK output.
Pin#8	P2.0/ACLK	It is general-purpose digital I/O pin/Timer_A, a clock signal at INCLK.
Pin#9	P2.1/INCLK	It is general-purpose digital I/O pin/Timer_A, Capture: CCI0B input, Compare: Out0 output.
Pin#10	P2.2/TA0	It is general-purpose digital I/O pin/Timer_A, Capture: CCI1B input, Compare: Out1 output.
Pin#11	P2.3/TA1	

		It is general-purpose digital I/O pin/Timer_A, Compare Out2 output.
Pin#12	P2.4/TA2	
		It is general-purpose digital I/O pin/Input for an external resistor that defines the DCO nominal frequency.
Pin#3	P2.5/ROSC	
Pin#7	RST/NMI	It is Reset or non-maskable interrupt input. It is selected test mode for JTAG pins on
		Port1/programming voltage input during EPROM programming.
Pin#1	TEST/VPP	
Pin#2	VCC	It is a Supply voltage.
Pin#4	VSS	It is Ground reference.
		It is an Input terminal of the crystal oscillator.
Pin#6	XIN	
Pin#5	XOUT/TCLK	The output terminal of a crystal oscillator or test clock input.

2. REQUIREMENTS

2.1 HARDWARE COMPONENTS:-

(i) MSP430 Launchpad:-

MSP430 is an easy-to-use flash programming microcontroller, just like other microcontrollers such as the ATmega range from Atmel. The MSP430 MCU was specifically designed to be low-cost and low-powered, suitable for a range of applications..The MSP430 does not feature an external memory bus, hence it is limited to the on-chip memory up to 512KB flash depending on board variation.

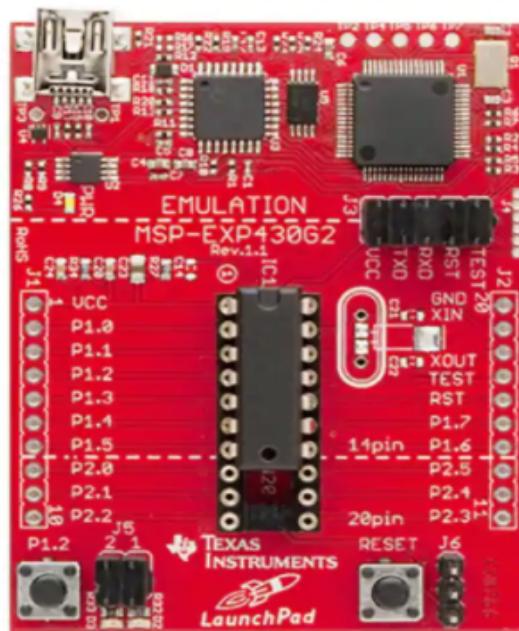


Fig 2.1.1 MSP430 Launchpad

(ii) SIM900 GSM Module:-

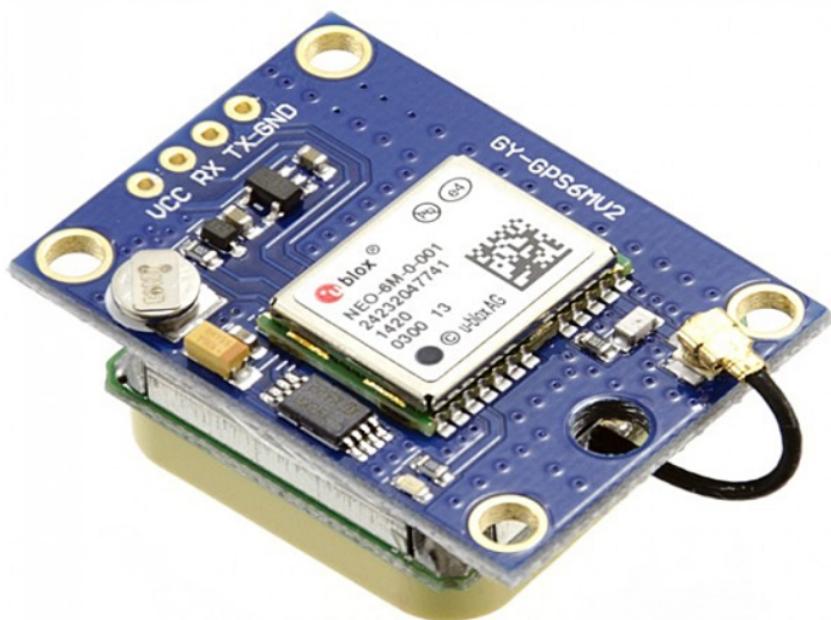
The SIM900 is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM900 can fit almost all the space requirements in your M2M application, especially for slim and compact demand of design.



Fig 2.1.2 SIM900 GSM Module

(iii) Ublox NEO-6M GPS Module:-

The U-blox NEO-6M global positioning system (GPS) module, a very popular, cost-effective, high-performance GPS module with a ceramic patch antenna, an on-board memory chip, and a backup battery that can be conveniently integrated with a broad range of microcontrollers.



**Fig 2.1.3 Ublox NEO-6M
GPS Module**

(iv) Vibration sensor module:-

Vibration sensor module which detects vibrations or sudden modulations. Vibration sensor module gives a digital output HIGH/LOW logic depending on the module. In our case, we have used an active HIGH logic vibration sensor module. It means whenever the vibration sensor will detect vibration it will give HIGH logic to the microcontroller.



Fig 2.1.4 Vibration sensor module

(v) Power Supply:-

Use this power regulation module to provide 5V and 3V3 power supply to your breadboard based project. This power supply board is designed to plug into a Breadboard panel with 2 power Distribution strips. The module can be powered by a USB port or an external power supply 7-12V. The module has two independent power lines, which can be set to output voltage of 5V or 3.3V, or completely remove power from the line. The module has an ON / OFF switch to turn on and off the module. It comes with reverse polarity and short circuit protections, which greatly helps during building and testing circuits on the breadboard. Here we have used 3.3V for MSP430 Launchpad, 5V for GPS Module and 12V for GSM Module board.



Fig 2.1.5 Power Supply

(vi) Connecting Wires:-

Jumper wires typically come in three versions: male-to-male, male-to-female and female-to-female. The difference between each is in the end point of the wire. Male ends have a pin protruding and can plug into things, while female ends do not and are used to plug things into.



Fig 2.1.6 Male To Female Jumper Wires

(vii)LED:-

Light emitting diode a device that produces a light on electrical and electronic equipment



Fig 2.1.7 LED

(viii) BREADBOARD:-

A breadboard, or protoboard, is a construction base for prototyping electronics. In the 1970s the solderless breadboard (a.k.a. plugboard, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these.

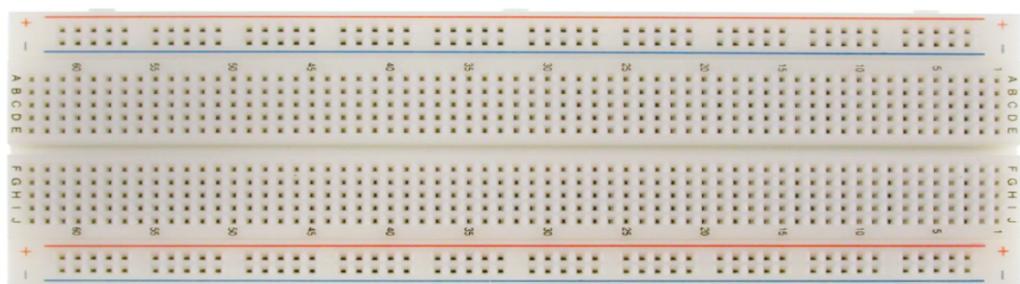


Fig 2.1.8 Breadboard

2.1 SOFTWARE APPLICATION

(i) ENERGIA:-

Energia is an open-source electronics prototyping platform started by Robert Wessels in January of 2012 with the goal to bring the Wiring and Arduino framework to the Texas Instruments MSP430 based LaunchPad. The Energia IDE is cross platform and supported on Mac OS, Windows, and Linux. Energia uses the mspgcc compiler by Peter Bigot and is based on the Wiring and Arduino framework. Energia includes an integrated development environment (IDE) that has it's foundation in the Processing IDE(Processing→Wiring→Arduino→Energia). Energia is also a portable framework/abstraction layer that can be used in other popular IDEs. Utilize a web browser based environment with Texas Instruments CCS Cloud at dev.ti.com or TI's powerful CCS Desktop IDE.

2.3 DIAGRAM/ LAYOUT

2.3.0 BLOCK DIAGRAM

This is the block diagram of vehicle tracking and accident alert system. This shows the overall view of the vehicle tracking and accident alert system circuit. The blocks connected here are MSP430, LED , GPS, GSM, Vibration Sensor Module , Power supply .

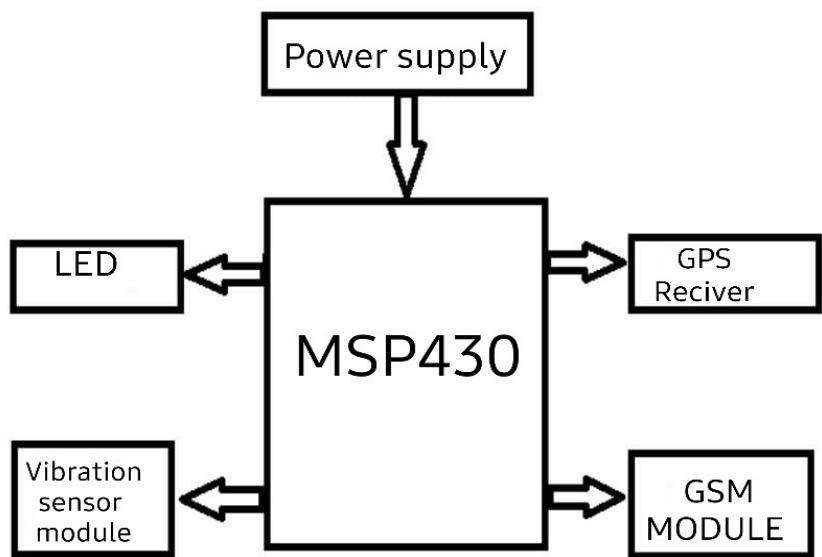


FIG 2.2.0 BLOCK DIAGRAM

2.3.1. CIRCUIT DIAGRAM

Circuit Connections of this **Vehicle Accident Alert System Project** is simple. Here Tx pin of **GPS module** is directly connected to digital pin number P1_1 of MSP430 Launchpad (hardware Serial) and 5v is used to power GPS Module. By using Software Serial Library here, we have allowed serial communication on pin P_6 and P1_7, and made them Rx and Tx respectively and connected to the **GSM module**. 12 Volt supply is used to power the GSM Module. The **vibration sensor** is connected at P1_3. A LED is also used for indicate the accident detection. Rest of connections are shown in the circuit diagram.

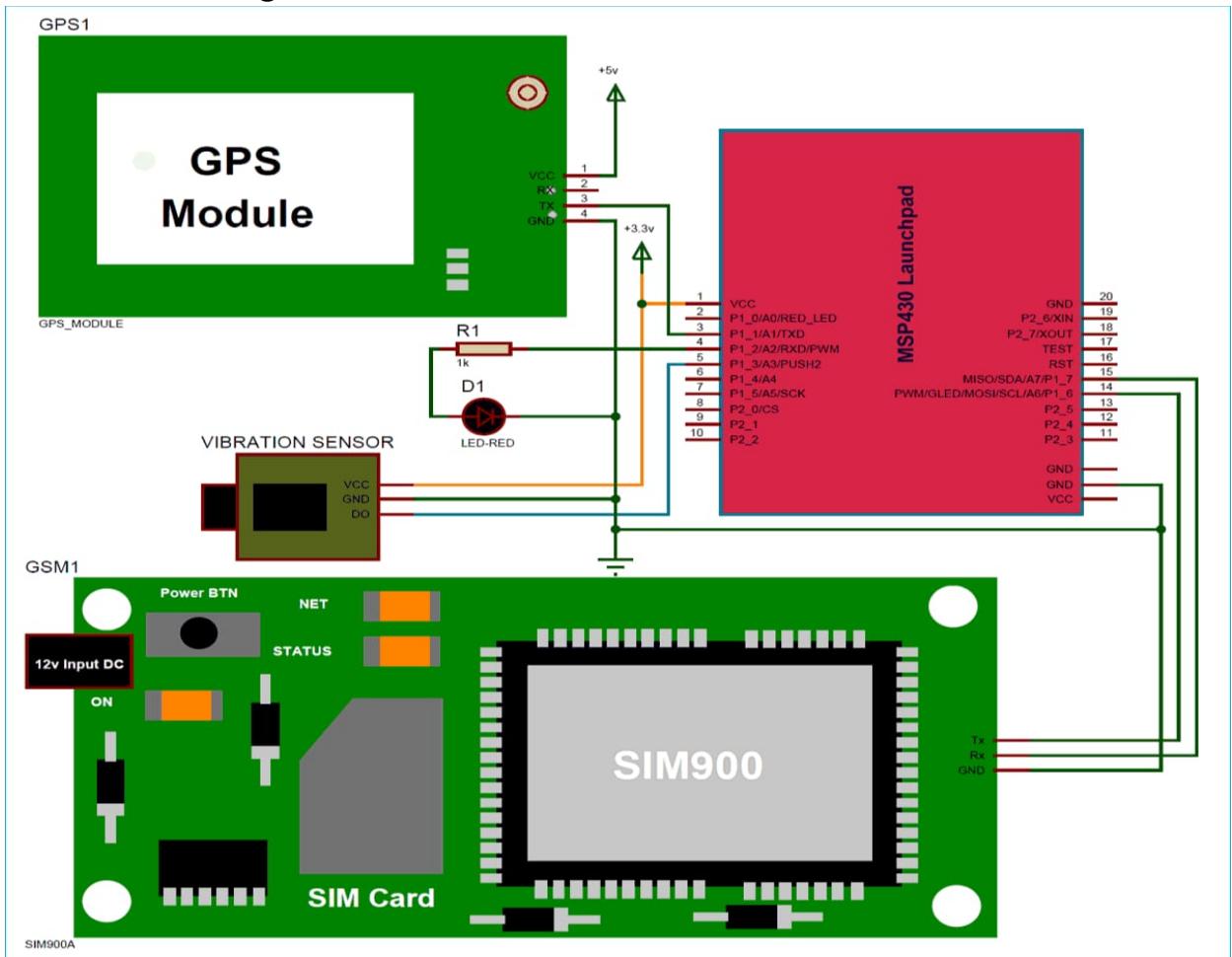


Fig 2.2.1 Circuit Diagram

2.4 OUTPUT/RESULTS:-

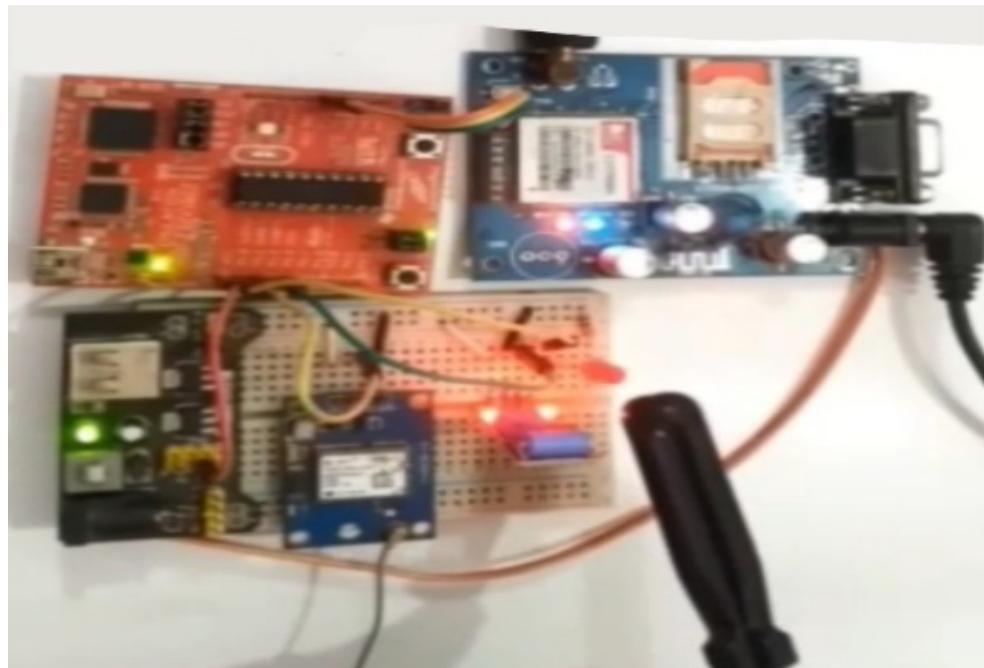


FIG 2.3 RESULT

MSP430 launchpad and a vibration sensor will be used to detect vehicle accident. So this project will also tell about interfacing a vibration sensor with MSP430 launchpad.

Vibration sensor module detects the vibration of vehicle and sends a signal to MSP430 Launchpad. Then MSP430 fetches data from GPS module and send it to user Mobile Phone via SMS using GSM module. An LED will also glow as Accident Alert signal, this LED can be replaced by some alarm. Location of the accident is sent in the form of Google Map link, derived from the latitude and longitude from the GPS module.

3. PROBLEM STATEMENT

This Vehicle Tracking system takes input from GPS and sends it through the GSM module to desired mobile/laptop using mobile communication. Vehicle Tracking System is one of the biggest technological advancements to track the activities of the vehicle. The security system uses Global Positioning System GPS, to find the location of the monitored or tracked vehicle and then uses satellite or radio systems to send the coordinates and the location data to the monitoring center. For traffic police if this system is located in every vehicle they can estimate the traffic by looking on the map and if any accident is detected then they can route the traffic into another way. This is how tracking is useful because India is one of busy traffic countries and this system can control many of the traffic problems. At the monitoring center various software's are used to plot the Vehicle on a map. In this way The Vehicle owners are able to track their vehicle on a real-time basis. Due to real-time tracking facility, vehicle tracking systems are becoming increasingly popular among owners of expensive vehicle.

4. METHODOLOGY

- Research articles collection.
- Familiarization with MSP430 with complete understanding of internal structure of Microcontroller.
- Start-up process of microcontroller, how entities and hardware, software initialization are done by microcontroller when it's turned on.
- This Accident detection & recovery model consists of micro-controller, software and hardware components such as: MSP430, GSM Module, GPS, Vibration Sensor, Power Supply.
- Automate the alert system concept providing additional features not present in pre-existing systems.
- Successfully detecting the occurrence of an accident without the need for user input using various sensors for detecting the accident.
- Decreasing the time between the occurrence of the accident and notification of the emergency services using the GSM module.
- Informing the emergency contacts set by the user that an accident has occurred so that their immediate family or friends are aware of the situation using the GSM module.
- Providing the exact location of the vehicle in the form of latitude and longitude coordinates in order to decrease the response time of the emergency services using the GPS module.

- Providing a small timeframe for the user to manually cancel system activation using a button on the system in case of a rare occurrence of false detection.

5. LITERATURE REVIEW

Aarya D.S, Athulya C.K, Anas.P, Basil Kuriakose, Jerin Susan Joy, Leena Thomas proposed a system that states that vehicle accidents are one of the most leading causes of fatality. The period between the occurrence of an accident and the dispatch of emergency medical services to the accident site is a critical factor in accident survival rates. Accident detection and messaging system will be stationed in the vehicle itself which will be helpful during the time of accident as hospital, police and emergency contact can be informed immediately. The system is executed using GPS and GSM technology. A vibration sensor detects a collision; which is the ability of certain materials to generate an electric charge when they are under mechanical stress. As soon as the collision is detected the GPS module locates the accident (latitude and longitude) and sends a message to the hospital and the emergency contact using the GSM module. The ambulance arrives to the location which is tracked by the GPS module and hence the victim

is treated as soon as possible, reducing the help time. In case if there is a minor accident, the victim can press a switch (button) to prevent the emergency contacts from being alerted. This system comprises MSP430, GPS, GSM and Vibration sensor, which detects the accident and alerts the authorities immediately, it also combats false alarms by using a switch provided for the driver. However, the system does not provide the medical

data and history of the victim and hence there could be a delay in the victim's treatment. We shall improvise our system in this scope. At present criteria, we cannot detect where the accident has occurred and hence no information related to it, leading to the death of an individual. The research work is going on for tracking the position of the vehicle even in dark clumsy areas where there is no network for receiving the signals. From the past event and the existing approach the below Drawback are been noted:

1. Manual system is adopted.
2. Tracking of accidents is a crucial process in the system.
3. Required medical attention cannot be given to the needed person.
4. Life loss and property loss were not stopped on a large scale.
5. The Automated system is used once the accident occurs.
6. This system GSM will send the message to the More Human life can be saved using this automated system.

Prashant Kapri, Shubham Patane, Arul Shalom proposed a system which states that an accident might occur at an isolated area where humans are absent to report any mishap. Inbuilt hardware modules in luxury vehicles have recently been developed to detect and report accidents. Unfortunately, such devices are both costly and immobile.

6. CONCLUSION

Vehicle tracking systems make better fleet management and which in turn brings large profits. Better scheduling or route planning can enable you to handle larger job loads within a particular time. Vehicle tracking both in case of personal as well as business purpose improves safety and security, communication medium, performance monitoring and increases productivity. So in the coming year, it is going to play a major role in our day-to-day living.

Main motto of the accident alert system project is to decrease the chances of losing life in such accidents which we can't stop from occurring. Whenever an accident is alerted the paramedics are reached to the particular location to increase the chances of life. This device invention is much more useful for the accidents occurring in deserted places and midnights. This vehicle tracking and accident alert feature plays a much more important role in day to day life in future.

Commercial fleet operators are by far the largest users of vehicle tracking systems. These systems are used for operational functions such as routing, security, dispatch and collecting on-board information. These are also used for fire detectors in large vehicles like train, bus etc. because the vehicle-like train contains a large number of people and the sending alert of fire accidents can save many lives. The applications for this project are in military, navigation, automobiles, aircrafts, fleet management, remote monitoring, remote control, security systems, tele services, etc.

- Fleet monitoring
- Vehicle scheduling
- Route monitoring
- Driver monitoring
- Accident analysis
- Geo-fencing geo-coding

There are many solutions proposed for the concerned problem and each one has some advantage over others. Among the other GSM and GPS solutions, some proposed the solution of finding the accident condition using only accelerometer sensor which may be a problem as it may lead to false alarm for some of the cases. Our system uses more than one sensor to increase the accuracy of the system and also we have provision to avoid the intimation in case of false alarm. The existing system also uses the external GPS and GSM modules

7. FUTURE SCOPE:-

The proposed system deals with the detection of the accidents. But this can be extended by providing medication to the victims at the accident spot. By increasing the technology we can also avoid accidents by providing alerts systems that can stop the vehicle to overcome the accidents. A wireless webcam can be added in this for capturing the images which will help in providing driver's assistance. This can also be better by locking all the brakes automatically in case of an accident.

This system is often interfaced with vehicle airbag systems that forestalls vehicle occupants from striking interior objects like the wheel or window. This will even be developed by interconnecting a camera to the controller module that takes the photograph of the accident spot that creates the tracking easier. Mostly in accidents, it becomes serious because the drivers lose control and fail to prevent the vehicle. In such cases, the vibration sensor is going to be triggered due to the vibrations received and also processed by the processor. The processor has got to be linked to the devices which may lock the brakes when triggered. With this improvement, we will stop the vehicle and may weaken the impact of the accident. This system also can be utilized in fleet management, food services, traffic violation cases, rental vehicle.

This system can also be expanded in the future by integrating it with Google Maps.

8. REFERENCES

- https://en.wikipedia.org/wiki/Vehicle_tracking_system
- http://ajerd.abuad.edu.ng/wpcontent/uploads/2019/12/AJERD0202_07.pdf
- http://ceur-ws.org/Vol-2889/PAPER_01.pdf
- <https://ieeexplore.ieee.org/abstract/document/9155836>
- <https://www.ti.com/microcontrollers-mcus-processors/microcontrollers/msp430microcontrollers/overview.html>
- <https://innovate.mygov.in/innovation/smart-vehicle-accident-detection-system/>