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ACCIDENT PREVENTION AND DETECTION WITH ALERT NOTIFICATIONS USING RADIO FREQUENCY

S. Boovaneswari [1]*, Dr.N.Palanivel[2] ,S. Dhevetha [3], M.S. Shabrin begum[4], S. Sneha [5] ,
[1] Assistant Professor, Department of Computer Science Engineering, Manakula Vinayagar Institute of Technology, Puducherry;
[2]Professor, Department of Computer Science Engineering, Manakula Vinayagar Institute of Technology, Puducherry;
[3] UG Scholar,Manakula Vinayagar Institute of Technology, Puducherry;
[4] UG Scholar, Manakula Vinayagar Institute of Technology, Puducherry;
[5]UG Scholar, Manakula Vinayagar Institute of Technology, Puducherry.

Abstract—The rise in mortality in our nation due to the occurrence of road accidents is very high. Quick medical attention can save a lot of lives. The main objective of this project is to determine the possibility of the occurrence of an accident efficiently and to prevent it, if possible. This is done with the help of radio frequency which is used to identify other vehicles whenever they are in close contact. The project can be classified into two categories which are accident detection and accident prevention. Speeding serves as the main reason for most accidents. The system focuses on finding the speed parameters of vehicles. If they seem to be maintained less than the fixed distance that needs to be maintained between each vehicle then a notification is sent to the respective car drivers which prevent the possibility of an accident. In the event of an accident, a notification with the current location is sent to the emergency contacts notifying them of it.

Keywords: Decision-making algorithm, IOT, GPS, Accident detection, Microcontroller, Berkeley algorithm

I.INTRODUCTION

Traffic crashes are one of the leading causes of death on Indian roadways. The exceptionally high frequency of on-road fatalities in India is a result of a variety of causes such as poor roads, reckless driving, and delayed medical attention. This system assists in quickly notifying the emergency contacts and allows for tracking the location of the car. Approximately 2300 accidents occur per day in India and 500 lives were lost in 2022. In the year 2022, India registered 59.7 percent of fatalities that occurred due to road accidents. Internet connectivity plays an important role in our daily lives, the data is processed at high speed which makes our daily activities faster and more efficient. The term “Internet of Things” is used in this context to refer to the network expansion by connecting and computing certain data present in common objects to work efficiently with restricted human intervention. Due to the occurrence of road accidents increasing rapidly, our system serves as a solution for the early prevention and detection of accidents. Our process can be separated into two main functions which are

prevention and detection. The prevention module monitors the distance between each vehicle and if there is a possibility of an accident occurring then the sound alarm starts beeping and also the speed of the vehicle can be controlled. In the event of an accident, the detection module finds if there is an occurrence of an accident and sends a notification to the person's emergency contacts along with the location of the accident for quicker medical attention.
The system is mainly functioning with the help of Radio Frequency which is used to calculate the distance between two vehicles and sends a signal to the alarm which starts beeping to let the driver know that there is a possibility of an accident.

INTERNET OF THINGS:

The Internet of Things(IoT) explains the interrelated network of physical objects (i.e., things) that have been embedded with software, sensors, and other similar technologies to connect and switch data with other related devices and systems over the internet. The network of connected devices and technologies aids in communication between the bias and the pall, as well as between the devices themselves.An IoT refers to a system of interconnected, internet-connected things that are appropriate to collect and transfer data over a wireless network without any physical connection.

The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals, or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

The Internet of Things is a pretty simple concept, it means taking all the physical places and things in the world and connecting them to the internet. It describes the network of physical objects—"things"—that are embedded with sensors, software, and other technologies to connect and exchange data with other devices and systems over the internet. These devices range from ordinary household objects to sophisticated industrial tools.

II.LITERATURE SURVEY

[1] Saad Ur Rehman et al (2021) proposed the model to be done only on motorbikes and has been tested with various bikes. This system can be divided into two different modules which are the Sensory unit and the data collection unit. It comprises MEMS 3-axis accelerometer, GSM module, Arduino UNO microcontroller, and battery unit. The battery is also directly connected to the motorbike to minimize the cost.This project is mainly based on the Tilt sensor. A tilt sensor is used to detect the tilt level of a motorbike. Fixing a tilt sensor can be used to find the occurrence of an accident by the inclination of the motorbike. The tilt sensor is connected to MPU 6050 accelerometer which is used to measure the 3-axis accelerometer and is then converted to the tilt angle by using certain mathematical formulas.The MEMS(Micro Electro Mechanical Systems) which is used with an accelerometer is used for finding and outputting the accelerations. It can be used for measuring the tilt, shock, and vibrations which is mainly for positioning and balancing the detection. After a series of crash tests, the safe tilt zone is found and the tilt angle lies between -40 and 40 degrees. This angle is set so that any tilt which does not belong to this safe zone is considered an accident. When a tilt angle exceeds the limit, it is considered to be an accident. So when this situation occurs, the location of the

injured driver is detected by the use of GSM and is sent to the emergency contacts of that particular person. The location is sent via SMS and also GPRS which is an online sensor.

[2] Souvik Roy et al (2020) propose the idea with a total of two separate modules which are the Radar Range Algorithm[RRA] and Distance-Time Based Parameter. The RRA is used for calculating barriers that are present in the vicinity before the collision occurs. The DTBP is used for the detection of accidents and the geolocation coordinates using Haversine Formula.The Haversine Formula is an accurate method of points by making use of the latitude and longitude of those points. The calculation of the geo-locations for accident detection can be retrieved by utilizing.This project uses an Atmega microcontroller, an LCD module, a Power Supply Unit, and an accelerometer/gyroscope sensor module. It also makes use of GPS and GSM to send emergency medical aid which will be very useful for reducing the mortality rate. The Bluetooth range of HC-05 is used for transmitting and receiving data between vehicles. This system for sending emergency medical aid is triggered by two possibilities which are the occurrence of accidents and the fire outbreak. These triggers are not accurate. So to avoid any false alarms which are inaccurate representations of accident detection. A manual switch is placed to cancel the false alarm within 10 seconds of sending.

[3] Durgesh Kumar et al (2020) analyzed various factors that serve as a reason for the road traffic accidents such as speed, alcohol, seat belts, visibility, distributed driving, exhaustion, and other human factors. Even if an accident occurs, if medical aid arrives at the scene as soon as possible the death rate of these fatalities can be reduced by a significant amount. Thus the emergency SOS seems to be an essential factor in reducing the number of deaths in road accidents. The software used here is OpenCV, Keras, and TensorFlow.An Open Source Computer Vision Library is used here for machine learning, image processing, and computer vision. From finding human actions in videos to following the eye movement of a person this algorithm acts very precisely. Keras is an open NN written in python used in TensorFlow which is used to build models, define layers, and set multiple input and output values. TensorFlow is a tool for building and implementing machine learning applications. A total of 1730 accident videos each of 4 seconds which are further divided into 100 frames on each were manually annotated. These videos are of high quality and collected from major cities ranging from motorbike to car collisions to train the system. The analysis of these videos in an automated manner has its own set of difficulties. Each image is broken into several frames which have to be analyzed separately. The algorithm works with two layers of short-term memory NN. The first layer is used to analyze whether it contains accidents or not. The second layer consists of checking the time dependence of car mischance. By training the system to detect accidents, manual labor becomes less and the possibility of an accident can be detected in a precise manner. This system had an accuracy of 92% while testing it after being trained in computing distance on the surface of a sphere between two

[4] Lukman Adewale Ajao et al (2020) worked on a model using an Arduino UNO board, limit switch, accelerometer (adx1335), GPS (NEO6M), GSP module(sim900A), and a Battery Temperature Sensor(BTS) to calculate the distance. The GSM module uses a dual band of 900MHz and 1800MHz and it operates at a 3A power supply. The system tracks the location

of the vehicle using GPS and verifies the condition by using the accelerometer and the limit switch and sends these data to the microcontroller where these data are processed and the position of the actuator is sensed. Depending on the result of these outputs, the SMS is sent to the corresponding contacts, medical service, and police stations.With this system, the occurrence of an accident can be determined by using the sensors such as the Limit switch and the 3-axis accelerometer combined with the latitude and longitude of the GPS in a short period in an effective manner.

[5] Madhura R Shankarpure and Deepa Abin (2019) developed a model in Android Studio 3.4.1. The compatibility of the device is jelly bean OS or higher to function properly. It should have RAM of 512 MB or more.It can be ultimately divided into two devices where one is used for the driver and the other is used for the owner of the vehicle.The components that are used are an accelerometer with a frequency of 100 samples/second, and a GPS with a frequency of 1575.42MHz. It consists of 27 satellites that continuously orbit around the earth and transmit the required information to the receiver. The range from the different satellites to that of the mobile phones may differ. This proposed project uses an inbuilt smartphone sensor accelerometer to measure the tilt range and orientation of the mobile phone by using the direction and sending the location of the accident to emergency medical services.This system uses a Decision-Making Algorithm to effectively detect the accident. This was inspired by the Particle Swarm Optimization Algorithm. This is a computational method that optimizes a problem by continually improving a candidate's solution concerning quality.

[6] Mohammad Ehsanul Alim et al (2020) propose that the module be embedded with an MQ-an 3-sensor breathalyzer for the detection of alcohol and an SW420 vibration sensor is used for accident detection. The two microcontrollers such as Arduino Mega2560 which is used in bikes and Arduino Nano which is used in helmet units. GSM is in the receiver from which a message is to be sent when an accident has happened and the GPS module is used to find the exact location of the accident. The DC adapter is connected to the gear and an OLED display shows the outputs and all the data will be sent using radio frequency communication. The dual motor controller can supply 12v power. Thus all these are connected in a circuit to find the accurate decision for the driver. The different conditions are calculated by the microcontroller which provides accurate decisions.

III.EXISTING SYSTEM

The system that is used previously or is in current use lacks precision due to various factors to detect the accident. It also makes use of easily disposable objects made of flimsy material which can be ultimately destroyed in case of a minor crash.

The existing system does not apply brakes in case of an emergency, and if met with a sudden movement by vehicles that are moving dangerously close then it is not intimated. And if in some unavoidable situation, the vehicle along with all of its passengers are met with an accident, it would take a considerable amount of time before it is noticed by other people and it would take even longer to get medical help.

The increased use of vehicles in today’s population seems to be a major reason for the occurrence of road accidents. Preventing the occurrence of accidents and also by detecting

accidents as soon as it occurs is a crucial stage in decreasing the mortality rate. The delay of the emergency services due to late detection can be prevented by sending a message to the emergency contacts as soon as the accident occurs. The prevention of the accident is done by the Berkeley algorithm and if the algorithm fails to achieve its purpose then its last resort would be to send a message to the victim's contacts for quick medical services.

LIMITATIONS

- Slow medical help
- The location is not known
- Quick speed control is not done
- Loss of lives
- Intimation if vehicles are near is not possible

PRE EXISTING SYSTEM

The existing system focuses on the vehicles that are about to crash in a straight manner, it doesn't check out for vehicles that come from all directions. The presence of the camera has fulfilled its fair share of detection but there are a lot more drawbacks to it. The presence of light plays a crucial factor in the detection and when there is a minimal amount of light present in that area, it would be very hard to prevent an accident. The fast-approaching vehicle may not be detected by the camera because of the lack of light and may result in an accident.

The older generation of cars does not have a built-in accident detector so this would be very beneficial to them. Furthermore, it would be hard to detect a vehicle that is moving very fast when it is present in a blind spot of the driver or the traffic in that place is messy to drive.

By referring to various papers, it can be found that each of the projects comprises both an advantage and a disadvantage. The IOT-based paper using Arduino and Gps has a complete system that can detect the accident at a low cost and also send the location to the victim's family.

The main disadvantage of this project is that the medical arrival time is too late as the emergency message along with the GPS location is only sent to the family. The time lag between the accident and the arrival time of the medical aid is large which has a possibility of adding to the already increased mortality rate.

The Arduino-based accident detection uses an Arduino board paired with a Battery Temperature Sensor. The exact location of the accident is sent to the particular emergency contacts. Even though the location has been sent to the victim's emergency contact, it will still take a considerable amount of time before this location is shared with the rescue team.

The deep learning methodology seems very useful as the process is fully monitored. The system is trained with various videos of real-time accidents ranging from motorbike to car accidents. The process is studied thoroughly by inputting various types of data such as the driver's condition, weather, and other circumstances.

The tests of these reports seemed positive but the unpredictability of a human can not be calculated and is unpredictable. The video of the accident may seem simple but the video is divided into hundreds of images which is quite hard to do.

The inbuilt mobile sensor accident detection is an app that tracks the GPS location of the car and keeps track of all the nearby medical services. The system is based on the orientation of the mobile phone by which various accidents can be detected.

Though the system can detect and prevent the accident, there is no way to identify if a vehicle

is about to crash with another vehicle. It can only detect the upcoming accident that is about to happen but there is no possible way to avoid it. The entire process depends on a phone. If the phone is lost or misplaced, it can turn fatal because a mobile phone can be broken easily

IV.MOTIVATION

The system is developed with the intent of developing a system that can be implemented in vehicles that would aid drivers in safe travel. The possibility of detecting a possible accident is enhanced in this system which would alert the driver in case of a vehicle approaching too close to another vehicle which can cause an accident. The system also alerts the nearby hospitals and close relatives if an accident takes place. The notification of an accident along with the location of the accident is sent to the receiver with the help of GPS which helps in providing emergency medical aid to the victims of the accident which ultimately helps in lowering the mortality rate. The potential benefits of using the detection system:

1. Mortality rate: By providing quick medical help to the victim, the constant increase in the death rate can be controlled and severe fatalities can be avoided.
2. Communication: The communication between the victim and their family and also between the victim and the emergency services can be improved.
3. The response time between the occurrence of the accident and the medical service is accelerated which helps in avoiding fatalities.
4. Location access: The exact location of the occurrence of the accident can be detected with the use of GPS.

V.PROPOSED SYSTEM

A major objective of a system is to produce an output that has value to its user. Whatever the nature of the output (goods, services, or information), it must be in line with the expectations of the intended user. Inputs are the elements (material, human resources, and information) that enter the system for processing. The notification system is based on new technology, and its main purpose is to detect an accident and alert the near hospital and emergency contact, so the victim can find some help.If this system is inserted in every vehicle then it is easy to prevent victim life and reduce the death rate.

METHOD

The proposed system makes use of a microprocessor to calculate the possibility of accidents by using the Berkeley algorithm, the inputs are derived from various sources such as sensor MPU 6050, a timing disk that calculates the speed with which the vehicle is maintaining, the radio frequency which uses the RSSI to indicate the distance with which the other vehicle is traveling. These inputs are passed to the microprocessor and then the necessary action is to be done based on the result.

The product proposed meets the following requirements.

- Is compact and lightweight to conserve resources
- Predicts the possibility of an accident
- Quick medical help
- The precise location of the accident
- Cost effective
- Victim life can be saved quickly
- Better accuracy

VI.IMPLEMENTATION

Data Collection:

The data from various devices and sensors for the calculation of 3 axis accelerometer, gyroscope, the speed of the vehicle, and the distance between the vehicles are inferred in this module. The distance between the vehicle is derived by the use of Radiofrequency which transmits and receives the signals.

Processing Module:

The data that is received from these devices are passed as inputs into the microcontroller by the I2C communication and serial communication. These inputs are manipulated by using the Berkeley algorithm to find the successive process.

Detection Module:

In this stage, the appropriate process is done depending on the output of the Berkeley algorithm. Based on the output, the actuator or the alarm, or the notification process is activated.

Modules Used:

- GPS
- GPS Antenna
- GSM-R module
- Buck converter DC to DC
- Node MCU
- GY521 Accelero and Gyro sensor
- Lithium ion battery

GPS Antenna:

The GPS antenna is directly connected to the GPS to amplify the signals that are being transmitted by satellites and it converts the signals that are received so that it can be used by the GPS to exactly identify the location.

GSM-R Module:

This device enables the system to communicate wirelessly through the mobile phone technology to communicate with other mobile networks. This system has a small slot for a nano sim which can be used for communication such as sms. This would allow the sim to send the pre designed text to the emergency contacts. This is connected to the Buck converter and another connection is sent to the Node MCU.

Buck converter DC to DC:

The DC to DC step down module which has the input voltage of 3.2 v to 40v and output voltage of 1.25v to 35v which gets the information from GPS and converts the location as message and send it to the GSM-R module which helps to send the location as the message to the victim 's relatives.

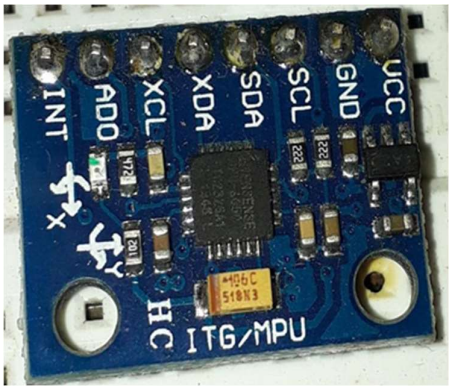
Node MCU:

Node MCU is a firmware of microcontroller development board which has a built-in wifi capacity. It is a development environment consisting of both hardware and software. This is

planted into the breadboard which receives input from various sources such as GPs receiver, GY 521, GSMR and a Buck converter.

GY 521

The GY 521 module has a regulator of 3.3v which should be inputted with a 5v. This module makes use of I2C communications. It contains a 3 axis accelerometer, 3 axis gyroscope and a digital sensor. This is used to process the algorithms with the inputs that have been received.



Components Used:

Hardware Requirements

- RF transmitter and receiver
  - Received signal strength indicator
- IMU Sensor
- MicroController(Arduino)
- Ultrasonic Sensor
- MPU 6050
- Relay
- Actuator
- Timing disk
  - Speedometer
- Alarm
- NodeMCU
- Battery 12V
- Miscellaneous[wires, connectors]

Radio Frequency:

The RF is used to measure the distance between two vehicles. This is mainly indicated by the RSSI. The Transmitter and receiver that are present transmit signals, so the process of transmitting signals is continued while the receiving is also done simultaneously. This signal that is being constantly collected is how the distance between the vehicles can be determined. The closer the signals are, the nearer the vehicle is present.

The communication between the devices is said to be in serial communication. It is the process of sending one-bit data at a time in a sequential manner over a communication channel. (2.4 GHz) RF. RF refers to the electromagnetic surge frequency within a range of 3 kHz to 300 GHz, including the frequency used for dispatches or Radar Signals. The decibel (or dB) is the basic unit used for radio frequency (RF) power measurement. Received signal strength

indicator (RSSI) is a measurement of the power present in a received radio signal.
RSSI can be abbreviated as Received Signal Strength Indicator, which is a way of calculating the strength of signals that's been received from the Radiofrequency. It is useful for determining how good the signal is. The formula can simply calculate RSSI.

RSSi=Pt-Pl(d)

Here the term Pt refers to the power of the actual signal transmission. The term Pl(d) denotes the loss of the signal power when it travels a distance of d. It is calculated in the decibel format. Factors like the height of the sensor placement, and the diversity of the device can affect the precision of the sensor.

IMU Sensor:

An IMU is a specific type of detector that measures angular rate, and force. IMUs are composed of a 3-axis accelerometer and a 3-axis gyroscope, which would be considered a 6-axis IMU. They can also include a new 3-axis magnetometer, which would be considered a 9-axis IMU.

Microcontroller:

A microcontroller is a compact intertwined circuit designed to govern a specific operation in an embedded system. A typical microcontroller includes a processor, memory, and input/ affair(I/ O) peripherals on a single chip. Arduino is an open-source electronics platform that's grounded on beginner-status hardware and software. The hardware element of an Arduino board is a programmable circuit board that's also known as a microcontroller.
A microcontroller is a small integrated circuit that is designed compactly to look over a particular operation in the embedded system. It is rooted inside of a system to control a specific function in a system. It receives the input values from the peripheral devices and interprets them using the processor.
The data that are gained from the input peripherals such as MPU 6050, ultrasonic, radio frequency, and timing disk are stored in temporary data memory. The processor can access these data and manipulate them by using the program that is the Berkeley algorithm that is programmed into it and then enact the proper output.

Ultrasonic Sensor:

Ultrasonic detectors work by emitting sound surges at a frequency too high for humans to hear. We use I2C communication which sends to a microcontroller. They also stay for the sound to be reflected, calculating the distance based on the time needed. This is comparable to how radar measures the time it takes a radio surge to return after hitting an object.

MPU6050:

The MPU6050 is a Micro-Electro-Mechanical System (MEMS) that consists of a 3- axis Accelerometer and 3- axis Gyroscope inside it.In this also we use I2C communication which sends a signal to a microcontroller. MPU6050 is used in different artificial systems and electronic devices to control and describe the 3-D stir of different objects.

Relays:

Relays are electrically operated switches that open and close the circuits by entering electrical signals from outside sources. A relay is a device that is used to connect the different volts and to pass the data between them. The microprocessor can be operated only by a 6v and the actuator works in 12v so to make this work together, an electromechanical switch which is

turned on and off by an electromagnet is used to make this connection work.

Actuator:

An actuator is a device that produces a stir by converting energy and signals going into the system. The stir it produces can be either rotary or linear. Actuators work behind the scenes in vehicles to convert energy into physical action or force.

The actuators are usually small devices that are present inside of a dashing board. It produces a motion by converting the signals that go into the vehicle. This is an important part that is used to control the brake of the vehicle in case of an emergency.

Timing Disk:

A timing disk is a type of device that is used to create friction and calculate the speed of the ignition. The timing disk is directly connected to the speedometer. This is usually used to find out the rpm so that the necessary action can be done. If this disk is not set properly, then there is a possibility of the engine not starting depending on the type of the disk. This disk is also responsible for the usage of brakes in the vehicles so if the vehicles are above the speed limit, then when the brakes are applied then the pressure increases and it forces the pads that are present there to squeeze tighter which in turn reduces the speed as the rotation is not in process. The speedometer is a type of gauge that is used for measuring and displaying the current speed of the vehicle. This is done by the use of a speed sensor which is mounted near the gear transmission and as the gear starts spinning the teeth of the gear whiz past it which interrupts the magnetic field.

This is connected manually to both the timing disk and the microprocessor and there are no special communications in it. The speed of the vehicle actively takes a huge part in the decision-making of the Berkeley algorithm.

NodeMCU:

The NodeMCU(Node MicroController Unit) is an open-source software and hardware development environment that's erected around a veritably affordable System-on-a-Chip (SoC) called the ESP8266.

Software Requirements

- Programming languages
  - Embedded C
  - C++
  - Html
  - CSS
  - JavaScript
- Berkeley Algorithm
- GPS
- Cloud
- API
- Webpage

Embedded C:

Embedded C is a set of language extensions for the C programming language. Embedded C Programming with Keil Language. Developing programs for specific hardware used in cars, modems, appliances, and cellular devices. Dennis Ritchie designed the embedded c.Here we are using this to code the Berkeley algorithm.

C++:

C++ is a cross-platform language. An extension of the C language is developed by Bjarne Stroustrup. C++ is a family of C. High level of control over system resources and memory is given by the C++ programmers. It is used to create high-performance applications. It is used along with embedded C to code the Berkeley algorithm.

Berkeley algorithm:

The Berkeley algorithm is a type of clock synchronization that is used in distributed computing. It is a master-slave process where the anode is selected as the master by a process of master election. It then calculates the time taken by each slave to get the process done and after the calculations are done, it then sends the output further so that it can be adjusted to accommodate the time of the slaves.

$$D_w = \frac{1}{2}\left(\frac{v^2}{a} - \frac{(v - v_0)^2}{a}\right) + v\,(t_1 + t_2) + d_0$$

Where,

d0 - head offset distance

v - rear vehicle speed

v0 - relative speed between the vehicles

t1 - system delay

t2 - driver reaction time

a - vehicle maximum brake deceleration.

GPS:

GPS standard for the global positioning system. Here we are using NE06M. It is used to get the current location of the victim.It sends the location as a message to the hospital and victims' close relatives.

API:

API standard for an application programming interface. It is a way for two or more computer programs to communicate with each other. API officially supports Java, Perl, PHP, Python, and C#.Here it works between node MCU and the cloud.

VII.EXPERIMENTS AND DISCUSSIONS

Specify the criteria: Recognize the device needs by adding the target audience, the precise use case, and the standards of the device. This would require getting feedback from people who drive on a regular basis and their emergency contacts.

Plan and design the system architecture: The architecture of the device includes the hardware and software components. This would involve proper planning of the equipment, and other required needs, and creating the algorithms for detecting the accidents.

Setting up the system: This includes creating the firmware with a microcontroller, accident detection algorithm, and notification system. This would also include writing the code in an appropriate programming language.

Processing inputs: By extracting various input values from different devices, the values are processed by using the algorithm to arrive at the necessary step.

Architecture:

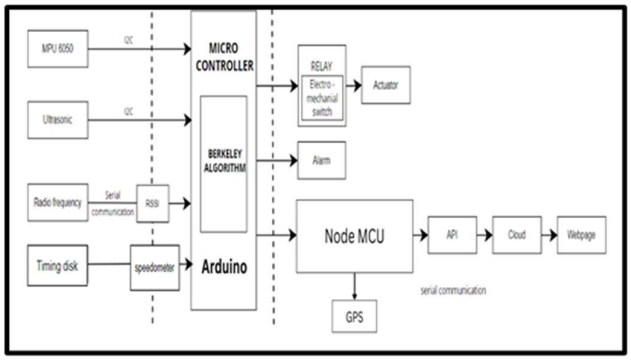


Fig:7.1 Architecture

The inputs from various sources such as MPU 6065, Ultrasonic, Radio frequency and timing disk are the main factors. The MPU 6065 is used for the calculation of the 3 axis accelerometer and gyroscope. The Radio frequency is used for transmitting and receiving of the signals from the vehicles and the signal strength is calculated by RSSI. The speed of the vehicle is taken from the timing disk and is sent to the speedometer for calculation. All these values are inputted into the Microcontroller.

The microcontroller is programmed with Berkeley algorithm by using embedded C and C++. The Berkeley algorithm is used for the detection of accidents and taking certain measures. Then even if the accident occurs after the certain measures then the emergency message is sent to the medical center and also the emergency messages to notify the close members of the accident. The location of the accident is retrieved from the GPS and is sent along with the message. The specific address of the GPS that we have used in this project is GPRMC which is an important factor for finding the location of the victim.

After the inputs are calculated with the algorithm, the necessary step is done. If the vehicles are too close to each other and the possibility of an accident is high then the alarm starts going off notifying the driver of the impending danger. The driver can take necessary action and can avoid the accident by applying brakes or can control the speed. Else the microcontroller sends an notifying the actuator so that the brake is applied. The brake for the vehicle is triggered by the use of a relay. The relay is an electromechanical switch which is used to convert the volts to function properly. The microcontroller works on 3.3 volts and the actuator works on 12 volts. So to transmit the required data, the relay is used which makes it possible to communicate.

If by some chance, the accident takes place even after all this precaution. Then the emergency message is sent. The user can set an account in the website and can add emergency contacts to whom the message should be sent. While the message is being sent, it also adds the GPS location that is retrieved at the time of accident. Thus by adding the location here, the medical help can be provided in a timely manner which can reduce the mortality rate

Flow chart:

The flowchart is constructed in a way so that it is easy to analyse the entire system and also check the flow of data in an ordered manner. It starts from when the engine turns on and continuously works in checking the probability of an accident and doing the requirements in case of an accident till the engine turns off. After the engine turns on, the speed of the vehicle is checked. It is required that the speed is above a particular limit and then gets the input values from various devices and is finally inputted for computing with the Berkeley Algorithm. And

depending on the output of the algorithm, the required action is done such as raising an alarm, controlling the speed or sending a message to the emergency contacts with the location of the accident.

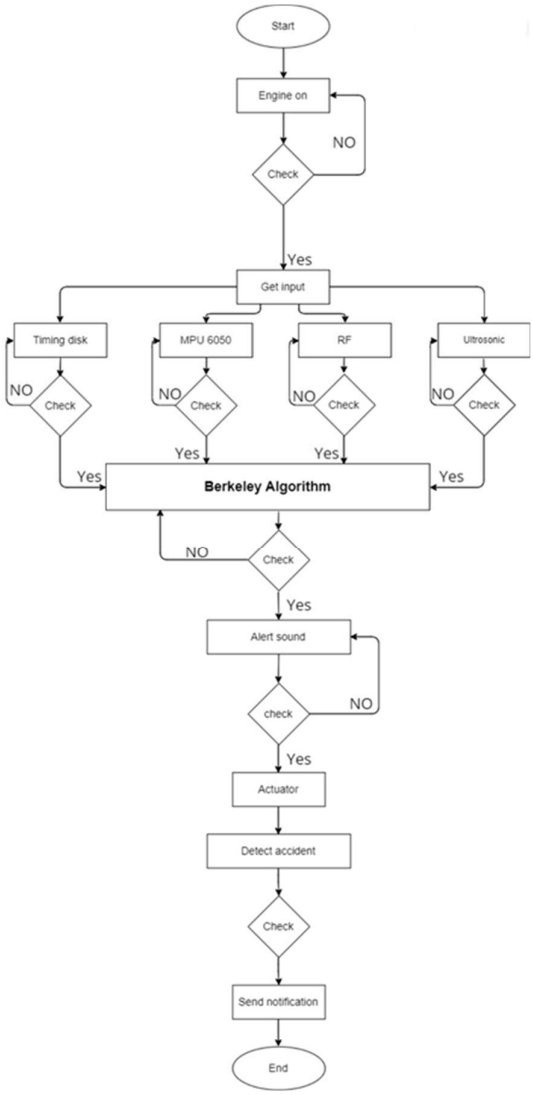


Fig:7.2 Flow chart

State of collision:
Inertial State

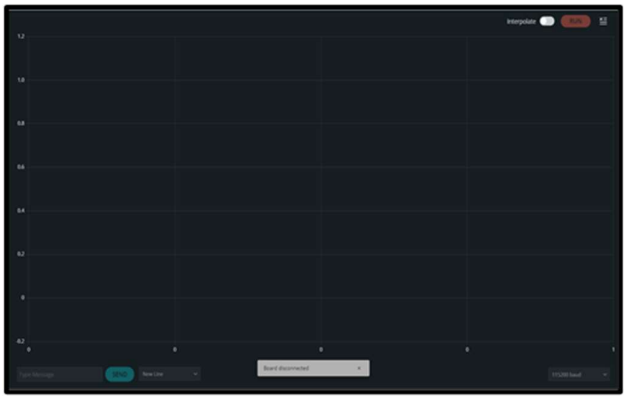


Fig:7.3 Inertial state

Initial State

Fig:7.4 Initial state

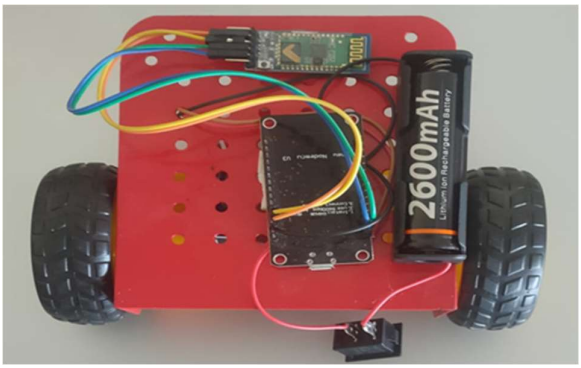
Jerk State

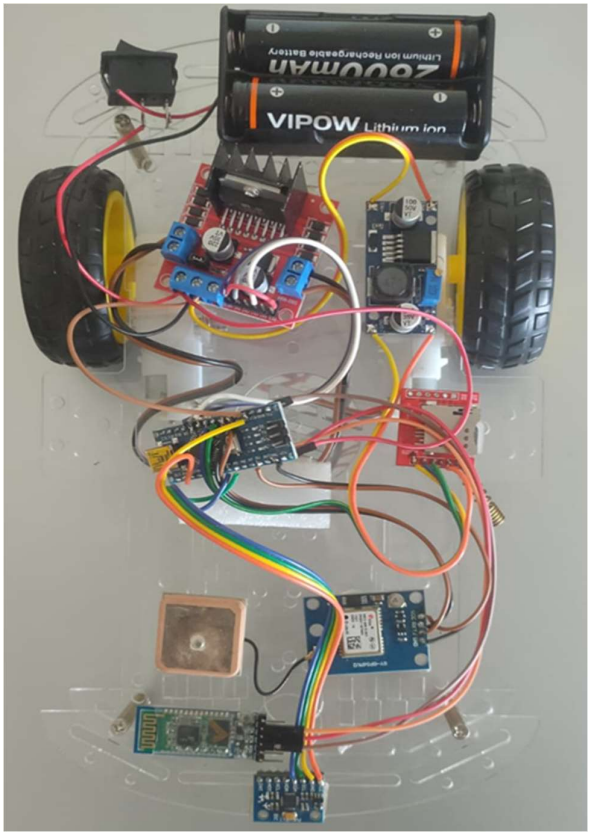
Fig:7.5 Jerk state

Collision State

Fig:7.6 Collision state

Proposed system model





VIII.CONCLUSION

Based on these premises, it can be concluded that this system can work optimally if supported by the necessary factors such as the radio frequency which can determine the RSSI, Ultrasonic rays, MPU 6050 sensor which has a 3-axis accelerometer and 3-axis gyroscope and timing disk which is used to determine the speed. The Berkeley algorithm is used to precisely calculate the possibility of upcoming accidents if detected. This is powered by a 12v battery which is easily replaceable if there is no power in it. This could easily be stated as a low-cost but effective prevention system.

The accident prevention and detection system is mainly operated by the microprocessor, and is not powered by a large device but makes use of a small 12v battery to charge it. This project successfully demonstrates how a vehicle can travel without facing any accidents and continually makes calculations to predict the occurrence of accidents. And even if an accident takes place then the emergency medical help will aid in saving the victim's life by providing quick medical help.

IX.FUTURE SCOPE

This system can be further developed by making the system more accurate and precise by adding various protection methods to further protect the system along with the vehicle. In the future, we hope to equip our current design with sensors that will allow the system to detect and prevent hitting inanimate objects and other living beings. Once these are in place, it would be ideal for concentrating more on making the vehicles go in an ordered manner so there is no

possibility of an accident. Moreover, if this system is used more widely and is monitored by the higher officials of the society then it would make the drivers drive more cautiously as speeding or other incidents will raise a question as to why the action is taken without a reasonable point.

REFERENCES

[1] Saad Ur Rehman; Shaheryar Ahmad Khan; Arshia Arif; Umar S. Khan(2021), Iot-Based Accident Detection And Emergency Alert System For Motorbikes.In 2021 International Conference on Artificial Intelligence and Mechatronics Systems (AIMS). DOI:10.1109/AIMS52415.2021.9466055

[2] Souvik Roy; Akanksha Kumari; Pulakesh Roy; Rajib Banerjee,(2020), An Arduino Based Automatic Accident Detection and Location Communication System.IN 2020 IEEE 1st International Conference for Convergence in Engineering.DOI:10.1109/ICCE50343.2020.9290701

[3] Durgesh Kumar Yadav; Renu; Ankita; Iftisham Anjum.(2020).Accident Detection Using Deep Learning.In 2020 2nd International Conference on Advances in Computing, Communication Control and Networking (ICACCCT).DOI: 10.1109/ICACCCN51052.2020.9362808

[4] Lukman Adewale Ajao; Blessing Olatunde Abisoye; Ibrahim Zakariyawu Jibril; Udeme Monday Jonah; Jonathan Gana Kolo. (2020).In-Vehicle Traffic Accident Detection And Alerting System Using Distance-Time Based Parameters And Radar Range Algorithm.In 2020 IEEE PES/IAS Power Africa.DOI: 10.1109/PowerAfrica49420.2020.9219812

[5] Madhura R. Shankarpure; Deepa Abin. (2019).Application for Car Accident Detection and Prevention Using Inbuilt Mobile Sensor Based On BIOA.In 2019 5th International Conference On Computing, Communication, Control, And Automation.DOI: 10.1109/ICCUBEA47591.2019.9128705

[6] Mohammad Ehsanul Alim; Sarosh Ahmad; Marzieh Naghdi Dorabati; Ihab Hassoun.(2020).Design & Implementation of IoT-Based Smart Helmet for Road Accident Detection.In 2020 11th IEEE Annual Information Technology, Electronics, and Mobile Communication Conference.DOI: 10.1109/IEMCON51383.2020.9284820

[7] Smeet Jani; Parthkumar Patel; Bhargav Divakar; Vismay Patel; Rutu Parekh.(2020).Cloud-based Accident Detection and Notification System.In 2020 IEEE International Students' Conference on Electrical, Electronics and Computer Science (SCEECS). DOI: 10.1109/SCEECS48394.2020.153

[8] Unaiza Alvi; Muazzam A. Khan Khattak; Balawal Shabir; Asad Waqar Malik; Sher Ramzan Muhammad(2020).A Comprehensive Study on IoT-Based Accident Detection Systems for Smart Vehicles.InIEEE Access (Volume: 8).DOI: 10.1109/ACCESS.2020.3006887

[9] Pranto Karmokar; Saikot Bairagi; Anuprova Mondal; Fernaz Narin Nur; Nazmun Nessa Moon; Asif Karim; Kheng Cher Yeo.(2020).A Novel IoT-based Accident Detection and Rescue System. In 2020 Third International Conference on Smart Systems and Inventive Technology (ICCSIT).DOI: 10.1109/ICSSIT48917.2020.9214296

[10] Kumaravelrajah Kapilan; Surangani Bandara; Thilantha Dammalage.(2020).Vehicle Accident Detection and Warning System for Sri Lanka Using GNSS Technology. At the 2020

International Conference on Image Processing and Robotics (ICIP).DOI: 10.1109/ICIP48927.2020.9367334

[11] Naji Taaib Said Al Wadhahi; Shaik Mazhar Hussain; Kamaluddin Mohammad Yosof; Shaik Ashfaq Hussain; Ajay Vikram Singh. (2018).Accidents Detection and Prevention System to reduce Traffic Hazards using IR Sensors.In 2018 7th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO). DOI: 10.1109/ICRITO.2018.8748458

[12]Lakshmy S; Renjith Gopan; Meenakshi M L; Adithya V; Mariya R Elizabeth.(2022).Vehicle Accident Detection and Prevention using IoT and Deep Learning.In 2022 IEEE International Conference on Signal Processing, Informatics, Communication and Energy Systems (SPICES). DOI: 10.1109/SPICES52834.2022.9774089

[13] Ancy John; P. R. Nishanth.(2017).Real-time embedded system for accident prevention.At the 2017 International Conference of Electronics, Communication, and Aerospace Technology (ICECA).DOI: 10.1109/ICECA.2017.8212745

[14] KR. Senthil Murugan; R. Roshni. (2021).Intelligent Accident Prevention and Detection for Four Wheeler.Published In 2021 the 6th International Conference on Communication and Electronics Systems (ICCES).DOI: 10.1109/ICCES51350.2021.9489046

[15] Luqman Shahzad; Kumeel Rasheed; Imran Ahmad; Syed Waseem Haider; Syed Saad; E.(2021).Cost-Effective Accident Prevention System for Vehicles. In 2021 International Conference on Decision Aid Sciences and Application. DOI: 10.1109/DASA53625.2021.9682266