Safety Alert System in Automobiles

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***Abstract*—**The SAS system using Arduino is very sufficient and worthy to be implemented in the vehicle specially in developing country like Nepal, India, Bangladesh etc. Accident is increasing due to increase in number of vehicles as a result every year the number of death is increasing. The Accident Detection and Alert System using Arduino prevent the uncertain death after accident because this system send the message alert to the hospital or police station. With the help of this project human life losses due to improper intimation is reduce. The main intention of the project is to find the accident spot at any places and intimating to the ambulance, police and neighbors through GSM and GPS network. The GSM and GPS based vehicle accident identification module contains MEMS, GSM module and GPS modem connected to the microcontroller. GLOBAL SYSTEM FOR MOBILES (GSM) technology is used to establish the cellular connection. GPS is used to trace the position of vehicle. Manual switch is providing for better convenience during emergency cases.

***Keywords*—** Accident Alert; Arduino; GSM; Safety System; Vehicle Spotting.

***Abbreviations*—**Common Gateway Interface (CGI); Heating Ventilation Air Conditioning (HVAC); Integrated Development Environment (IDE); Intelligent Monitoring Terminal (IMT); Monitoring System Devices (MSD).

I. INTRODUCTION

THE Safety Alert System is an emergency messaging system that can send alerts to phones, email addresses, and text/SMS and TTY/TDD devices [Saigh et al., 2014]. The Safety Alert System also sends desktop alerts to campus-owned computers through Alertus Desktop Notifications. The Safety Alert System will be used only for emergency communication purposes and never for routine communications.

Vehicle tracking system main aim is to give Security to all vehicles. Accident alert system main aim is to rescuing people in accidents [Mejri et al., 2014]. This is improved security systems for vehicles. The latest like GPS are highly useful now a days, 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 on to 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 interrupt to the system, sends the location data to the monitoring unit. When the vehicle is stolen, the location data from tracking system can be used to find the location and can be informed to police for further action. Some Vehicle tracking System 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 [Bevacqua et al., 2012]. 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.

Vehicle tracking features are mainly benefit for the companies which are based on transport system. Since it can show the position of all vehicles in real time, so that they can create the expected data accordingly [Perego et al., 2011]. These tracking system can store the whole data where the vehicle had gone, where did it stop, how much time it take at every stop and can create whole data analysis. It is also used in buses and trains, to estimate how far are they, how much time it takes for them to come to a particular stop. These systems are used to data capture, data storage, data analysis and finally data transfer.

Accident alert system features is based on new technology, its main purpose is to detect an accident and alert to the control room, so the victim can find some help [Reason, 2016]. It can detect accidents the intensity of the accident without any visual contact from control room. If this system is inserted in every vehicle then it is easy to understand how many vehicles are involved in a particular

accident and how intense is it. So that the help from control room will be according to the control room. The present board designed has both vehicle tracking and accident alert systems, which make it more valuable and useful. This board alerts us from theft and on accident detection also. This device detects fire accidents also by placing fire detector in one of the interrupt pins.

Tracking in India is mainly used by transport systems, taxi companies, traffic operators. Taxi operators use this to estimate how far the vehicle is from a particular area and send this information to call centers and they can inform general public about the distance of the taxi location and time it takes tom come to them. Another use is 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 in to 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.

II. RELATED WORKS

Prgrammable Logic Controllers [Huang et al., 2011] i.e. PLCs are being used for industrial automation as well large scale control system. It is used for sequential slow operations. It has been adopted as a traditional solution for automation industry and available only with proprietary vendor having license. With advancement of technology and emerging open source technological approach, arduino become a very famous and handy electronic development facility. It has possibilities of to be used as PLCs. In this paper, technological aspects of replacement of PLCs with Arduino have been discussed.

Arduino [Badamasi, 2014] is an open-source platform used for constructing and programming of electronics. It can receive and send information to most devices, and even through the internet to command the specific electronic device. it uses a hardware called arduino uno circuit board and software programme (Simplified C++) to programme the board.

Alkar & Buhur (2005) implemented Internet based wireless flexible solution where home appliances are connected to slave node. The slave nodes communicate with master node through RF and master node has serial RS232 link with PC server. The nodes are based on PIC 16F877 µc. PC server is formed of a user interface component, the database and the web server components. An Internet page has been setup running on a Web server. The user interface and the Internet front end are connected to a backend data base server. The control of devices is established and their condition is monitored through the Internet.

Myers (2001) used X10 controller interfaced through serial port to PC server for control of devices. The Common Gateway Interface (CGI) is used to interface between the browser and the X10 protocol via http connection. The server executes CGI programs in order to satisfy a particular request from the browser, which expresses its request using the http.

Colak Ilhami et al., (2008) developed Internet controlled Heating Ventilation Air Conditioning (HVAC) system. The system can be controlled by three different units (web based remote control, remote control by hand-held device and keypad control mounted on AC). The hardware system of AC is controlled by PIC16F877 microcontroller. A DAQ board inserted into PCI bus of web server is used to control system over web. User is able to access system parameters over web by logging and setting parameters on forms available on main control page. User submits forms to web server having CGI program which performs requested tasks and reports status of system operation. The current operational parameters of the system are measured by microcontroller and displayed on LCD. Using web camera focused on LCD, these parameters are monitored online by client PC.

Zhu & Cui (2007) developed remote intelligent monitoring system based on embedded Internet technology for device-room monitoring of the campus network. The Intelligent Monitoring Terminal (IMT) is provided with the functions of Embedded Internet Node Unit and local MSD (Monitoring System Devices). IMT can give alarm of theft or fire according to detection analysis of temperature, sound and smog. And it also can connect to Internet for carrying out remote data communication. The MCU S3C44B0, which utilize 32-bit ARM kernel, is adopted in intelligent monitoring terminal. µClinux operating system is chosen as the software core of embedded system. It offers self-contained TCP/IP network protocol module and provides strong support for embedded Internet technology

III. SAFETY ALERT SYSTEM TO SPOT THE ACCIDENTS

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 to send the coordinates and the location data to the monitoring center. At 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 vehicles.

Accident in the sense it could be collision of two vehicles or fire accident inside the vehicle. These shock sensors are attached to the car on all sides of the vehicle and they all are connected to the OR gate. OR gate is used because to detect at least one sensor is high. The output from the or gate is connected to the interrupt pin of microcontroller and whenever this pin 12 is high the micro controller sends the message about the accident. In the following sub section, detailed discussion about the components involved in this project is given.

3.1. Arduino and its Working Procedure

The Arduino UNO is a widely used open-source microcontroller board based on the ATmega328P microcontroller and developed by arduino. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board features 14 Digital pins and 6 Analog pins. It is programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform. The ATmega328 on the Arduino Uno comes preprogrammed with a bootloader that allows to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol. The Uno also differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. popular board.

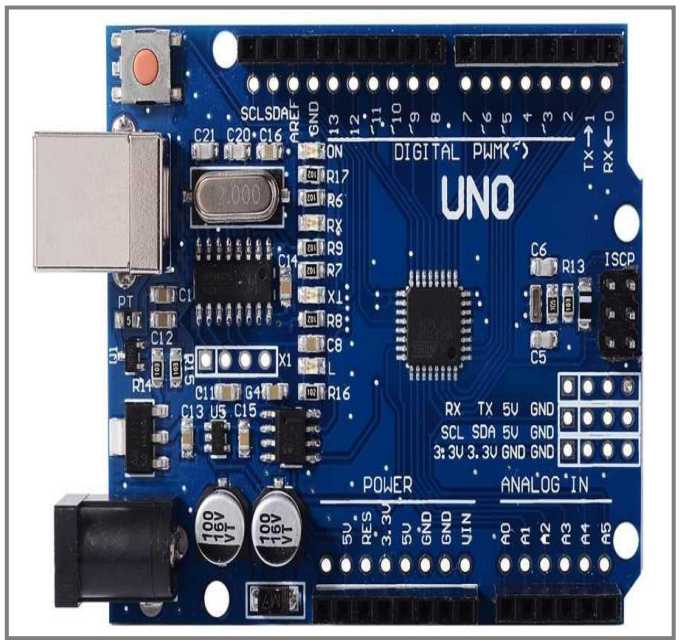

Figure 1: Arduino

Table 1: Arduino Specification

Microcontroller	ATmega328P
Operating Voltage	5v
Input Voltage	7-20v
Digital I/O Pins:	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB of which 0.5 KB used by bootloader
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz
Length	68.6 mm
Width	53.4 mm
Weight	25 g

The circuit diagram of Arduino is given in the following figure 2.

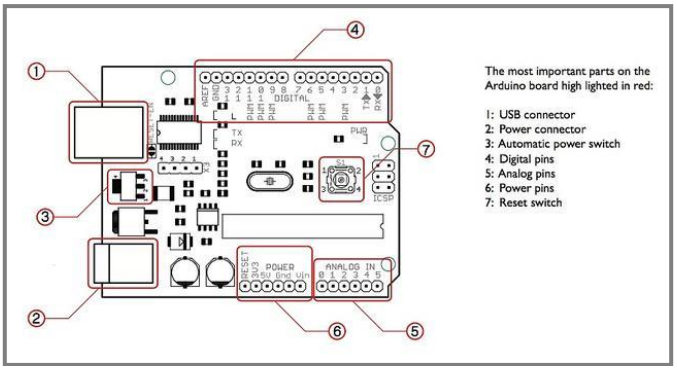

Figure 2: Circuit of Arduino

3.2. Working Procedure of Microcontroller

A microcontroller (or MCU for microcontroller unit) is a small computer on a single integrated circuit. In modern terminology, it is similar to, but less sophisticated than, a system on a chip or SoC; an SoC may include a microcontroller as one of its components. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals. Program memory in the form of ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications consisting of various discrete chips. Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. Mixed signal microcontrollers are common, integrating analog components needed to control non-digital electronic systems. Some microcontrollers may use four-bit words and operate at frequencies as low as 4 kHz, for low power consumption

(single-digit milliwatts or microwatts). They will generally have the ability to retain functionality while waiting for an event such as a button press or other interrupt; power consumption while sleeping (CPU clock and most peripherals off) may be just nanowatts, making many of them well suited for long lasting battery applications. Other microcontrollers may serve performance-critical roles, where they may need to act more like a digital signal processor (DSP), with higher clock speeds and power consumption.

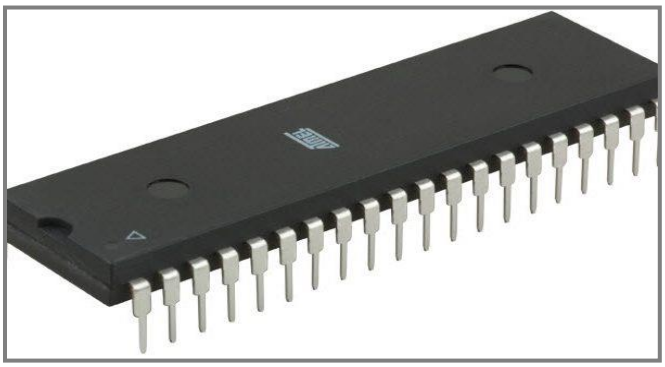

Figure 3: Microcontroller

3.3. Types

- ARM core processors (many vendors)
- ARM Cortex-M cores are specifically targeted towards microcontroller applications
- Atmel AVR (8-bit), AVR32 (32-bit), and AT91SAM (32-bit)
- Cypress Semiconductor's M8C core used in their PSoC (Programmable System-on-Chip)
- Free scale ColdFire (32-bit) and S08 (8-bit)
- Free scale 68HC11 (8-bit), and others based on the Motorola 6800 family
- Intel 8051, also manufactured by NXP Semiconductors, Infineon and many others
- Infineon: 8-bit XC800, 16-bit XE166, 32-bit XMC4000 (ARM based Cortex M4F), 32-bit TriCore and, 32-bit Aurix Tricore Bit microcontrollers
- MIPS
- Microchip Technology PIC, (8-bit PIC16, PIC18, 16-bit dsPIC33 / PIC24), (32-bit PIC32)
- NXP Semiconductors LPC1000, LPC2000, LPC3000, LPC4000 (32-bit), LPC900, LPC700 (8-bit)
- Parallax Propeller
- PowerPC ISE
- Rabbit 2000 (8-bit)
- Renesas Electronics: RL78 16-bit MCU; RX 32-bit MCU; SuperH; V850 32-bit MCU; H8; R8C 16-bit MCU
- Silicon Laboratories Pipelined 8-bit 8051 microcontrollers and mixed-signal ARM-based 32-bit microcontrollers
- STMicroelectronics STM8 (8-bit), ST10 (16-bit), STM32 (32-bit), SPC5 (automotive 32-bit)
- Texas Instruments TI MSP430 (16-bit), MSP432 (32-bit), C2000 (32-bit)
- Toshiba TLCS-870 (8-bit/16-bit)

The circuit diagram of microcontroller is given in the following figure 4.

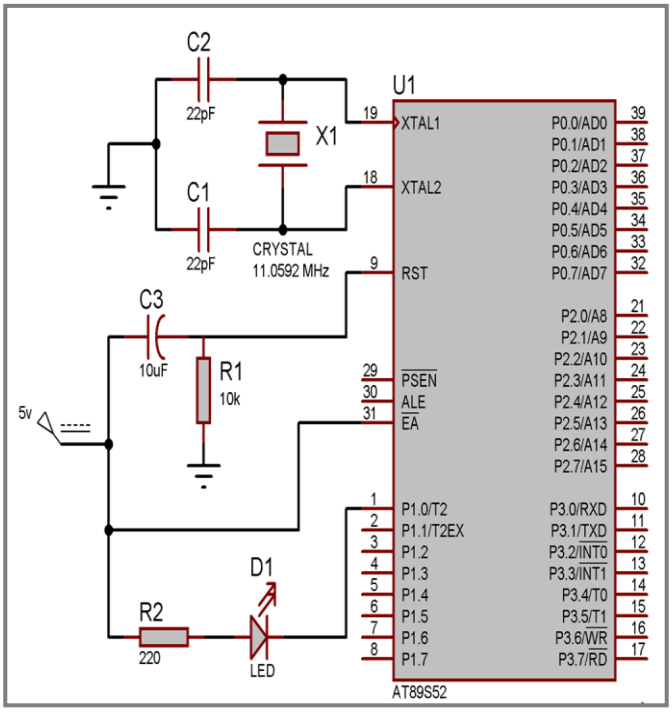

Figure 4: Circuit of Controller

3.4. GSM Module

GSM is a mobile communication modem; it is stands for global system for mobile communication (GSM). The idea of GSM was developed at Bell Laboratories in 1970. It is widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands.

Figure 4.5: GSM Module

The feature of GSM module is shown below

- Improved spectrum efficiency
- International roaming
- Compatibility with integrated services digital network (ISDN)
- Support for new services.
- SIM phonebook management
- Fixed dialing number (FDN)
- Real time clock with alarm management
- High-quality speech
- Uses encryption to make phone calls more secure
- Short message service (SMS)

The schematic diagram of the GSM module is shown in the follows figure 6.

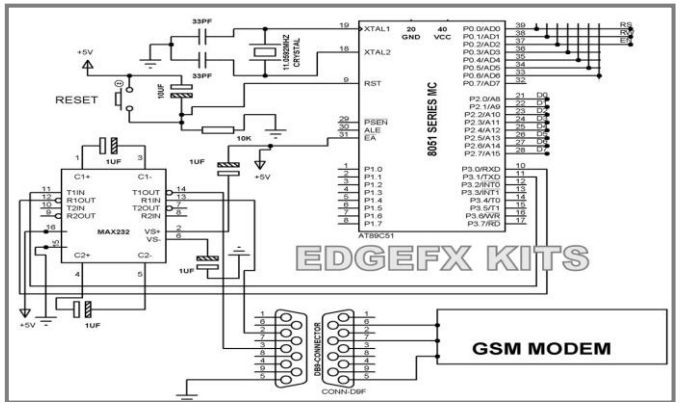

Figure 4.6: Circuit of GSM Module

3.5. Working Procedure of Bridge Rectifier

A Bridge rectifier is an Alternating Current (AC) to Direct Current (DC) converter that rectifies mains AC input to DC output. Bridge Rectifiers are widely used in power supplies that provide necessary DC voltage for the electronic components or devices. They can be constructed with four or more diodes or any other controlled solid state switches. Depending on the load current requirements, a proper bridge rectifier is selected. Components' ratings and specifications, breakdown voltage, temperature ranges, transient current rating, forward current rating, mounting requirements and other considerations are taken into account while selecting a rectifier power supply for an appropriate electronic circuit's application.

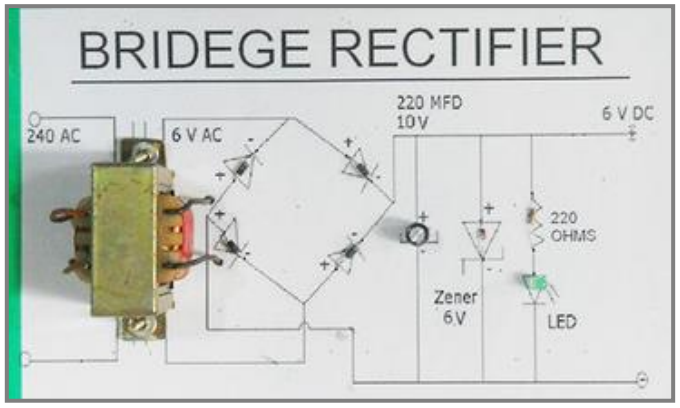

Figure 7: Bridge Rectifier

The circuit diagram of the bridge rectifier is given in the below figure 8.

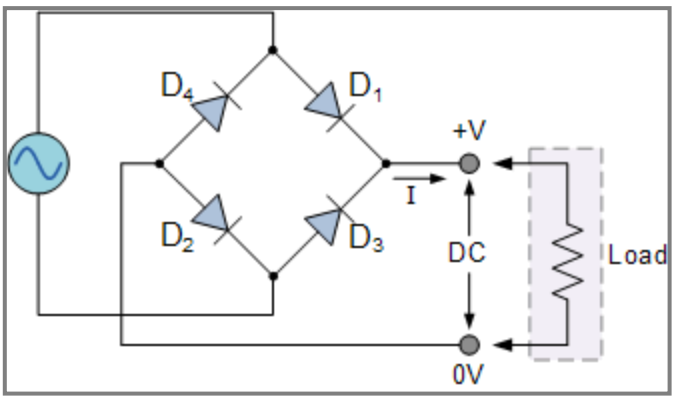

Figure 8: Circuit of Bridge Rectifier

As we discussed above, a single-phase bridge rectifier consists of four diodes and this configuration is connected across the load. For understanding the bridge rectifier's working principle, we have to consider the below circuit for demonstration purpose. During the Positive half cycle of the input AC waveform diodes D1 and D2 are forward biased and D3 and D4 are reverse biased. When the voltage, more than the threshold level of the diodes D1 and D2, starts conducting – the load current starts flowing through it, as shown as red lines path in the diagram below.

Bridge Rectifier Operation: During the negative half cycle of the input AC waveform, the diodes D3 and D4 are forward biased, and D1 and D2 are reverse biased. Load current starts flowing through the D3 and D4 diodes when these diodes starts conducting as shown in the figure. We can observe that in both the cases, the load current direction is same, i.e., up to down as shown in the figure – so unidirectional, which means DC current. Thus, by the usage of a bridge rectifier, the input AC current is converted into a DC current. The output at the load with this bridge wave rectifier is pulsating in nature, but for producing a pure DC requires additional filter like capacitor. The same operation is applicable for different bridge rectifiers, but in case of controlled rectifiers thyristors triggering is necessary to drive the current to load. This is all about the bridge rectifier theory its types, circuit and working principles. We hope that this wholesome matter about this topic will be helpful in building students' electronics or electrical projects as well as in observing various electronic devices or appliances. We appreciate you for your keen attention and focus on this article. And therefore, please do write to us for choosing required component ratings in this bridge rectifier for your application and for any other technical guidance.

3.6. Working Procedure of Step-Down Transformer

A Step down Transformer is a type of transformer, which converts a high voltage at the primary side to a low voltage at the secondary side. If we speak in terms of the coil windings, the primary winding of a Step down Transformer has more turns than the secondary winding. The following image shows a typical step down transformer.

The circuit diagram of the step down transformer is shown in the below figures.

Figure 9: Step Down Transformer

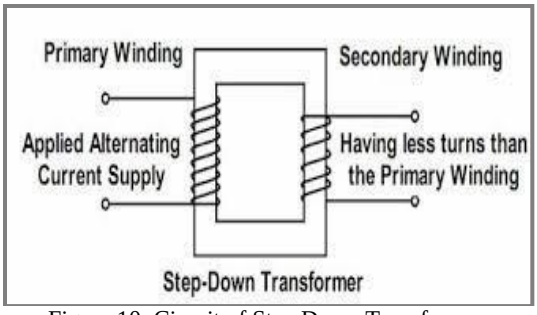

Figure 10: Circuit of Step Down Transformer

3.7. Copper Wire

Copper wire is used in electrical wiring it is also used for creating electric field in many applications. In our project we use American wire gauge (AWG) 29 gauges are used. AWG is used to describe standard wire it is described by using cross sectional area.

Grade	Diameter (mm)	Area (mm2)	Resistance/km (Ohms)	Ampacity (Amps)	Fuse current (Amps)
29	0.286	0.0642	268.5	1.254	12

3.8. Limit Switch

Limit switches are used in a variety of applications and environments because of their ruggedness, ease of installation, and reliability of operation. They can determine the presence or absence, passing, positioning, and end of travel of an object. They were first used to define the limit of travel of an object; hence the name "Limit Switch".

Standardized limit switches are industrial control components manufactured with a variety of operator types, including lever, roller plunger, and whisker type. Limit switches may be directly mechanically operated by the motion of the operating lever. A reed switch may be used to indicate proximity of a magnet mounted on some moving part. Proximity switches operate by the disturbance of an electromagnetic field, by capacitance, or by sensing a magnetic field.

Rarely, a final operating device such as a lamp or solenoid valve will be directly controlled by the contacts of an industrial limit switch, but more typically the limit switch will be wired through a control relay, a motor contactor control circuit, or as an input to a programmable logic controller. Miniature snap-action switch may be used for example as components of such devices as photocopiers, computer printers, convertible tops or microwave ovens to ensure internal components are in the correct position for operation and to prevent operation when access doors are opened. A set of adjustable limit switches are installed on a garage door opener to shut off the motor when the door has reached the fully raised or fully lowered position. A numerical control machine such as a lathe will have limit switches to identify maximum limits for machine parts or to provide a known reference point for incremental motions.

Figure 11: Limit Switch

3.9. Working Procedure of LCD Display

LCD modules are very commonly used in most embedded projects, the reason being its cheap price, availability and programmer friendly. Most of us would have come across these displays in our day to day life, either at PCO's or calculators. The appearance and the pin outs have already been visualized above now let us get a bit technical. 16×2 LCD is named so because; it has 16 Columns and 2 Rows. There are a lot of combinations available like, 8×1, 8×2, 10×2, 16×1, etc. but the most used one is the 16×2 LCD. So, it will have (16×2=32) 32 characters in total and each character will be made of 5×8 Pixel Dots.

Figure 12: LCD Display

The circuit diagram of the LCD display is shown in the below figure 13.

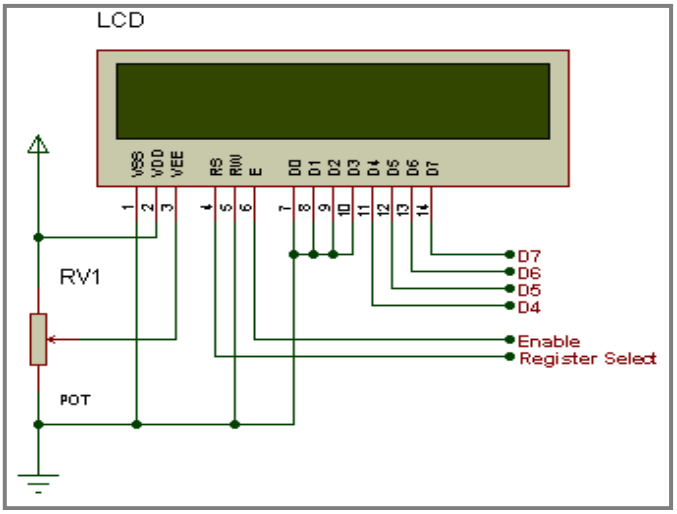

Figure 13: Circuit of LCD Display

The circuit diagram of the safety alert system is shown in the below figure 14.

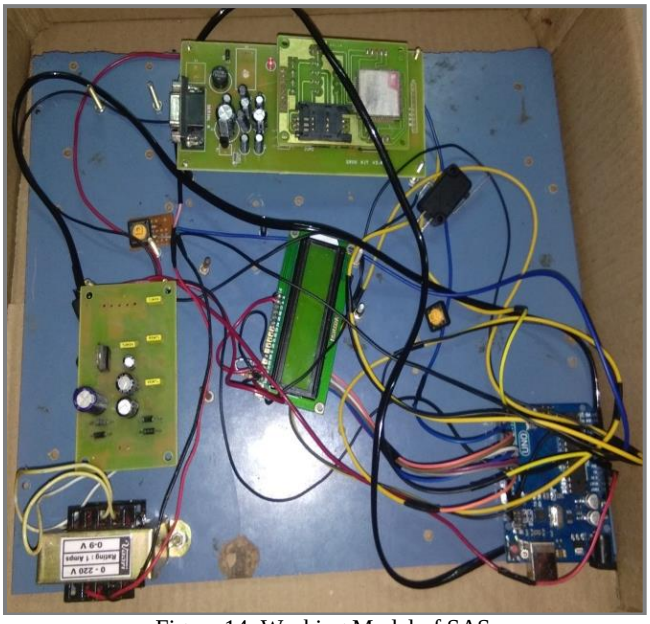

Figure 14: Working Model of SAS

The working procedure of the safety alert system is given below.

- When the vehicle is meet with an accident. Limit switch is activated and transmit the signal.
- Adruino receives the input signal and activate the GSM module
- GSM module get activated and transmit the emergency alert to the ambulance, police and neighbour mobiles
- By this message one can find the exact location and situation of the passenger.

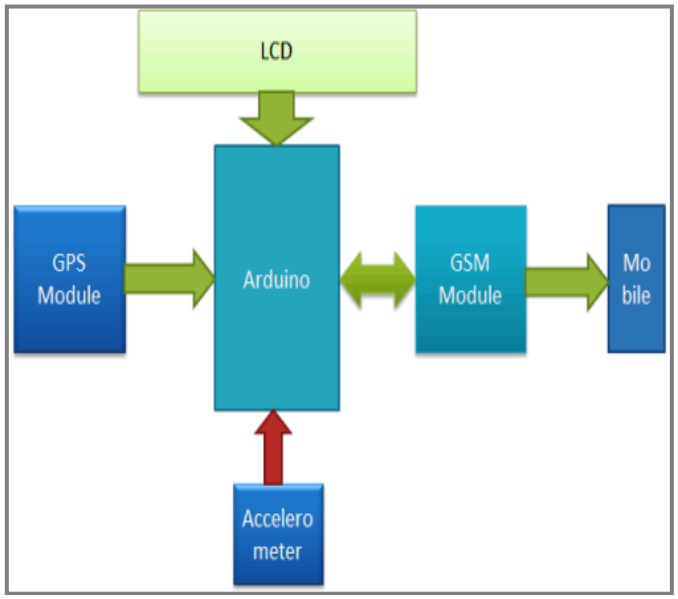

Figure 15: Block Diagram of SAS

IV. Materials and Cost Analysis

In the following table 2, material used for implementing the safety alert system and their specification details are given.

Table 2: Material Specification

S.NO	COMPONENT	SPECIFICATION
1	Arduino	CK 47 25V
2	Microcontroller	590 KIT V3.4
3	GSM Module	AN154
4	Bridge Rectifier	AC –DC SUPPLY
5	Step-Down Transformer	0-220V 1 AMPS 0-9V
6	Copperwire	0.286d
7	Limit Switch	AC 250V 6A DC 250V 0.3A
8	LCD Display	16*2

The cost estimation details of each component used in our system for implementing the safety alert system is shown in the following table 3.

Table 3: Cost Estimation Details

S. No	Component	Quantity	Cost (INR)
1	**Arduino**	1	520
2	**Gsm**	1	100
3	**Sim**	1	35
4	**Limit Switch**	1	75
5	**Manual Switch**	1	15
6	**Power Supply**	-	450
7	**LCD Display**	1	120
8	**Wires**	As required	60
TOTAL			1325 INR

V. Conclusion

Vehicle tracking system makes better fleet management and which in turn brings large profits. Better scheduling or route planning can enable you handle larger jobs 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 accident which we can't stop from occurring. Whenever 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 occurred in deserted places and midnights. Thus the accident can be reduced and controlled by using our project "SAFETY ALERT SYSTEM". In future, gas sensor can be implemented to identify the accident. GPRS can be integrated with Arduino with the help of ECU.

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