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# A Novel Approach to Prevent Accidents by using IoT System

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***Abstract*** **—** With the use of a motion sensor, the IoT-based system can identify any objects that cross a road in order to reduce traffic accidents. One ESP 8266 microcontroller serves as the client in the system while another serves as the server. The LED will illuminate and the buzzer will sound when motion sensor A detects an object, alerting drivers and lowering the likelihood of a collision. To identify any fire mishaps, the system also has a fire sensor installed. The system may be simply deployed in any point along the roadway to offer drivers with on-the-spot protection in the event of a fire. The technology is reliable, affordable, and user-friendly, which makes it the perfect choice for lowering traffic accidents. With its simple and efficient design, the IoT Based System is the ideal solution for enhancing safety on the highways.

**Indexterms*:*** *IoT, Sensors, Detection, Microcontroller.*

## I.INTRODUCTION

A physical object with links between sensors and software is called the Internet of things (IoT). It is capable of processing. It connects to and exchanges data with other devices and systems via the internet. It connects and stores data between two or more devices via the internet. Whenever data is required, it can be retrieved quickly and easily [1]. The data in IoT can be retrieved at any time, from any location, and from any device. IoT stores data in cloud networks and connects all devices.

A network of physically networked objects, such as furniture, vehicles, home appliances, and other items, that are fitted with electronics, software, sensors, and network connectivity is referred to as the "Internet of Things" (IoT). These objects can collect and share data to technology[2]. The aim of IoT is to create seamlesscommunication between devices to improve efficiency, comfort, and convenience in our daily lives. The devices can be controlled and monitored remotely, and the data collected can be analyzed to make informed decisions. Examples of IoT devices include smart home devices, wearable technology, smart cars, and industrial equipment.

Nowadays highway accidents are increasing day by day. To prevent these kinds of accidents different kinds of innovations are introduced. The research states that there were 4,12,432 sad incidences of road accidents in 2021, which resulted in 1,53,972 fatalities and 3,84,448 injuries [3].The nation saw a historically low number of accidents,fatalities,and injuries in the year 2020.This was brought about by the rare COVID-19 pandemic breakout and the ensuing strict statewide lockdown, especially in March-April 2020,followed by a gradual easing up of the containment measures.

Compared to 2019,the major accident-related indicators have performed better in 2021.Injuries from traffic accidents declined by 14.8% and fatalities by 8.1% in 2021 compared to 2019 [4].However,the number of fatalities related to traffic accidents rise by 1.9% during the same time in 2021.So, to prevent this kind of accident our project is framed up.

This study provides answers to the following questions:

1. Istherea low-cost accident prevention and alerting system that can be installed in any part of the street light on roads?
2. Howtoreducetheaccidentsbyearlydetectionofobstacleandalertthevehicles?

Contribution of work Developing mechanisms for road accident prediction, prevention, detection, and management research is primarily focused on improving precision or reduction in rescue time following the occurrence of road accidents. In this study, the proposed system uses an IoT system architecture based on smart prevention to detect early obstacles and prevent automotive accidents. The proposed solution is affordable, effective and simple to retrofit into any street light along a road.

In this project, the system detects the motion of a human or any animal crossing the highway and intimate to the travelers on the highway by light and buzzer. These lights and buzzers are used to convey the message that something or someone is crossing the highways, which can prevent the collusion of the highwaycrossing
The following is how this paper is structured. Section II describes major related work in the areas of automatic vehicle accident detection and multi sensor fusion. Section III describes the architecture of the proposed system, as well as the methodology and equipment required. Section IV describes the operation of each server as well as the results and analysis of the system. Section V discusses the system's comparative study. Section VI outlines the system's conclusion and future scope.

## I. RELATEDSTUDY

This section discusses research related to the detection, prevention, modelling, and analysis of traffic accidents.

S.Priyanka et al., [5]This method helps us identify criminality in the threat zone area and resolve environmental problems like energy waste. It will help in the reduction of cost and energy used and boost the safety of the area by providing proper alerts to the authenticators. This system can be developed further by adding better image processing features and help in being a reliable and efficient system.S.sangyong Jia et al., [6] This device is fog computing which is powered by the smart street lamp (SSL). Use of the SSL in Hangzhou, China served as validation.The typical maintenance window ,which measured the interval between the appearance of an aberrant lamp status and the server checking it, was 20 minutes. The fog computing-based Smart Street Lamp.

M. Suresh et al., [7] This solution uses Arduino IDE software programs to encourage these gadgets to notify the emergency room when they observe any deviations. The IBNN forecast method is also utilized to forecast the energy that Yong-Kul Ki and Dong-Young Lee will use throughout particular utilized to forecast the amount of energy. The development of an intelligent automatic light also makes use of an efficient IoT architecture.K. Deve et al., [8] proposed a system to create a smart fire detection system that uses a voting mechanism and the wisdom of crowds to reduce false positives. Overall, the bulk of these system criteria was satisfied. The testing environment revealed some issues on the other hand, but overall the system worked as said.

S. Wu et al., [9] In this system, the accuracy rate of the fire detection is very hig compared to other such experiments and early detection of fire has led to the safety of the forest. This system has classified each type of smoke for accuracy and made sure the wrong detection is minimized.D. Ozaki et al., [10] initiated A new dangerous animal detection system is being developed that can recognize an animal's species, posture, and proximity to traps, as well as its presence and preventative senses. It has been demonstrated that the depth camera and laser radar distance data can be used to determine the type and posture of animals. A sensor node will be deployed to collect measurement data from devices in areas where harmful animals are present, and a sensor node will be deployed to collect measurement data from devices in areas where dangerous animals are present.

Muneera Begum H et al.,[11] This article describes a wild animal infringement recognition, diversion, and alert system based on transceivers and the Internet of Things. IoT infringement involving wild animals. When the beam of a laser diode

is cut off, the detector's buzzer sounds. Animal ingress and diversion can be detected using these technologies, resulting in crop loss of less than 5%. The deployment of sensor nodes in early warning zones improves perimeter control by more than 95%.Ching-Cherng Sun et al.,[12] It uses to reduce energy losses and light pollution, it uses an arbitrary form of lighting to illuminate highways. The distinctive microlens array effectively disperses LED light on a freeform roadway after first collimation.As the microlens aperture shape significantly influences the illumination pattern shape, this may be particularly well suited for future advancements in dynamic adaptive lighting using flexible microlenses arrays with adjustable apertures, or even by automatic mechanisms for changing plates.

M. Suresh et al.,[13] In order to encourage these gadgets to notify the emergency room when they observe any deviations, this system utilizes Arduino IDE software programs. The energy usage patterns of Yong-Kul Ki and Dong-Young Lee are also predicted using the IBNN forecast method. Moreover, a smart automated light is built using a powerful IoT framework.Eisley Dizon et al.,[14] This technology offers an IoT-enabled solution for energy-saving streetlights. That is not conclusive, but it does show a significant decrease in power consumption based on the relationship between Trac flow and total energy consumption. The solution could be useful for other cities.

P.Arjun et al.,[15] The main problems with manual street light systems, such as energy waste, criminal detection, the usage of incandescent lights, and high maintenance costs, are supposed to be addressed by this system. This approach also preserves public safety by saving between 50 and 60 percent of the energy utilised for transportation and other crucial purposes.Santini Yoomak et al.,[16] This idea is to put outthe surplus energy that will be transferred into the power system if the batteries are fully charged. Yet, the system continues to produce a high even when there is little solar energy. The efficiency of the solar system at its peak power point, which is influenced by solar irradiation and temperature, determines how well the stand-alone and grid-connected modes operate.

Yu-Sheng Yang et al.,[17] This paper makes a recommendation for a street lighting management system that consists of a cloud-based management platform and a collection of edge devices. A machine learning algorithm can be added to the system to further improve the smart lighting management mechanism based on sensor-generated environmental data. In conclusion, this study offers a powerful and practical method for controlling street lighting that makes use of state-of-the-art technology.Yuxi Jiang et al.,[18] discussed about the Traffic-Adaptive Street Lighting System (TaSLC), a method for street lighting, uses the signature of received signal strengths from automobiles and pedestrians to determine precise traffic parameters. This innovative plan can save energy while maintaining accurate traffic monitoring. Overall, the suggested TaSLC method and related hardware present a viable method for lowering energy usage while preserving precise traffic monitoring.

Yao-Chung and Ying-Hsun Lai et al.,[19] encourageThe creation of a smart IoT platform is proposed, using streetlights as computer nodes and workload forecasting models for smart campus environments. The experimental findings show that the proposed model outperforms the regression strategy and TDNN in terms of the accuracy of short-term prediction. Marc Füchtenhans et al.,[20] The potential and use of smart lighting systems in industrial settings have not yet received significant attention in the literature. Enhancing lighting is one of engineering managers' top priorities. By reducing energy needs and improving worker well-being, smart lighting systems support sustainability goals.

M. Suresh et al.,[21] This solution makes use of Arduino IDE software programmes to encourage these devices to alert the emergency room when they notice any irregularities. Moreover, an efficient IoT framework is used to construct an intelligent automatic light.Sikhinam Nagamani et al.,[22] This method consists of wireless technology that may be managed by a base server by simply delivering the information and operates in accordance with the weather. The main goals of this research are to prevent energy waste and save lives from accidents. As sunshine is a renewable energy source, there won't be any issues with electricity. It is also possible to set up charging stations for electric cars and bikes.

Shih-Chang Hsia et al.,[23] In this study, a single-chip LED driver with a mixing-mode design is demonstrated. Two switches are all that are required to modify the LED brightness without the need for a microprocessor. Moreover, a remote

control SPI interface is built into this chip. The affordable chip can provide simple operation, a small system footprint, outstanding efficiency, and accurate dimming for LED smart lighting control. This chip can be utilized in smart lighting systems to connect to the Internet of Things for high-power LED dimming (IoT). C.M.Tsai et al.,[24] In this development, a split light source streetlight is recommended to make maintenance simpler. It is simpler to replace the light sources if they are close to the streetlight's base. But, the rays must leave the top of the streetlight in order to shine on the IA. Uniform lighting is made possible to provide each piece of the FM with an equal degree of brightness dependent on the RP's light dispersion using 400x400 area partitions in the RP, FM, and IA. The suggested streetlight can achieve an average brightness of 20.6 lx in the IA with 90% power efficiency, 85.9% uniformity, and minimal glare.

Andras Szalai, et al.,[25] discussed about the proprietary solutions for LED-based street lighting systems, such the Eclipse system of Prolan, are emerging because none of the existing lighting control standards were designed formanagement of streetlighting.Due to the platform's capabilities, it might be required to introduce functionalities outside of lighting control when smart streetlighting systems are completely integrated into smart city solutions.Andrzej Ozadowicz et al.,[26] given an infrastructure and control systems for the street and outdoor lighting projects are organised differently as a result of this study. It is based on the EN-15,232 standard guidelines, which were originally designed to organise control functions and functional strategies in the BACS. The project's objective is to improve pedestrian and vehicle safety while reducing energy consumption and maintenance costs for the lighting system.

Cassio Gobbato et al.,[27]This study provides a design for LED modular driver-based street lighting systems. A luminaire built of modules stops the light from going out completely by preventing it from working at full power until the system is fixed. The recommended low-power module-based street lighting lamp permits maintaining the lamp's key properties, such as efficiency and the absence of an electrolytic capacitor, as nearly as is practical to those of a single module, regardless of the total lamp power. That makes the recommended remedy suitable for efficient LED-based street lighting systems.Casagrande et al.,[28] This study covers the significance of adjusting traditional photometric values when analyzing lighting systems with low brightness levels, such as general outdoor illumination or public lighting. In this regard, a different approach to lighting projects for public lighting that takes into account mesopic photometry is provided.

Khan Muhammad et al.,[29] Intelligent CCTV surveillance systems are a result of the inbuilt processing power of smart cameras. These smart cameras are capable of detecting a wide range of anomalous events, including fires, accidents, and medical emergencies.Understanding the objects and scenes being observed receives relatively little attention in this work and is instead primarily focused on the detection and localization of fire.Sergio Saponara et al.,[30] This study suggests an embedded, real-time fire and smoke detection technique that can make use of regular security cameras. The creation of sophisticated IoT fire/smoke detection equipment for both indoor and outdoor environments is the aim of this effort. It stands out for its low latency and real-time performance when compared to earlier regional-based detectors for the detection method. Linking the described system to iCloud services in further development could offer remote visual status and feedback on fire and smoke.

Nikhil Kumar et al.,[31] This study suggests an embedded,real-time fire and smoke detection technique that can make use of regular security cameras. The creation of intelligent Internet of Things (IoT) devices for indoor and outdoor fire/smoke detection is the aim of this project.Comparing the suggested detection approach to previous regional-based detectors, it stands out for its low latency and real-time performance. Further development could involve linking the suggested system to iCloud services to enable remote visual status and feedback on fire and smoke. Unaiza Alvi, et al.,[32] The various techniques that make up this strategy emphasise both preventing and identifying accidents. These methodologies employed a wide range of sensors, such as accelerometer sensors, shock sensors, pressure sensors, etc., as well as a wide range of machine learning techniques, such as neural networks, support vector machines, representation learning, etc., for accident detection.

The preceding works discuss the various methods and technologies that have been used to detect the problem and provide a suitable solution for it. These developments have been considered and implemented in many places, but they still have

flaws that need to be addressed for improved system efficiency and future development. Taking into consideration all of the points raised in the preceding works, the proposed work was designed to overcome all flaws.

## III.PROPOSEDMETHODOLOGY

Motion sensors and flame sensors are used in an IoT based system to help prevent highway accidents. Motion sensors detect the movement of objects and can be used to detect vehicles on the road. This information can be used to trigger an alarm or alert system in the event of a potential collision. Flame sensors can detect the presence of fire, which can becritical in the event of a vehicle fire on the highway.

The sensor can trigger an alarm and alert system to warn other drivers and emergency services . By integrating these sensors into an IoT-based system, real-time data can be collected and analyzed to provide insights into thesafetyofthehighway.Thisinformationcanbeusedtoimplementproactivemeasurestopreventaccidentsandimprove road safety. The use of motion and flame sensors in an IoT-based system can significantly reduce the number of highway accidents and improve road safety. the block diagram of the proposed methodology is shown in fig 1.

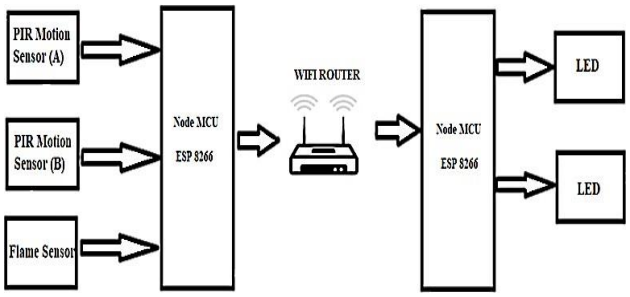


**Fig.1Proposed system architecture**

### *3.1 NO DEMI CROCONTROLLER ESP8266*

The ESP 8266 is a low-cost Wi-Fi microcontroller that is widely used for IoT (Internet of Things) applications. It is equipped with a 32-bit processor, built-in Wi-Fi, and a range of digital and analogue inputs and outputs. The ESP 8266 is popular among hobbyists and developers due to its affordability and versatility [33].
These can be used for a variety of applications such as sensing and control. The device supports several communication protocols, including HTTP, MQTT, and Web Sockets, making it ideal for IoT applications [34]. Overall, the ESP 8266 is a versatile and affordable microcontroller that is ideal for a wide range of IoT applications

### *3.2 MOTION SENSOR*

It is commonly used for security purposes, such as in burglar alarms, as well as for automating lighting, heating and cooling systems [35]. Passive infrared sensors sense variations in the infrared radiation levels released by objects in their range of vision in order to detect body heat and movement.Microwave sensors emit microwaves and detect any reflected waves that have been disturbed by movement [36].

### *3.3 FLAME SENSOR*

A flame sensor detect the presence of a flame or fire. It is commonly used in various industrial, commercial, and residential applications to trigger a fire alarmortocontrol a fire suppression system. The basic principle of a flame sensor is to detect infraredradiation, ultraviolet radiation, or visible lightproduced by aflame [37]. Depending on the type of sensor, it mayuse

aphotodiode, phototransistor, or ultraviolet sensor to detecttheradiation.

There are several types of flame sensors available, including ultraviolet sensors, infrared sensors, and visible light sensors. Each type of sensor has its advantages and disadvantages, and the type of sensor used will depend on the specific application and the type of flame being detected [38].

### *3.4 ARDUINOIDE*

It is a free, open-source software application that provides a platform for writing, compiling, and uploading code to an Arduinoboard. It was created to make it easier for peopletoget started with programming and electronics, and it has becomeoneofthemostpopulartoolsforhobbyists,makers,andprofessionalsalike.

### *3.5 BUZZER*

An active buzzer is a alarm type device that generates acontinuous sound when direct current (DC)electrical power is supplied . This makes them simpler to use, as they donot require an external oscine external magnetic field oscillations in various applications such as alarms, buzzers, timers, and reminders [39]. In terms of design, 5V active buzzers are typically small in size, making them easy to integrate into compact space-saving designs [40].

## IV. IMPLEMENTATION AND RESULT

Numerous systems have been suggested to decrease the occurrence of accidents and notify users. The focus of this project is primarily on monitoring vehicles for objects ar highway crossings and detecting fires. The system has the ability to monitor motion on both sides of the road.

The flowchart for the system is shown in fig. 2 and it begins with a sensor check. It then determines if the obstacle has been located. It doesn't do any operations if it hasn't been detected. But, if an obstacle is detected, the sensor contacts the server to convey signals to the client.

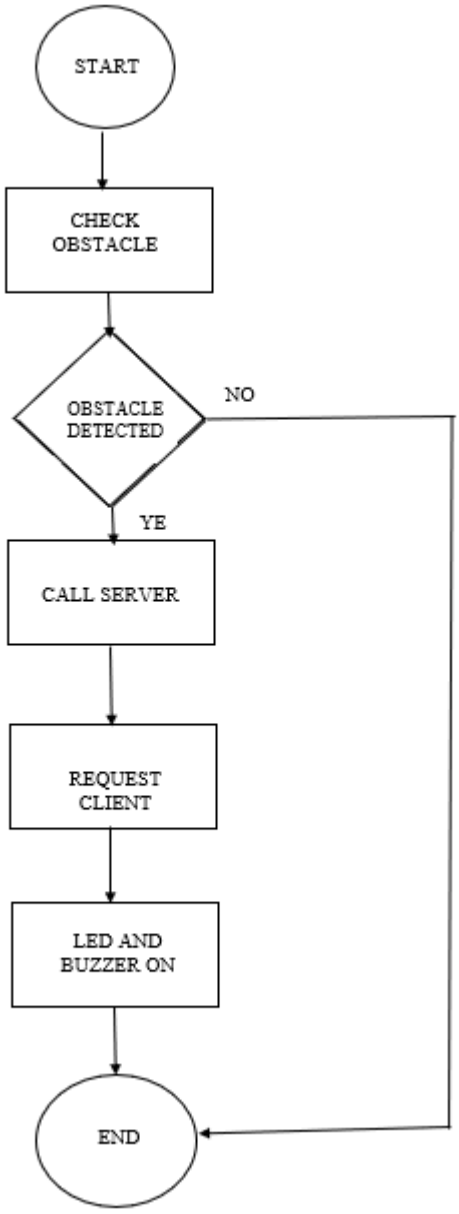


**Fig.2 Flowchart of the proposed system**

*4.1 Working of server:*

The system comprises a two-part transmitter and receiver. It includes a sensor module, wireless module, and data transfer module. When motion is detected on the highway, the impact sensor sends signals that set a flag bit in the microcontroller. The microcontroller is then notified that an motion has occurred, and it alerts the drivers.

The data is transferred via a wi-fi link using two-node microcontrollers. One microcontroller is worked as a server and another microcontroller is worked as the client. Two motion sensors and a fire sensor are connected to the server .one motion sensor is named motion sensor a and another motion sensor is named motion sensor b.

The data is sent to the client and the led begins flashing when any object is found on the motion sensor. The blinking of the

led ceases if the motion sensor b detects the thing. If any fire accidents occur, the flame sensor is detected and another led blink.
If the object entered the road, the motion sensor A detects and sends an alert to the Node microcontroller client through the node microcontroller server. The client turns on the lead, it was 10-20 meters apart from the server. If the object is across the motion sensor B, the led automatically turns off, otherwise, the led turns ON.
The system will use LED lights to alert drivers about the incident when fire accident is detected. Numerous methods have been suggested for monitoring vehicles and detecting accidents with alerts. The connections are shown in fig. 3.

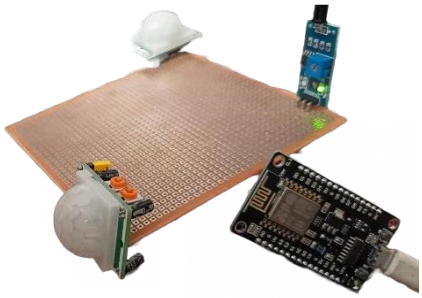

**Fig. 3 Server Connections**

*4.2 Working of Client :*
Numerous systems have been suggested to decrease accidents and warn the druggies. This design substantially focuses on vehicle monitoring for trace crossing objects and fire accident discovery. This system is able of covering the stir on two sides of the road.
If any obstacle or motion is detected by detector A, then it sends an alert to the Node microcontroller client through the Node microcontroller server. The message is received by the client which turns on the LED to caution the motorist about the danger ahead of them and reduces the number of accidents that occur on highways as shown in fig. 4.

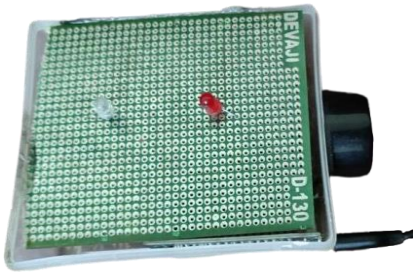


**Fig.4Client Connections**

In the program the motion sensor A reading is denotedas sensor0_reading , motion sensor B reading is denoted assensor1_reading,firesensorreadingisdenotedassensor2_reading.Ifthemotionsensoraisdetectedthesensor0_readingisshowna s1ifnotthesensor0_readingremains 0.sensor2_reading is shown as 1 if the fire is detected by fire sensor as shown in fig 5.

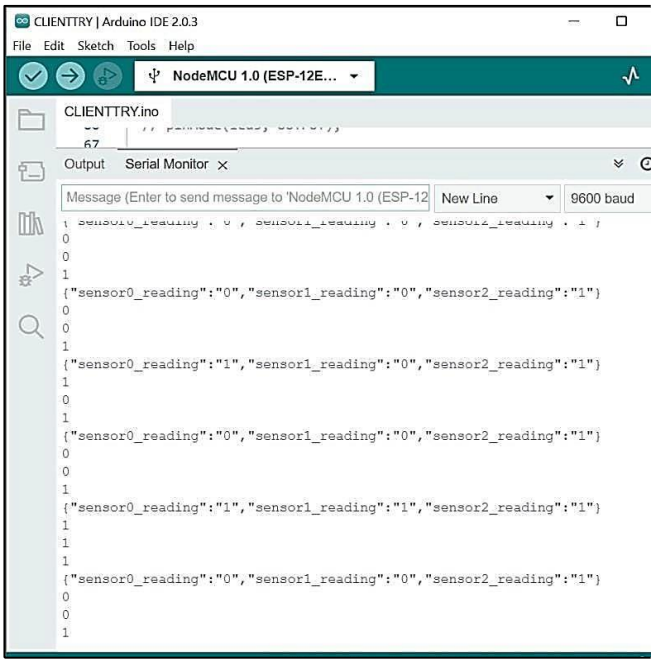


**Fig.5 Sensors detections1**

If the sensor0_reading is 1 then the Led a is starts to turn on and buzzer also turn on which means the motion sensor a is detected. If the sensor1_reading also become 1as shown in fig 6,it indicates that the motion sensor b detects the objects. By which the led a turns off.

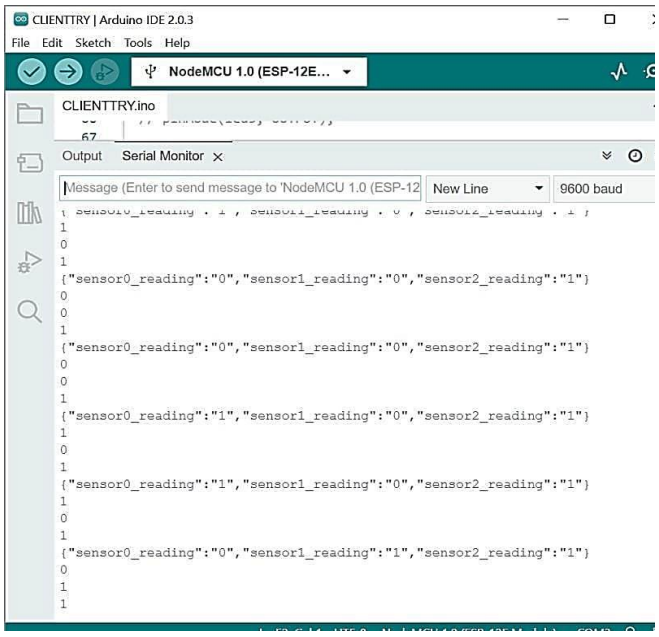

**Fig.6 Sensors detection 2**

## V.COMPARISON BETWEEN EXISITING SYSTEM AND PROPOSED FRAME WORK

The difference between features available in existing system [41] and proposed system are tabularized shown in table 1.
Table 1.ProposedFrameworkinComparisontoExisting System

**Table 1 Proposed Framework in Comparison to Existing System**

| Trial case | Existingsystem | Proposedsystem |
|---|---|---|
| CommunicationMechanism | Mostoftheothersystem,donothave a goodconnectivitybetween theserver and client. | The connectivitybetween theserver and clientis stronger thanthe other system,helpsin preventingaccidents. |
| PowerConsumption | Current featurefacestheproblemof excess powerconsumption. | Our system isenabled to savethe power andwork efficientlyin low power modeaswell. |
| Data transfer bitrate | The data transferbit rate is lessthan1150 bit/s. | The data transferbit rate isbetween1150 to 6900bit/s. |
| Distancecovered | The distancecovered fortransformationof data is below 5meters. | The distancecovered fortransformationof data is above 5meters. |
| CostEffectiveness | The cost iseffective withlesscomponents. | The cost iseffective withconnection ofaddedcomponents. |

## VI. CONCLUSION AND FUTURE SCOPE

To ensure maximum security and safety in real-world scenarios where drivers may be unaware of hazards, an accident-avoidance technique has been proposed. The system's desired output was achieved, guaranteeing the safety of passengers and the public. This system can operate effectively on highways and old bridges, as well as in heavy traffic areas, hospitals, schools, U-turns, and highway vehicles, are capable to the use of embedded systems. Any human or animal passing by on the server side can be easily detected and warned.

Motion detection across the highways is used to detect any motion across the highways. If any motions are detected at one end of the highway corner,the travelers get an indication that some obstacles are detected in between highways. If not detected at the end of the highway,travelers didn't get any alert notification in between their travel. Also, fire sensor is used to detect any accidents across the highways and indicates to the travelers on the highways. For indications, we use LEDs and a buzzer. The LED indication is used for motion detection and flame detection. Buzzer indication is used for motion detection on highways. Through this detection and indications to travelers, accidents on highways can be reduced.

This system becomes more efficient and dependable in real-time by utilizing ESP8266.The project present a real-time online safety prototype that limits vehicle speed when drivers are tired. A system to recognize driver fatigue symptoms and regulate vehicle speed to prevent accidents is what such a model aims to achieve. The stir detector is one of the system's primary components that corresponds to numerous real-time detectors.

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