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An Advanced Fatigue, Vehicle Monitoring and Information Processing System for Accident Management Support

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Research Article

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Abstract: Driving under the influence and excessive speed are the primary causes of car accidents. In addition to this mechanical failure of the engine, driver fatigue during long drives is also a contributing factor to the accident. Many lives could have been saved if emergency services received timely accident information and reached the scene promptly, and if drunk drivers were prevented from driving. These days, GPS is a fundamental component of vehicle systems. The microcontroller transmits the alert message via the GSM modem, which contains the location information directed to either a police control room or a rescue team. Thus, after receiving the information, the police can immediately trace the location via the GPS MODEM. Once the location is confirmed, appropriate action will be taken. The sensors used in suitable locations uphold the detection. The source battery, which is charged by the solar cell, provides the power supply. Additionally, piezoelectric plates mounted on the accelerator, clutch, and brake offer backup power.

Keywords: Fatigue; GSM MODEM; GPS MODEM; Piezoelectric; Accelerator; Solar Cell

INTRODUCTION

In the automobile industry, Vehicle Safety Technology (VST) denotes specialized technology (Advanced-Driver Assistance System) designed to guarantee the safety of vehicles and their occupants. This encompasses car-to-computer communication, GPS tracking features, and more. The rapid advancement of technology and infrastructure has simplified our lives. With the arrival of technology, traffic dangers and frequent road accidents have escalated, leading to significant loss of life and property due to inadequate emergency services. The main reasons for these road accidents are: absence of training institutes, drivers lacking skills, inadequate road conditions, mobile phone usage while driving, overloading, and ineffective governmental strategies related to this issue. The main issues are road accidents and traffic jams. Thus, the worth of human life is overlooked. They entail significant human suffering and financial costs associated with premature fatalities, injuries, and loss of potential earnings. Numerous new techniques, including the Antilock Breaking System (ABS), Adaptive Cruise Control (ACC), and Anti-Collision System (ACS), have been developed to prevent accidents. Despite these advancements, a significant number of accidents still occur. India has one of the highest rates of traffic accidents globally. A report from the National Crime Records Bureau (NCRB) disclosed that India experiences over 135,000 deaths related to traffic collisions annually. Furthermore, the delay in the ambulance's arrival at the accident site and the traffic congestion between the accident site and the hospital increase the victim's chances of death.

SYSTEM DESIGN

There is a need of introducing a system to reduce the loss of life due to accidents and the time taken by the ambulance to reach the hospital. To overcome the drawback of existing system we will implement the new system in which there is an automatic detection of accident through sensors provided in the vehicle.

A. Prevention System

The prevention system involves, switching off automobile if the driver has consumed the alcohol the buzzer is initiated and the engine of the vehicle does not start. On a long drive in the case of truck or the busses that cover long distance undergo mechanical failure that leads to overheating of the engine. Generally a normal person can drive only for few hours. If the driver drives the vehicle beyond the specified limit of driving the driver can fall asleep and hence can lose the control over the vehicle. For this the eye blink sensor is used in order to monitor the driver eye blink pattern. If there is any change in that the buzzer is initiated and the fuel injection system is cut off by using the relay. The obstacle sensor detects the obstacle coming on the way of the vehicle while it is moving on road.

B. Detection System

The detection part involves, when a vehicle faces accident, immediately MEMS sensor will detect the signal and then Microcontroller sends the alert message through the GSM modem including the location to predefined numbers that can be reserved for a rescue team. The rescue team will arrives at the accident place and takes the microcontroller to analyze the parameters of accident automobile.

C. Vehicle Unit

For implementation of this, vehicle unit should be installed in every vehicle. It consists of alcohol sensor, MEMS sensor, temperature sensor, obstacle sensor, GPS & GSM Module and the eye blink sensor. The alcohol sensor MQ-2 is placed at the dashboard or the steering of the vehicle where it can easily detect the alcohol content if the driver has consumed the alcohol. The LM-35 temperature sensor is the one which will detect the temperature of engine. If the temperature of the engine goes beyond the specified range the buzzer is initiated and the vehicle slowly stops. Obstacle sensors are placed at the front bumper. The function of the obstacle sensor is that it will detect the on road obstacles and suitably giving warning signals to the driver. Eye blink sensor are the sensor that will monitor the drivers eye blink pattern of making sure that if the drivers fall asleep the buzzer is turned on and the fuel injection system is disconnected making sure that the vehicle does not accelerate further. This information consists of the location of accident detected by GPS module installed in vehicle. The GPS system finds out current position of vehicle (latitude and longitude) which is the location of accident spot and gives that data to GSM module. This information to the control unit is sent by GSM module.

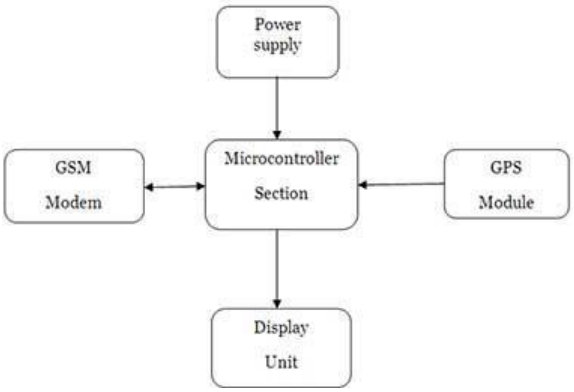


Fig 1. Block Diagram Of Detection System

D. Control Unit

Control unit is the brain of our system. Practically, the control unit will contain all the information about the hospital location and the contact number of all the hospitals in order to send an ambulance to the accident spot. The system calculates the nearest distance from the accident spot to the nearest hospital location through a Google API. It receives the message through another GSM module about accident location from the GPS and GSM module installed in its vehicle unit and responds. This also consist the microcontroller that ensures the proper signal is initiated and displayed on the LCD Screen as and when required.

E. Medical Response Unit

Control unit sends the ambulance to the accident location. Ambulance serves the victim from the accident location.

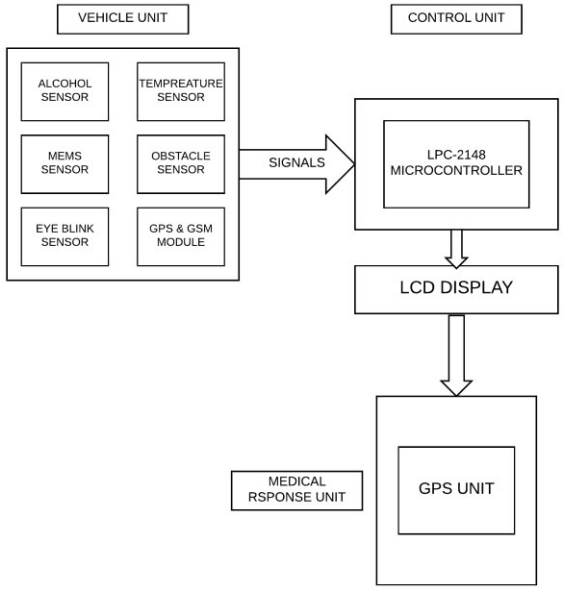


Fig 2. Block Diagram Of The Proposed System

F. Power Supply Unit

The Power supply unit is the most important part of the system since for every equipment installed requires some certain amount of power to operate effectively and making sure that it gives the required output. The power supply is given by the battery that provides the required amount of the power to the system. The vehicle consists of clutch, brake and accelerator that are continuously used by the driver. The clutch, brake and the accelerator are fixed with a piezoelectric plate. Whenever the brake, clutch or accelerator is used a small amount of pressure is applied on this and hence it converts the mechanical pressure to the electricity that can be stored in the battery.

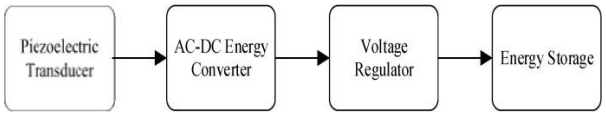


Fig 3. Block Diagram Of Peizoelectric Power Generation

In case, due to some mechanical damage, the piezoelectric plate does not work effectively the solar power can be used to charge the battery. This also ensures that the power that is utilized by the vehicle's battery unit for other purpose is not made in use and hence the energy is saved in the battery.

The MQ-2 gas sensor is sensitive to LPG, i-butane, propane, methane, alcohol, Hydrogen and smoke.

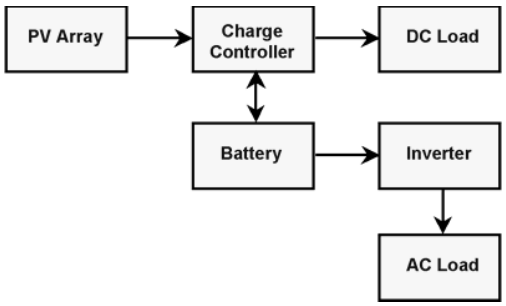


Fig 4. Solar Energy Conversion Block Diagram



Fig 5. MQ-2 Alcohol Sensor

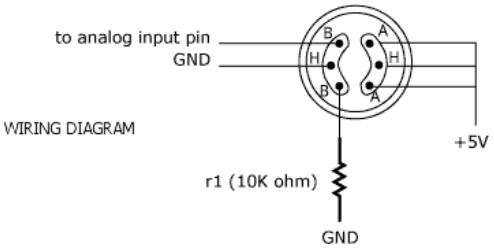


Fig 6. Wiring Diagram

Output of the sensor is directly proportional to alcohol content. When Ethanol molecules in the air meet the electrode i.e. between alumina and tin dioxide in sensor, ethanol burns into acetic acid producing more current hence alcohol increases current also increases.

G. Obstacle Sensor

Infrared Obstacle Sensor Module has built in IR transmitter and IR receiver that sends out IR energy and looks for reflected IR energy to detect presence of any obstacle in front of the sensor module. The module has on board potentiometer that lets user adjust detection range. The sensor has very good and stable response even in ambient light or in complete darkness.



Fig 7. IR Sensor

Eyeblink Sensor

This Eye Blink sensor is IR based. The Variation Across the eye will vary as per eye blink. If the eye is closed means the output is high otherwise output is low. This to know the eye is closing or opening position. This output is given to logic circuit to indicate the alarm.

H. MEMS Sensor

The ADXL330 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs, all on a single monolithic IC. The product measures acceleration with a minimum full-scale range of. It can measure the static acceleration of gravity in tilt- sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.

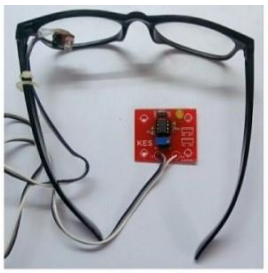


Fig 8. Eye blink Sensor

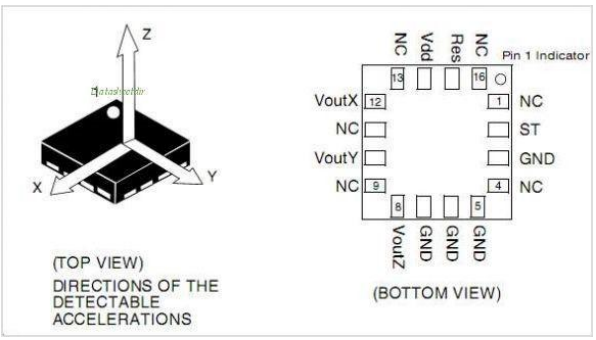


Fig 9. MEMS Sensor

I. LM-35 Temperature Sensor

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies.

the eye is closing or opening position. If the driver closes eye for more than 3 seconds, it provide alarm, engine will be stop and message with location sent to

owner. The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. It's operating range

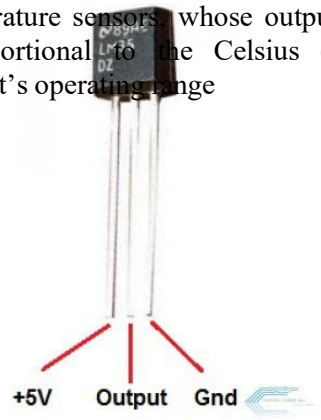


Fig 10. LM 35 Temperature Sensor

J. GSM

GSM (Global System for Mobile communications) is the technology that underpins most of the world's mobile phone networks. The GSM platform is a hugely successful wireless technology and an unprecedented story of global achievement and cooperation. GSM has become the world's fastest growing communications technology of all time and the leading global mobile standard, spanning 218 countries. GSM is an open, digital cellular technology used for transmitting mobile voice and data services. GSM operates in the 900MHz and
1.8GHz bands GSM supports data transfer speeds of up to 9.6 kbps, allowing the transmission of basic data services such as SMS.

K. GPS

GPS (Global Positioning System) technology is used to find the location of any object or vehicle to monitor a child continuously using satellite signals. Three satellite signals are necessary to locate the receiver in 3D space and fourth satellite is used for time accuracy. GPS will give the information of parameters like longitude, latitude and attitude. With the help of these parameters one can easily locate the position of any object. In this GPS technology, the communication takes place between GPS transceiver and GPS satellite.

−55 to +150°C temperature range. When engine temperature goes to threshold it produces alarm and engine get stopped.

RESULTS

The project caters to an active market for individuals who travel long distances at once. A variety of users could find this system advantageous, from truckers making daily journeys to families undertaking long-distance travel twice yearly. This alcohol sensor works like a typical breathalyzer in that it can detect the concentration of alcohol on your breath. Its sensitivity is high, and its response time is quick. It offers an alarm, the engine will halt, and a message with the location will be dispatched to the owner. The Obstacle Detecting Sensor identifies objects and obstacles directly ahead within a narrow field of view, making it valuable for robotics applications. We can use the Automatic Braking System instead of an alarm, which will decrease the car's speed. It offers nothing but alarm. This Eye Blink sensor operates on an infrared basis. The Variation Across the eye will change with each eye blink. When the eye is shut, the output is high; when it is open, the output is low. This is to know.

CONCLUSION

A system for automatic accident prevention and reporting is developed and deployed using technologies such as to avert accidents, a GPS modem to determine the vehicle's location in latitude and longitude, and GSM for mobile messaging at the recipient's end. While we are wrapping up our paper and the whole stimulus, we remain open to improving how enhanced technology is applied to make electronic equipment usage more efficient. The snapshot shows the message alerts generated when our accident alert system is tested at two nearby locations. Thus, the coordinates vary slightly; while the latitudes and longitudes retain the same initial values, their fractional components differ slightly.

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