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VEHICLE ACCIDENT DETECTION AND AUTOMATIC REMOTE ALARM DEVICE

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Abstract: This project aims to address the critical issue of individuals being left without assistance in the event of an accident while riding their vehicle. With the implementation of an accident detection and alert system, this project seeks to provide a solution to this problem. The system utilizes an Arduino, GPS Receiver, and GSM module to control the entire process. The GPS Receiver identifies the vehicle's direction, while the GSM module sends an SMS containing the directions. The system can detect severe accidents using a Vibration sensor and can also identify rollovers. The microcontroller sends this information to the GSM module, which transmits the data, including the victim's precise location, to the assigned contact. The contact can then use the GPS MODEM to locate the victim and provide immediate assistance. This project offers a professional and innovative solution to a significant problem, ensuring the safety of individuals riding their vehicles. The implementation of the Accident Detection and Alert System using Arduino is a highly effective solution, particularly in developing nations such as Nepal, India, and Bangladesh where the number of vehicles on the road is rapidly increasing. With the rise in vehicular accidents, fatalities have also been on the rise. However, the Accident Detection and Alert System using Arduino can prevent uncertain deaths by sending a message alert to a registered mobile number, providing the precise location of the accident. This system is a valuable investment in ensuring the safety of drivers and passengers alike.

Keywords: GSM Module, GPS Modem, Ardunio Uno.

INTRODUCTION

Embedded Systems

An embedded system is a special purpose computer system that is designed to perform very small sets of designated activities. Embedded systems date back as early as the late 1960s where they used to control electromechanical telephone switches. The first recognizable embedded system was the Apollo Guidance Computer developed by Charles Draper and his team. Later they found their way into the military, medical sciences and the aerospace and automobile industries.

Today they are widely used to serve various purposes like:

- Network equipment such as firewall, router, switch, and so on.

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- Consumer equipment such as MP3 players, cell phones, PDAs, digital cameras, camcorders, home entertainment systems and so on.
- Household appliances such as microwaves, washing machines, televisions and so on.
- Mission-critical systems such as satellites and flight control.

The key factors that differentiate an embedded system from a desktop computer:

- They are cost sensitive.
- Most embedded systems have real time constraints.
- There are multitudes of CPU architectures such as ARM, MIPS, PowerPC that are used in embedded systems. Application-specific processors are employed in embedded systems.
- Embedded Systems have and require very few resources in terms of ROM or other I/O devices as compared to a desktop computer.

PROJECT INTRODUCTION

AIM:

The main aim of this project is to implement real time vehicle parameter monitoring to continuously tracking of a vehicle's position and to monitor vehicle parameters.

PURPOSE:

The purpose of the project is to monitor vehicle parameters. When they exceeds threshold intimation is given to the nearby RTA (or) vehicle manufacture including readings of parameters and location of the vehicle.

BLOCK DIAGRAM:

VEHICLE SECTION:

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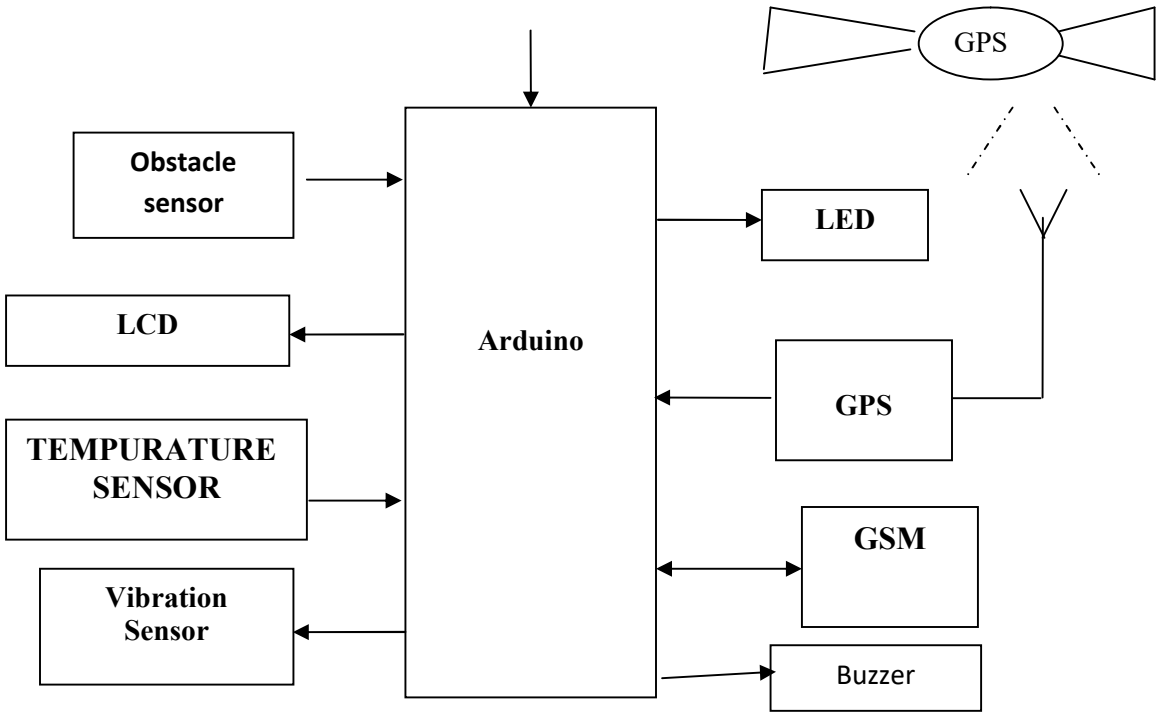

TECHNOLOGY:

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.

SOFTWARES:

1. Embedded C
2. Arduino IDE

HARDWARES:

1. Micro Controller
2. Power Supply
3. GPS module
4. GSM Module
5. Buzzer and alarm
6. Temperature Sensor
7. LCD

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8. Led

APPLICATIONS:

1. Used in vehicle tracking
2. Used for parameter monitoring
3. Used for theft identification

ARDUINO

Overview:

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno 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. The Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode.

The board has the following new features:

1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible with both the board that uses the AVR, which operates with 5V and with the Arduino Due that operates with 3.3V. The second one is a not connected pin, that is reserved for future purposes.

- Stronger RESET circuit.
- Atmega 16U2 replace the 8U2.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

GSM

(GLOBAL SYSTEM FOR MOBILE COMMUNICATION)

GSM (GLOBAL SYSTEM FOR MOBILE COMMUNICATION) is the most popular standard for mobile telephony systems in the world. The GSM Association, its promoting industry trade organization of mobile phone carriers and manufacturers, estimates that 80% of the global mobile market uses the standard. GSM is used by over 1.5 billion people across more than 212 countries and territories. This ubiquity means that subscribers can use their

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phones throughout the world, enabled by international roaming arrangements between mobile network operators. GSM differs from its predecessor technologies in that both signaling and speech channels are digital, and thus GSM is considered a second generation (2G) mobile phone system. This also facilitates the wide-spread implementation of data communication applications into the system.

The GSM standard has been an advantage to both consumers, who may benefit from the ability to roam and switch carriers without replacing phones, and also to network operators, who can choose equipment from many GSM equipment vendors. GSM also pioneered low-cost implementation of the short message service (SMS), also called text messaging, which has since been supported on other mobile phone standards as well. The standard includes a worldwide emergency telephone number feature (112).

Newer versions of the standard were backward-compatible with the original GSM system. For example, Release '97 of the standard added packet data capabilities by means of General Packet Radio Service (GPRS). Release '99 introduced higher speed data transmission using Enhanced Data Rates for GSM Evolution (EDGE).

G.P.S

History

The Global Positioning System (GPS) is a Global Navigation Satellite System (GNSS) developed by the United States Department of Defense. It is the only fully functional GNSS in the world. It uses a constellation of between 24 and 32 Medium Earth Orbit satellites that transmit precise microwave signals, which enable GPS receivers to determine their current location, the time, and their velocity. Its official name is NAVSTAR GPS. Although NAVSTAR is not an acronym, a few backronyms have been created for it. The GPS satellite constellation is managed by the United States Air Force 50th Space Wing. GPS is often used by civilians as a navigation system.

The GPS is made up of three parts: satellites orbiting the Earth; control and monitoring stations on Earth; and the GPS receivers owned by users. GPS satellites broadcast signals from space that are picked up and identified by GPS receivers. Each GPS receiver then provides three-dimensional location (latitude, longitude, and altitude) plus the time.

Components of a GPS

The GPS is divided into three major components

- The Control Segment
- The Space Segments
- The User Segment

LIQUID CRYSTAL DISPLAY

LCD screen:

LCD screen consists of two lines with 16 characters each. Each character consists of 5x7 dot matrix. Contrast on display depends on the power supply voltage and whether messages are displayed in one or two lines. For that reason, variable voltage 0-Vdd is applied on pin marked as Vee. Trimmer potentiometer is usually used for

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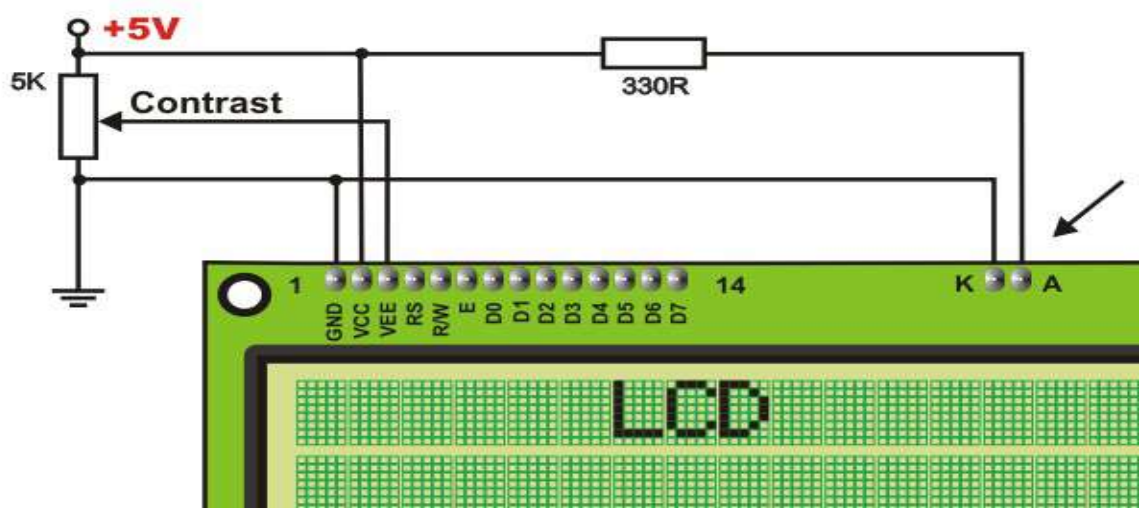
that purpose. Some versions of displays have built in backlight (blue or green diodes). When used during operating, a resistor for current limitation should be used (like with any LE diode).



SENSORS

LM35 TEMPERATURE SENSOR

LM35 is a precision IC **temperature sensor** with its output proportional to the temperature (in ºC). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With **LM35**, temperature can be measured more accurately than with a thermistor. It also possess low self heating and does not cause more than 0.1 ºC temperature rise in still air.

The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every ºC rise/fall in ambient temperature, *i.e.,* its scale factor is 0.01V/ºC

Pin No	Function	Name
1	Supply voltage; 5V (+35V to -2V)	Vcc
2	Output voltage (+6V to -1V)	Output
3	Ground (0V)	Ground

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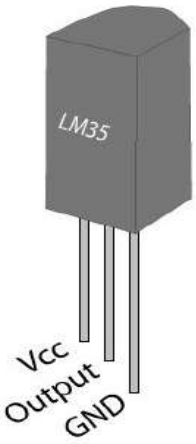


FIG: TEMPERATURE SENSOR LM35

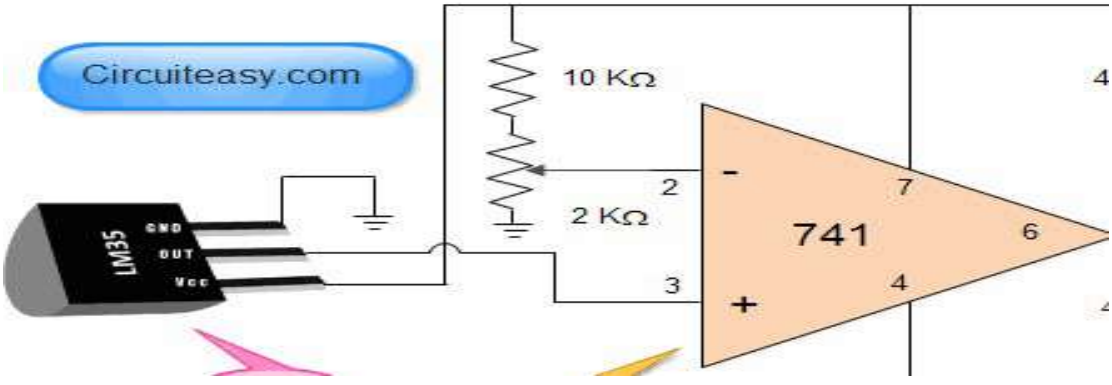
TEMPERATURE SENSOR

This project uses IC LM35 as a sensor for detecting accurate centigrade temperature. Linearity defines how well over a range of temperature a sensor's output consistently changes. Unlike thermistor, Linearity of a precision IC Sensors are very good of 0.5°C accuracy and has wide temperature range. its output voltage is linearly proportional to the Celsius (Centigrade) temperature.

The LM35 is rated to operate over a -55° to +150°C temperature range.It draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air. LM35 Operates from 4 to 30 volts.

Output of IC is 10mv/degree centigrade for eg if the output of sensor is 280 mV then temperature is 28 degree C. so by using a Digital multimeter we can easily calculate the degree temperature. For trigger point you should set the voltage of pin 2 of IC 741 by using preset or potentiometer.

Our aim of this project is not to construct a thermometer but to activate or deactivate a device at a particular margin temperature. For simplicity we have used 2 LED for indication of both low (Green) and high (Red) temperature.



Circuit Diagram of temperature sensor

Working: The output of IC2 increases in proportion to the temperature by 10 mV per degree. This varying voltage is feed to a comparator IC 741 (OP Amplifier). OP Amplifier are among the most widely used electronic devices

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today.The op-amp is one type of differential amplifier. It has two input inverting (-) and non-inverting (+) and one output pin. We have used IC741 as non-inverting amplifier which means pin 3 is the input and the output is not reversed. This circuit amplifies the difference between its input terminals.

As a comparator, Bistable output of an op amplifier is as follows :-

$$V_{\text{out}} = \begin{cases} V_{\text{S}+} & \text{if } V_1 \\ V_{\text{S}-} & \text{if } V_1 \\ 0 & \text{if } V \end{cases}$$

Part list:

IC LM35, IC LM741

Resistance: 10K Ohms, 470 Ohms X 2Pcs

Preset or P.O.T of 2K Ohms

LED 2pcs (Red and Green)

9V Battery with Snap

Switch, wire

**By making this Temperature Sensor Project, student will be capable of making many similar project i.e Automatic room heater controller, determine hotness of Tea or Coffee to avoid burning your tongue,Automatic Fan Controller etc.*

TILT SENSOR

A tilt sensor, or tilt switch, is a device used for measuring the tilt of an object in multiple axes with reference to an absolute level plane**. ... Tilt sensors work by detecting changes in angle from a pre-set "zero" state.Infrared Flame Detector.**

They are small and compact instruments which make them a viable option for many applications where orientation or inclination detection is a key factor, such as warning systems on construction or agricultural vehicles. Alongside our vast range of inclinometers and inclinometer sensors, our tilt-switches at Level Developments also use highly accurate sensors to operate, gaining an advantage over alternatives such as mercury switches or rolling ball mechanisms.

Tilt sensors work by detecting changes in angle from a pre-set "zero" state. They are set with a maximum and minimum threshold in which the application will work or be safe to operate based on the specific application's

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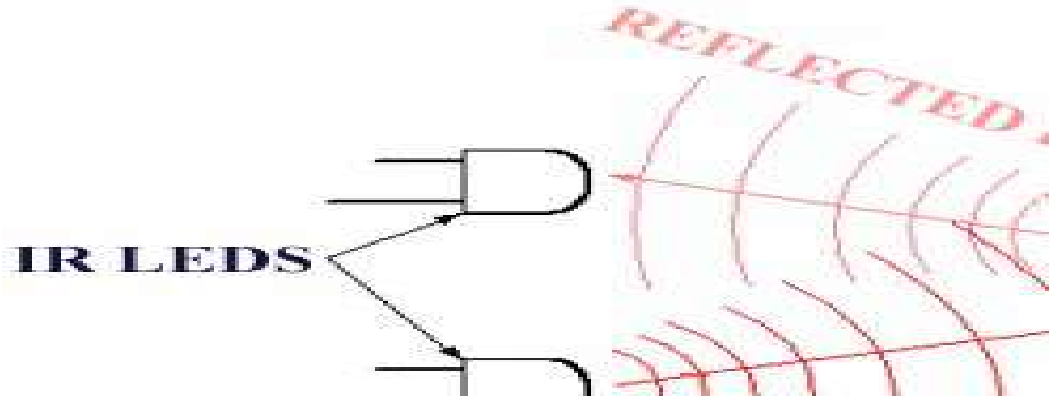
needs. If the tilt or inclination exceeds these threshold values in either direction, a relay will be engaged and the switch closed, thus sending an operation to an external device such as an alarm or warning light to indicate unsafe or non-working conditions.

IR SENSOR

IR the same principle in ALL Infra-Red proximity sensors. The basic idea is to send infra red light through IR-LEDs, which is then reflected by any object in front of the sensor.

Then all you have to do is to pick-up the reflected IR light. **For detecting the reflected IR light, we are going to use a very original technique: we are going to use another IR-LED,** to detect the IR light that was emitted from another led of the exact same type. This is an electrical property of Light Emitting Diodes (LEDs) which is the fact that a led produce a voltage difference across its leads when it is subjected to light. As if it was a photo-cell, but with much lower output current. In other words, the voltage generated by the leds can't be - in any way - used to generate electrical power from light, It can barely be detected. that's why as you will notice in the schematic, we are going to use a Op-Amp (operational Amplifier) to accurately detect very small voltage changes.



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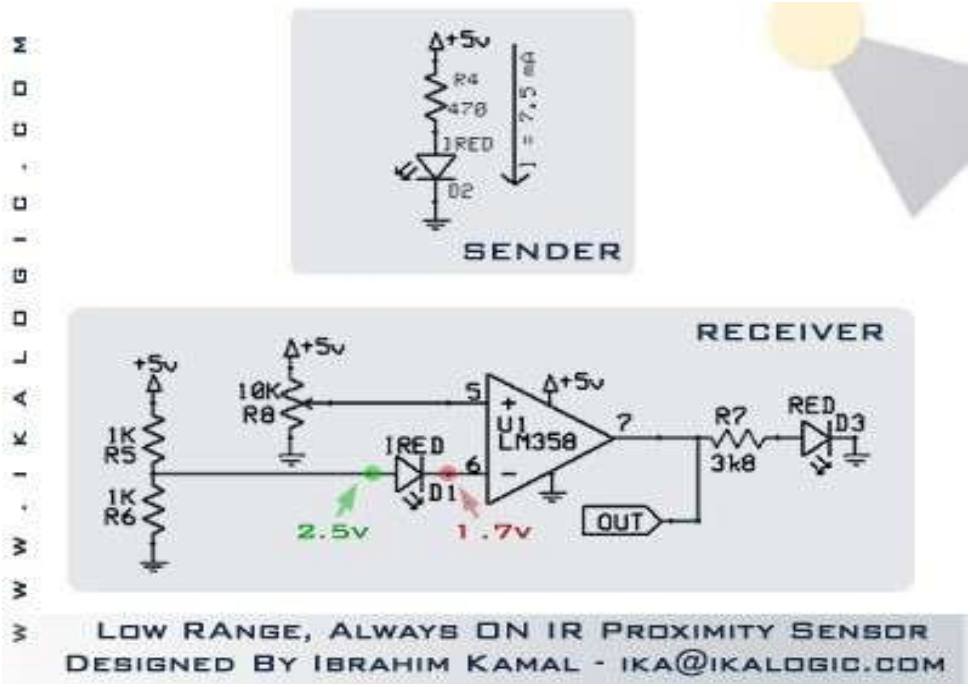

The sender is composed of an IR LED (D2) in series with a 470 Ohm resistor, yielding a forward current of 7.5mA. **The receiver** part is more complicated, the 2 resistors R5 and R6 form a voltage divider which provides 2.5V at the anode of the IR LED (here, this led will be used as a sensor). When IR light falls on the LED (D1), the voltage drop increases, the cathode's voltage of D1 may go as low as 1.4V or more, depending on the light intensity. This voltage drop can be detected using an Op-Amp (operational Amplifier **LM358**).

You will have to adjust the variable resistor (POT.) R8 so the the voltage at the positive input of the Op-Amp (pin No. 5) would be somewhere near 1.6 Volt. if you understand the functioning of Op-Amps, you will notice that the output will go High when the volt at the cathode of D1 drops under 1.6. So the output will be High when IR light is detected, which is the purpose of the receiver.

If the +ve input's voltage is higher than the -ve input's voltage, the output goes High (5v, given the supply voltage in the schematic), otherwise, if the +ve input's voltage is lower than the -ve input's voltage, then the output of the Op-Amp goes to Low (0V). It doesn't matter how big is the difference between the **+ve** and **-ve** inputs, even a 0.0001 volts difference will be detected, and the the output will swing to 0v or 5v according to which input has a higher voltage.

SOFTWARE DESCRIPTION

Arduino IDE compiler:

Arduino is an open-deliver electronics platform based mostly on smooth-to-use hardware and software utility. Arduino boards can observe inputs - slight on a sensor, a finger on a button, or a Twitter message - and flip it into an output - activating a motor, turning on an LED, publishing a few components online. You could tell your board what to do by sending a hard and fast of commands to the microcontroller at the

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board. To do so that you use the Arduino programming language (based totally mostly on Wiring), and the Arduino software (IDE), based on Processing.

Over the years Arduino has been the brain of lots of obligations, from regular gadgets to complex medical gadgets. A worldwide community of makers - college students, hobbyists, artists, programmers, and specialists - has collected spherical this open-deliver platform, their contributions have brought as much as a terrific amount of available know-how that can be of terrific assist to novices and experts alike.

Arduino has become born on the Ivrea interaction format Institute as a clean tool for instant prototyping, geared towards university college students without a historic past in electronics and programming. As quickly as it reached a miles wider community, the Arduino board started converting to conform to new dreams and traumatic situations, differentiating its provide from smooth eight-bit boards to merchandise for IoT

Programs, wearable, three-d printing, and embedded environments. All Arduino boards are without a doubt open-deliver, empowering clients to assemble them independently and ultimately adapt them to their unique dreams. The software program, too, is open-supply, and its miles growing thru the contributions of customers globally.

The advantages of the Arduino IDE utility are

1. much less steeply-priced
2. The clean smooth programming surroundings
3. Extensible software program application utility and hardware

ADVANTAGES:

- Easy to operate
- Sophisticated security
- Simple and Reliable Design
- Isolates both GSM signal

CONCLUSION

- The project **"Accident Detection and Alert System"** has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used and tested.
- Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit.

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- Secondly, using highly advanced Arduino board and with the help of growing technology the project has been successfully implemented.
-

FUTURE WORKS

- This system could be more reliable and useable if we develop or add some other features and systems. They are as follows:
- The Accident Alert System is a versatile system which can be modified to work with many other embedded circuits in vehicles to provide a number of applications.
- The Accident Alert System can be interfaced with the Air Bag system, which provides security to the driver in case of an accident.
- The circuit can be used for parking assistance in vehicles with slight modifications.
- A Proximity sensor can be added to the circuit, which would alert the driver by beeping a buzzer if the driver is about to collide with the vehicle in front.
- The presence of GSM modem makes it possible to track the vehicle in case of theft.
  The GPS modem makes it possible to make route navigation possible.
- A warning light or a loud horn can be interfaced with the circuit which is turned on in case of an accident, which draws the attention of the people nearby to the site of the accident

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