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A GSM & GPS BASED SYSTEM FOR AUTOMATIC ACCIDENT NOTIFICATION AND SEVERITY ESTIMATION

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Abstract--- New communication technologies integrated into modern vehicles offer an opportunity for better assistance to people injured in traffic accidents. Recent studies show how communication capabilities should be supported by artificial intelligent systems capable of automating many of decisions to be taken by emergency services, thereby adapting the rescue resources to the severity of accident and reducing assistance time. In this paper the accident can be notified automatically using sensors and the location &severity of accident also send as SMS via GSM to the nearest police station and hospital to bring the ambulance to the spot to rescue the passengers. Our system considers most relevant variables (such as sensors) that can characterize the severity of accident.

Keywords--- GPS Receiver, GSM, UART, LCD, PIC, Google earth.

I. INTRODUCTION

Road accidents are a human tragedy. They involve high human suffering and monetary costs in terms of untimely death, injuries. Unfortunately, more than half victims are in the economically active age group of 25-65 years. Advanced life saving measures, such as electronic stability control, also show significant promise for reducing injuries. By observing previous accident history chart we are able to conclude that there are more number of people dies in each country. Moreover, each minute that an injured crash victim does not receive emergency medical care can make a large difference in their survival rate, e.g., analysis shows that reducing accident response time by one minute correlates to a six present difference in the number of lives saved. This paper shows how the sensors and processing capabilities of GPS and GSM can be used to overcome the challenges of detecting traffic accidents without direct interaction with a vehicle's on-board sensors.

II. SYSTEM ARCHITECTURE

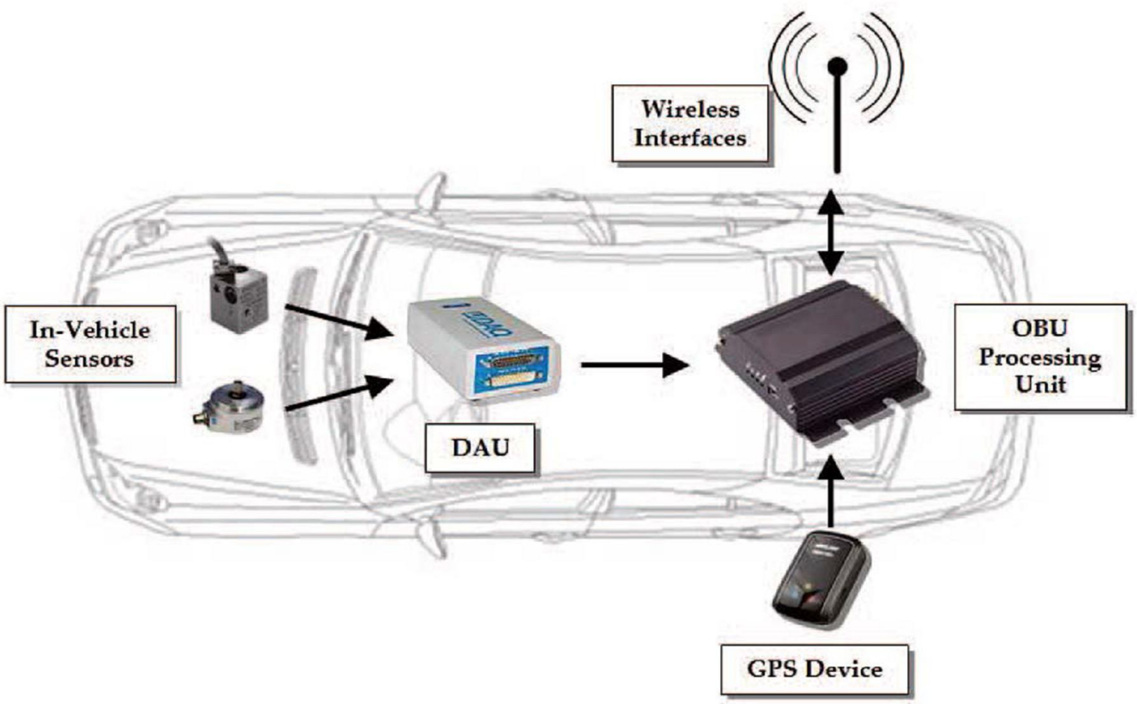

Fig. 1 System Architecture

The main objective of the proposed OBU lies in obtaining the available information from sensors inside the vehicle to determine when a dangerous situation occurs, and reporting that situation to the nearest Control Unit, as well as to other nearby vehicles that may be affected.

Fig. 1 shows the OBU system, which relies on the interaction between sensors, the data acquisition unit, the processing unit, and wireless interfaces:

1) In-vehicle sensors: They are required to detect accidents and provide information about its causes. Accessing the data from in-vehicle sensors is possible nowadays using the On-Board Diagnostics (OBD) standard interface, which serves as the entry point to the vehicle's internal bus. This standard is mandatory in Europe and USA since 2001. This encompasses the majority of the vehicles of the current automotive park, since the percentage of compatible vehicles will keep growing as very old vehicles are replaced by new ones.

2) Data Acquisition Unit (DAU): This device is responsible for periodically collecting data from the sensors available in the vehicle (airbag triggers, speed, fuel levels, etc.), converting them to a common format, and providing the collected data set to the OBU Processing Unit.

3) OBU Processing Unit: It is in charge of processing the data coming from sensors, determining whether an accident occurred, and notifying dangerous situations to nearby vehicles, or directly to the Control Unit. The information from the DAU is gathered, interpreted and used to determine the vehicle's current status. This unit must also have access to a positioning device (such as a GPS receiver), and to different wireless interfaces, thereby enabling communication between the vehicle and the remote control centre.

A. Hardware System

Hardware system includes GSM, GPS Receiver, PIC 16F877A, LCD, MAX232, Sensor, Power supply.

1) GSM Module:

This GSM modem is a highly flexible plug and play GSM 850 900 / GSM 1800 / GSM 1900 modem for direct and easy integration RS232, voltage range for the power supply and audio interface make this device perfect solution for system integrators and single user. It also comes with license free integrated Python. Python is a powerful easy to learn programming language. Such a Python driven terminal is 5 times better and faster and 5 times cheaper than standard PLC/RTU with communication interface and external GSM / GPRS modem.

2) GPS Receiver:

A GPS tracking unit is a device that uses the Global Positioning System to determine the precise location of a vehicle, person, or other asset to which it is attached and to record the position of the asset at regular intervals. The recorded location data can be stored within the tracking unit, or it may be transmitted to a central location data base, or internet-connected computer, using a Cellular network or satellite modem embedded in the unit. This allows the asset's location to be displayed against a map backdrop either in real time or when analyzing the track later, using GPS tracking software.

GPS Receiver has following features:

- 12 parallel satellite tracking channels.
- Supports NMEA-0183 data protocol & Binary data protocol.
- Direct, differential RTCM SC 104 data capability.
- Static navigation improvements to minimize wander due to SA.
- Active or Passive antenna to lower cost.
- Max accuracy achievable by SPS.
- Enhanced TTFF when in Keep –Alive power condition.
- Auto altitude hold mode from 3D to 2D navigation.
- Standard 2x10 I/O connector.
- Pins for powering GPS and Active antenna.
- Two message formats NMEA and Binary.
- Two serial port
  - One is I/O….GPS data (Rx, Tx, Gnd).
  - Only input….RTCM format differential corrections (Rx, Gnd).

3) PIC 16F877A:

- 35 Instruction sets.
- Operating speed: DC - 20 MHz clock input.
- 2K x 14 words of Program Memory, 128 x 8 bytes of Data Memory (RAM).
- Pin out compatible to PIC16C72/72A and PIC16F872.
- Interrupt capability.
- Eight-level deep hardware stack.
- Direct, Indirect and Relative Addressing modes.

4) LCD Display:

A liquid crystal display (LCD) is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals (LCs). LCDs do not emit light directly. Liquid crystal displays (LCDs) are a passive display technology. This means they do not emit light; instead, they use the ambient light in the environment. By manipulating this light, they display images using very little power. This has made LCDs the preferred technology whenever low power consumption and compact size are critical. They are used in a wide range of applications, including computer monitors, television, instrument panels, aircraft cockpit displays, signage, etc. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones. LCDs have displaced cathode ray tube (CRT) displays in most applications. They are usually more compact, lightweight, portable, less expensive, more reliable, and easier on the eyes.

5) Power supply:

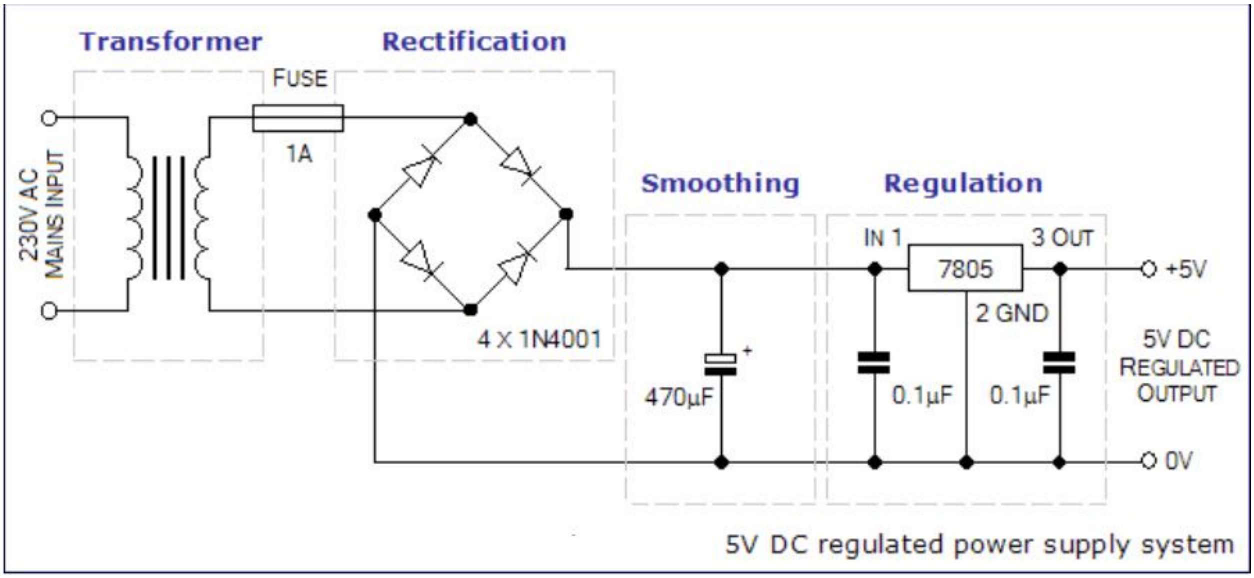

Fig. 2 Typical power supply section

5.1) Main Transformers:

Primary side:

Usually single 240V winding or two 120V windings. Might have tapings to allow operation from other supplies such as 200V, 220V, 240V, 100V, 110V etc. These multi tapped transformers are usually fitted to test equipment that could be used all over the world.

Secondary side:

Efficiency usually ~90% for small (<20VA) units, rising to 95% for larger (~100 to 200VA) units.
MAINS transformers ratings:

Transformers are rated in VA (Volt Amps) with respect to their outputs
A 20VA transformer with a 10V secondary will provide 2A (10V x 2A = 20VA)
A 45VA transformer with a 15V secondary will provide 3A (15V x 3A = 45VA)
A 60VA transformer with two 20V secondary windings will provide 1.5A from each secondary winding (20V x 1.5A x 2 = 60VA)

The power rating of a transformer is directly related to the cross sectional area of its magnetic circuit, for a conventional E I transformer this is the cross sectional area of its central limb (or twice the CSA of one side limb).

VA rating = (CSA x 5.6)2 where CSA is measured in square inches.

So transformer with centre limb 1" wide and laminations 1.2" deep is rated to (1" x 1.2" x 5.6)2 = 6.722 = 45VA

Smoothing capacitor:

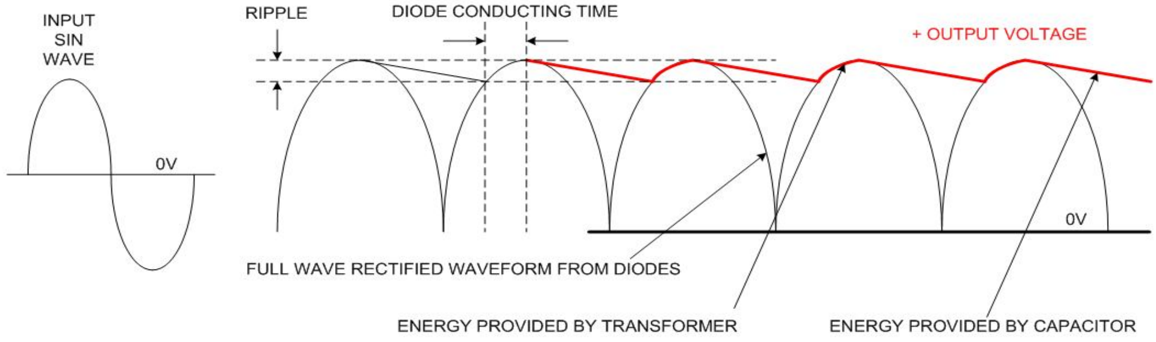

Fig. 3 Smoothing capacitor characteristics

Close approximation calculations:

C x E = I x t where **C** is the capacitance in uF
E is the peak to peak ripple in Volts
I is the full load current in mA
t is the diode conduction time in ms, ~ 9ms @ 50Hz

With a 20Vrms output from the transformer the maximum voltage will be about (20V x 1.414) less 2 diode drops, i.e., **28.28V – 1.4V = 26.88V.**

The minimum output (at full load) will be **(28.28V x 0.9) – 2V = 23.4V**

With a 4700uF smoothing capacitor the peak to peak ripple will be

(I x t)/C = (2000mA x 9ms)/4700uF = 3.83V

i.e. at full load the minimum voltage will be **23.4V – 3.83V = 19.5V**

B. Software System

Software system includes MPLAB IDE for development of source code and for simulation PROTUS ISIS can be used.

III. WORKING METHODOLOGY

The proposed system consists of in-vehicle GPS receiver, GSM modems (stationary and in-vehicle), and microcontroller. The users of this application can monitor the location graphically on Google Earth The microcontroller here used is it has 40 pins it is 8 bit microcontroller. The GSM terminal is an industrial GSM modem for the transfer of data using 3G technology. In the modern world so many sensors are available but here vibrator senor is used to sense the vibration acting on the vehicle so accident detection here is done by the vibrator sensor, which is used as accident sensor. The LCD is used to display the GPS location, time, information about an accident. GPS is used to locate the vehicle location where is goes. The vibrating level on the sensor can be used for estimating the severity of accidents. Power supply unit supplies power to all functioning units.

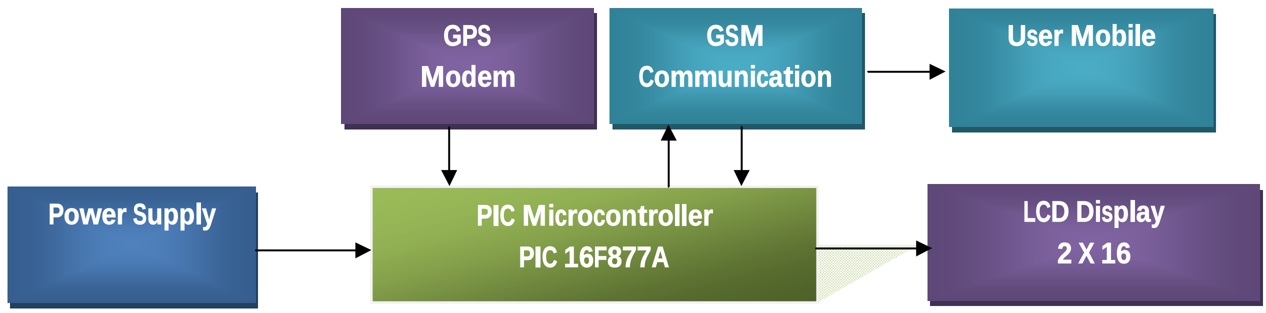

Fig. 4 Working methodology

When microcontroller, GPS and GSM modem are switched ON, the microcontroller gets the vehicle location, date and time. And monitor the vibrator sensor. Now microcontroller starts to sense all the vibrator sensors to check whether accident is happened or not. In case if any one of the vibrator sensors get activated then microcontroller assumes as accident occurred and analyze the level of vibration occurred and estimate the severity a n d sends the vehicle location, Priority level, date and time to the nearest police station and hospital to take rescue operation.

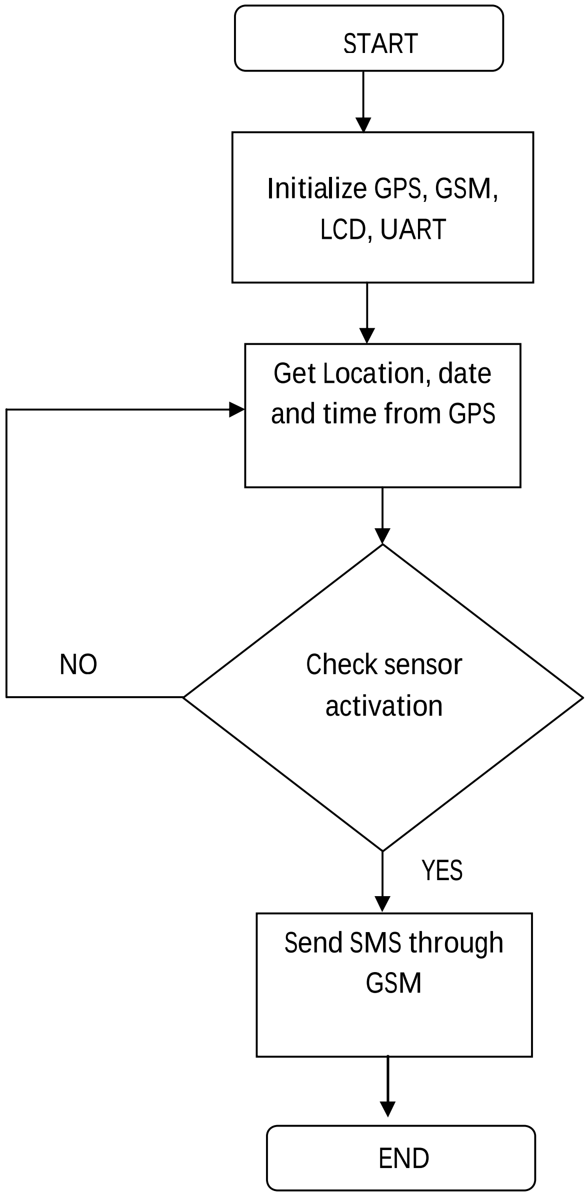

Fig. 5 Software flow chart

IV. RESULT

Fig. 6 Developed system

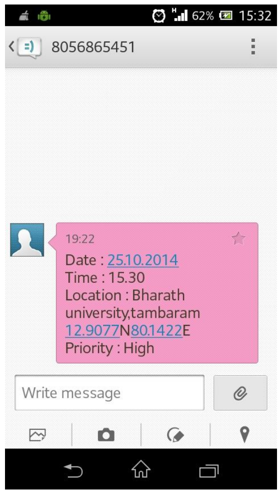

Fig. 7 Receiver side

V. CONCLUSION

The new communication technologies integrated into the automotive sector offer an opportunity for better assistance to people injured in traffic accidents, reducing the response time of emergency services, and increasing the information they have about the incident just before starting the rescue process. . This paper shows that compared with other applications, this system has advantages in terms of transmitting the severity of accident through 3G services, so that the rescue team may know about the condition of the passenger to bring them to hospital in earliest condition which can be vitally important for some real-time applications. Through research presented in this paper, we propose an intelligent car system for accident notification and making the world a much better and safe to lives.

VII. ACKNOWLEDGEMENT

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