A STUDY ON CLOUD AND IOT BASED ACCIDENT DETECTION & PREVENTION SYSTEMS

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Abstract— The world's population has recently surpassed 7 billion, and accidents are also growing day by day due to poor driving habits, excessive speed, and carelessness. In India, there were more than five lakh traffic accidents in 2015, and 1.5 lakh fatalities were reported. By 2022, this number is anticipated to rise by 50%. The deaths of the victims are increasing because of not getting emergency help at the hospital at the right time and not reaching the emergency vehicle at the right time to the accident spot. So, requires an urgent need to develop an IOT-based Accident detection model which will help in reducing deaths. This project involves conducting a study on accident detection to ascertain the best strategy to use to prevent traffic accidents and provides the best solution for locating the accident site whenever occurs and sending the information about the accidents to the nearby the hospital by sending alerting message. This paper mainly discusses the accident detection and prevention system that is developed by using IOT.

Keywords- Accident detection, GPS, GSM, Arduino, IoT

I. INTRODUCTION

India has the 2nd largest population in the World and youngest nation and large workforce, despite having all the advantages to emerge as a developed country it is lagging in road infrastructure. So, it is rapidly increasing its road connectivity and transportation, so the availability of vehicles increased in the country [1]. India also has the largest road network for its economy to serve the people in transportation addition to these advancements road accidents also increased the rate of change in the past several years. This put people's lives in danger. According to Road Transport and Highways Transport Research Wing of India, there is one out of 10 were killed in road accidents across the world. In 2020 there are 3, 66,148 road accidents and 1,31,725 deaths and 3,58,279 are injured in the accidents. Most deaths are caused by delays in the emergency services and a lack of knowledge of the accident [2]. There are many methods provided by many people to detect the accident by using IOT using mobile and GSM technologies etc. The Internet of Things, or IoT, is a new technology that will transform everyday items into an ecosystem that will enrich and simplify our lives. IoT is the most recent technology that can make any electronic gadget smarter. IoT harnesses the power of data to provide users with valuable insights that can be used to improve organizational efficiency and productivity.

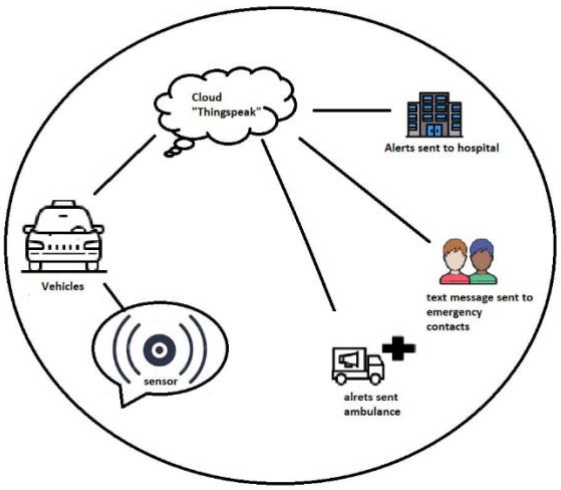

Fig 1: Edge devices are connected to a Cloud environment

Fig 1 shows the communication between edge devices in a cloud environment. This project's main purpose is to determine the best technology that is used to prevent accident deaths by detecting the damage by using IoT sensors and communicating through a wireless network to deliver the damage cause information without any mankind help it will automatically deliver to the respected destinations. The following components of an IoT system make it work more efficiently.

Microcontroller: This serves as the system's brain, processing the data obtained from the sensor. The microcontroller can be programmed to perform particular functions. The most popular microcontrollers are the Arduino Uno and the Raspberry Pi.

Sensors: These are electrical devices that can continuously monitor specified values. DHT (Digital Humidity and Temperature) sensors, for example, monitor temperature and humidity differences in the environment in real time and send the data to the microcontroller. Other sensors include the LDR (Light Dependent Resistor), soil moisture sensor, PIR (Passive Infrared) sensor, and water flow sensor, among others.

Wi-Fi Module: This makes it easier to link the device to the cloud platform. With the assistance of this module, data will be sent to the cloud platform. The ESP-8266 is the most frequently used Wi-Fi module. You don't need an extra Wi-Fi module to connect because the Raspberry Pi has one built in.

Cloud Platform: The way data is managed is what distinguishes IoT from other technologies. IoT makes it simple to transfer data to the cloud for storage and research. You must connect the project to a cloud server for this to work. The Think Speak IoT platform is the most popular cloud tool.

Actuators: These are the devices that execute a specific action upon getting the commands from the microcontroller. Actuators such as water pumps, relay driver modules, and DC motors perform actuations such as irrigating an area, switching devices ON/OFF, and so on, based on programming.

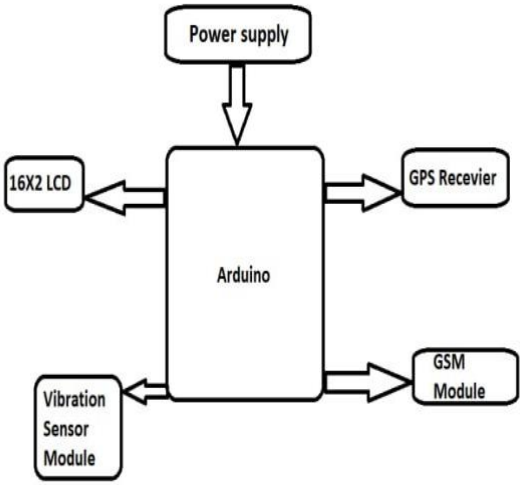

Fig 2: working principle of Arduino.

Fig, 2 shows the working principle of Arduino. The Arduino serves as the system's brain, processing input from the sensor. Arduino is an open-source hardware platform that allows hobbyists and enthusiasts all over the world to create projects. It

includes an ATMEGA microcontroller, which processes data and ensures the correct operation of the IoT system. And the beauty is that the Arduino can be programmed 'n' times, allowing you to create different types of IoT projects simply by changing a simple code.

Accident detection systems perform in Smartphones, GSM and GPS technologies, and mobile apps are helpful resources for the detection of accidents [3]. The techniques for automatically detecting accidents and monitoring/observing the functioning of the vehicle are presented in this study which helps in saving host life. In the present generation, the internet of things is the most popularly used technology that will help human life to make it easier and it will also help in archiving the sustainable goals of humans to make this world more secure by using these technologies.

II. LITERATURE SURVEY

[1] "Car Accident Detection and Car Health Monitoring Using IoT" [2019] was proposed by D. D. Patil1, Teja's Shah2, Sunil Konuri3, Ajay Kumar Challa4, Rohit Rawool5. Monitoring using IOT is used for Car Accident detection. In every device is connected IOT Senor device on the car to get data that could be detected after intimation about accidents. The accidents happen mainly because of driver negligence and the other problem is the delay in service from the nearest rescue services. Details are sent to the closest health centers and police stations with help of the system's location place at the scene of the accident.

[4] "IoT Based Accident Prevention and Tracking System for Night Drivers "(2015) was proposed by Aishwarya, Ashish Rai, Charitha, Prasanth, Savitha, etc. Here in the proposed method, Research for drowsy driving conditions, road accidents often happen at night to overcome this they have proposed a model of an Eye-Blink Monitor System EBM, which warns the subject whenever the host feels sleepy, IR sensor to find the eye blink ratio and accelerometer to monitor head movement. As an output fast reaction team to act in an emergency, a sensor is employed to send all of the data they have acquired across a smart grid network. The key components of this model are components, including Drowse Sensor with IR sensors, LCD Display, an LM358 Comparator, an NXP an NXP RD25 8051 Microcontroller a vibrator, an Engine Speed Controller, an Analog to Digital Converter (ADC), Gravity Sensors with 3-axis accelerometer, and a GSM & GPRS Module 12V 2Amp. DC + SMPS Power Supply.

[6] "Internet of Things-Enabled Accident Detection and Reporting System for Smart City Environments "[2019] was proposed by Fizzah Bhatti, Munam Ali Shah,1 Carsten Maple,2, and Saif Ul Islam. It enables the Internet of Things (IoT) Intelligent-Transportation Systems (ITS) are being discussed extensively in academic research and the business world as a way to improve traffic safety in smart cities. Road accidents have significantly increased because of the ever-growing number of automobiles. Vehicles equipped with a variety of sensors make it possible to not only keep an eye on the surroundings and the vehicle itself in real time but also make incident detection easier. For instance, a substantial study has been done using Information and Communication Technologies (ICT) for quick and effective rescue operations following accidents. Most works offer advanced methods that emphasize speeding up response time.

[7] "Based Intelligent System for Vehicle Accident Prevention and Detection at Real Time" [2019] proposed by Vivek kinage and Piyush Patil. To reduce the deaths due to drunken driving vehicle accidents they have proposed a system to avoid accidents. If a driver doesn't act within a certain amount of time after receiving a warning when the reading exceeds certain threshold values, our

suggested solution will take care of the issue by shutting off the gasoline supply. This suggested design allows the use of the Arduino microcontroller, as well as the MQ-3 sensor, an infrared sensor, an accelerometer, and a camera. Each one of these sensors is regulated by Arduino.

[8] "IoT-Based Automatic Accident Detection and Tracking System for Emergency Services "[2020] was proposed by Yellamma pachipala. Here in the proposed method, they are trying to reduce the deaths related to road accidents and to control the traffic by Using sensing technology and lot. Where the crash sensors are attached to the vehicles by which whenever an accident occurs the crash sensors immediately comes into action and passes the details to the nearest services and to the persons who through a global system of mobile and accident area spotted through google map and directly manages the traffic signals near it which help to serve the patient in the health center on time. In this method, they have used integrated ultrasonic, mic sensors, and MEMS for Accident detection.

[9] "IoT-Based Smart Alert System for Drowsy Driver Detection" [2021] proposed by Anil Kumar B and Debabrata. The study aims to develop an intelligent and vigilant approach that can automatically prevent drowsy driving impairment. But being sleepy is a natural bodily occurrence that might occur for a variety of reasons. Consequently, developing a trustworthy alarm system is essential to prevent mishaps. For this problem, they have developed a method where they employed a Video Streaming Processor (VSP), which is examined by the notion of the eye blink via Eye Aspect Ratio (EAR) as well as Euclidean distances among the eyes and used facial landmarks algorithms that aid in eye recognition. Also, a voice assistant over the Raspberry Pi surveillance system is used to assist. The IoT module alerts when the driver's weariness is recognized and sends a warning message with position and collision impact details, which helps prevent the accident. Fig 2 shows, Key components used are the Pi camera module V2, speaker module, crash Sensors, force-sensitive resistor sensor, and GPS module.

[8] *"IoT Vehicle Accident Detection and Classification System Using Sensor Fusion"* [2021], Nikhil Kumar, Debopam Acharya, and Divya Lohani are proposed. The IOT Based platform is used for accident detection. It has been in recent times available for saving the life of after accidents. This article technique develops rescue of various emergency services, like fire accidents, Road Traffic Accidents, etc. While thinking about of while using some machine learning models are GMM, Naive Bayes (NB), and accident detection and classification (ADC). These are to identify the situation after the accident regarding injuries sustained by the victims and the total amount of damage to the vehicle. The Vehicle movement, speed, absolute pitch, and roll have been used to train and test each candidate ADC model to identify the correct movement of the scenario depends. The NB-based ADC model is found to be highly accurate with a 0.95 mean F1-score.

[9]" Accident Detection System Using IoT Based Cloud Computing Technology*"* [2021] proposed by Dr. Rajapraveen, Dr. Swati Sah, and Dr.Vivak To avoid accidents they have proposed a system for braking and collision avoidance for Adhoc vehicle networks like the Intelligent Transportation System is focused on communication and road safety amongst on-road cars. They have used technologies like Ultrasonic transmitters and receiver sensors; however, two- or four-wheeled vehicles will stop by sensing the obstacles while employing this technology. This helps in avoiding accidents, and braking circuits where a wide variety range from 35 low-end PIC guidelines to about 70 top PIC guidelines.

[10] “Intelligent Accident Detection and Smart Alert System for Vehicles” [2021] is proposed by R. Raffik, M. Michael Jones, T. Murugajothi, and B. Kannadasan. In this article, they have developed an accident detection and smart alert system using different sensors like GPS, GSM, AUDINO, and GYROSCOPE. This is a system mainly involved in detecting accidents and alerting them about the accident. The gyroscope sensor is used for detecting accidents and sends the signals to the microcontroller which is Arduino UNO; the host should turn off the Arduino manually to determine that it is a false alarm. When there is no response for a certain period it will send the message to the pre-programmed phone numbers. As a result, they will know that accident is occurred and know the exact location of the victim via GPS via the internet.

[11] “IoT Based Accident Detection and Lifeguard System” **[**2021] was proposed by Saranya S1, Kartika G2, Gayathri U3, Ramya B4, and Avinashi lingam N5. The IOT-based platform is used to implement the suggested accident detection. We are trying to detect accidents. Here their agenda is to detect accidents and provide Lifeguard System like (GSM) on IOT BASED Detection. When the nearest emergency services, vehicle indemnity enterprises, or both vehicle indemnity and health indemnity enterprises, are decided on it after the car's identification of the collision utilizing a piezoelectric sensor by the attention of tremor generated by fatefully official broadcasting.

[12]”IoT Based Accident Detection System for Hairpin Bend Roads“[2022] proposed by Poonguzhali and Gokul Kathrine. The goals of their proposed work are to make hill travel safe and comfortable by preventing collisions, particularly at hairpin bends as well as U curves, and to warn drivers of both vehicles approaching the bend by creating traffic warning signals that signal the approach of a preceding vehicle on the opposite end of the bend. This model contains an ultrasonic sensor to detect vehicle reaching, a solar cell with a battery, and used NodeMCU sensor system to support the ESP-NOW communication technology.

[13] “Traffic Accident Detection through Self-Supervised Consistency Learning” [2022] was proposed by Jianwu Fang, Jiahuan Qiao, Jie Bai, and Hongkai Yu. It is used for accident detection in driving scenarios. This article’s main goal is to propose self-supervised consistency learning to detect accidents. The format of this learning is to observe video clips, and location videos and within this field to predict the visual scenes of context in driving scenarios and detecting traffic accidents on road. This scenario is fulfilled by the collection of consistency learning networks and it is represented by Bar graphs and pie charts.

[14] “Accident Detection and Alert Generation Using Raspberry Pi “[2022] was proposed by Prajwal Umesh Ghorpade, and Anurag Nema. The Raspberry Pi-based device is used to implement the suggested accident detection. They are trying to identify the accidents and send the alert to nearby central stations. Here whenever the vehicle crashes an Automatic sensor detection that sends a text message to a calamity replier when the system detects a rapid change to bump and rotation force in one of the vehicles ending, along with the accident's location and line up. The plan is that possible if the system detects an accident moment, the jurisdiction should be contacted right away to avoid further traffic blocking and to give passengers more time.

[15] “Accident Detection & Rescue System Using IoT” [2022] is proposed by Nandish, EknathBabu, Gaveshanaa, and Shambhulingeshwara. In this research, they offered the best solution for solving the problem using MPU-6050 sensors. This MPU-6050 sensor relates to the microcontroller unit. Each time Mpu-6050 receives the signal, whenever the crash happened, it will send to the microcontroller

unit to tell the accident is accredited NODEMCU ESP-8266 will send the alarm alert to the police control room, rescue crew, and family members through GSM. Then, after receiving the info about the accident the police and rescue teams will identify the accident spot using the GPS of the vehicle. Then the necessary actions will be taken to help the victims. Each time the data is coming will be sent to a cloud server via the internet to store the data for future investigation.

[16] "Accident Detection and Alert System" [2022] was proposed by c k Gomathy. They proposed a system to alert the medical centers nearby about the accident that has commenced. They have stated that it can be achieved by using an accelerometer and heartbeat sensor. Accelerometer is kept in the vehicle and the heartbeat sensor is in the human body where sudden change or any abnormality in a heartbeat and sudden tilt in the vehicle helps to find the seriousness of the situation and helps the systems to take decisions and immediately sends the info to the mobile that is connected with the bikes accelerometer through "global system for mobile" and "global positioning system" and from there the mobile application will be going to send text messages and also the exact location of the accident to the nearby health centers and to the host friends.

Summary: As from the survey we can know that accidents are a major cause of death in the current days and there are many proposals to overcome it we have learned many technologies and mechanisms in this survey where we are going work and deal with factors like drowsy driving, accident prevention, and detection methods. When we include it into the cloud with automation everything will be automated the process from the cloud. By using the cloud, we can make things faster and save information in the most secure way in the cloud.

III. CONCLUSION

Here we conclude that there are several ways to identify an accident, through employing IOT, mobile, GSM, and other technologies. As to provide more safety while driving and faster medical treatment this project involves conducting a study on accident detection to ascertain the best strategy where the Pi camera model V2 is successfully integrated with Raspberry Pi3, it continuously records each movement of the driver's face. The main disadvantage of the system is that it focuses on reporting and doesn't provide any sense of rescue. All the solutions lack an automated smart approach to accident detection, reporting and navigation. And when the mobile application systems have the disadvantage of using mobile to send the information at the time of accident. If the mobile crashed at the time of accident, it is impossible to send the alert and track the location of vehicle.

IV. FUTURE WORK

The work especially focuses on behavioral measures of the driver with severity measurement of collision in the following sections. The EAR is accurately calculated due to the use of the Raspberry Pi3 model and Pi camera modules to make a persistent recording of face landmarks that are localized through facial landmark points. But the Raspberry Pi3 model and Pi camera modules are securely processed due to the operating system of the controller and predictable secure shell (SSH) keys. The use of SSH host keys provides secure network communications and helps to prevent unauthorized communications or file transfers. The IoT-based application is being developed through the integration of some IoT modules like wireless sensors, GPS tracker, Pi camera, and smart code for detecting the drowsiness of the driver. So, the above modules are properly integrated with the Raspberry Pi controller module that intelligently controls and smartly warns a drowsy driver. That will help to prevent accidents and provides the best solution for locating the accident site whenever one occurs.

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