International Journal of
Electrical and Computer System Design
ISSN: 2582-8134 www.ijecsd.com

ANN Based Vehicular Black Box Using Edge Computing

K.Bhuvaneshvari [1], Subeshsriruban N [2], Manoj kumar I [3], Rajeev K [4], Rajesh kumar S [5]

[1]Assistant Professor/EEE, P.A College of Engineering and Technology, Pollachi, Tamil Nadu, India,k.bhuvana020@gmail.com.

[2,]UGStudent/EEE, P.A College of Engineering and Technology, Pollachi, Tamil Nadu, India,subeshsubesh694@gmail.com.

[3,]UG Student/EEE, P.A College of Engineering and Technology, Pollachi, Tamil Nadu, India ,manoj902778@gmail.com.

[4,]UG Student/EEE, P.A College of Engineering and Technology, Pollachi, Tamil Nadu, India ,rajerajeev11@gmail.com.

[5,]UG Student/EEE, P.A College of Engineering and Technology, Pollachi, Tamil Nadu, India ,rajeshkumar989438@gmail.com.

Abstract: Nowadays automobiles technologies are rapidly increase each and every year and also every second accident count also increase. So, while using some technologies like black box placed in the automobile means creating a new level of data service in vehicle. The automobile black box has functions similar to an airplane black box. It is highly useful to analyse the cause of vehicular accidents and prevent the loss of life and property arising from vehicle accident these paper presents the prototype automobile black box system it is having the group of sensor and also gives the black box sends an data in cloud storage.

Keywords: ANN, Black box, Edge computing

1. Introduction

Introducing the ANN-based Vehicular Black box with Edge Computing – a pioneering solution at the intersection of artificial neural networks (ANN) and edge technology. This innovative black box is engineered to process and analyze critical vehicular data in real-time, enhancing both safety and efficiency on the roads. By harnessing the computational power of edge devices, it ensures rapid decision-making and facilitates automatic responses, making it a key advancement in modern automotive technology.

2. Existing Methodology

As of now accident information system is available using GSM but it is not effective. Normally black box cost is high so no one prefer to install in the vehicle and normally black box is just store the data.In existing system black box is done by using the sensors with gsm if any of the parameter reach above the threshold level it sends only the message. In an existing system circuit looks bulky not in compact. In this system use GSM & GPS communication.

3.Proposed Methodology

In this project various sensors are used to continuously monitor the condition of the driver i.e. whether driver is feeling drowsy or not, alcohol consumption's and speed of driving In case of accident all the data will be saved in a government server and can't be modified. To monitor the various sensors such as alcohol sensor, temperature sensor, Gas sensor, Touch sensor, Crash sensor, Vibration sensor and GPS are connected to Arduino board The output of the sensors is read from Arduino and communicated to single board computer. These data are uploaded into the node MCU board.

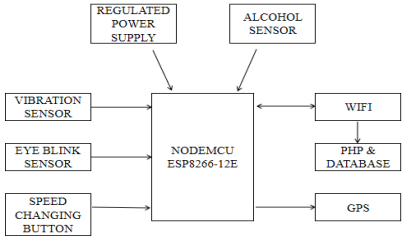

Figure 1. Block diagram

The ever-increasing numbers of traffic accidents all over the world are due to diminished driver's vigilance level and defaulters are using existing loopholes to escape the laws. For this reason, developing system that actively monitors the driver's level of vigilance and recording the driver of any insecure driving condition in government server. In this project we continuously monitor the condition of the driver i.e. whether driver is feeling drowsy or not, alcohol consumption's and speed of driving In case of accident all the data will be saved in a government server and can't be modified. .The proposed system is designed such that, the device itself sends a message to the concerned person when an accident is met. Proposed system uses Node MCU Arduino board that provides an easy access to input/output and analog pins and easy burning/uploading of a program. The system uses GPS to find the location of the accident and to send that location in the form of SMS to the previously coded number. It also includes the feature to detect the presence of alcohol. To monitor the various sensors, GPS are connected to Arduino board which is Node MCU. Arduino board is connected to Ubidots (open-source cloud). The output of the sensors is read from Arduino and communicated to single board computer. The data is stored in the cloud the given system is proposed in IOT.

Ideology

The proposed system is designed such that, the device itself sends a message to the concerned person when an accident is met. Proposed system uses Node MCU Arduino board that provides an easy access to input/output and analog pins and easy burning/uploading of a program.

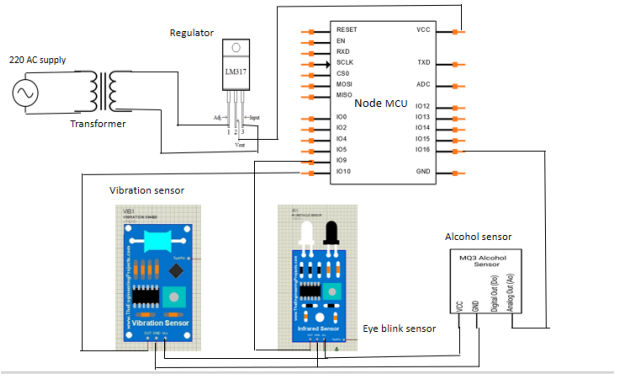

Figure 2: Circuit Diagram

The system uses GPS to find the location of the accident. It also includes the feature to detect the presence of alcohol. To monitor the various sensors, GPS are connected to Arduino board which is Node MCU. Arduino board is connected to Ubidots (open-source cloud). The output of the sensors is read from Arduino and communicated to single board computer. The data is stored in the cloud the given system is proposed in IOT.

VII. HARDWARE DESCRIPTION

There are primarily five components which are used for the designing of our ANN based Vehicular Black box using Edge Computing, and they are:

1) NODEMCU ESP8266-12E
2) Transformer
3) Vibration sensor
4) Eye blink sensor
5) Alcohol sensor

➢ *NODEMCU ESP8266-12E*

The NodeMCU (Node Micro-controller Unit) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WiFi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds

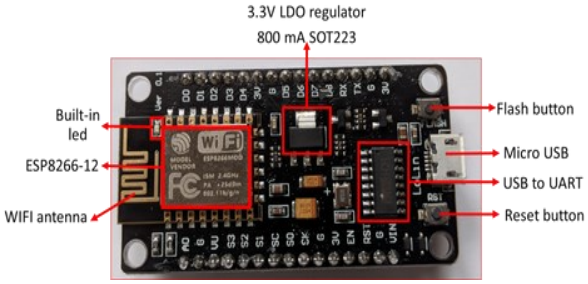

Figure 3: NODEMCU ESP8266-12E

➢ *TRANSFORMER*

A transformer is made from a core that has common input and output sides. Two inductive windings are embedded in this core which is electrically insulated from each other. The input coil in which electrical voltage is fed is known as Primary Winding. The output coil from which the electrical voltage is drawn is called the Secondary Winding.

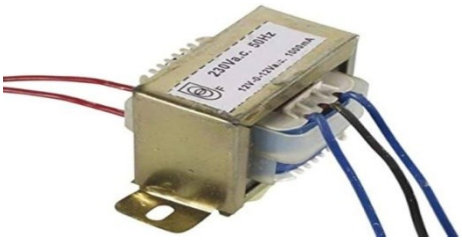

Figure 4: Transformer

➢ *VIBRATION SENSOR*

The working principle of vibration sensor is a sensor which operates based on different optical otherwise mechanical principles for detecting observed system vibrations.The sensitivity of these sensors normally ranges from 10 mV/g to 100 mV/g, and there are lower and higher sensitivities are also accessible. The sensitivity of the sensor can be selected based on the application. So it is essential to know the levels of vibration amplitude range to which the sensor will be exposed throughout measurements.

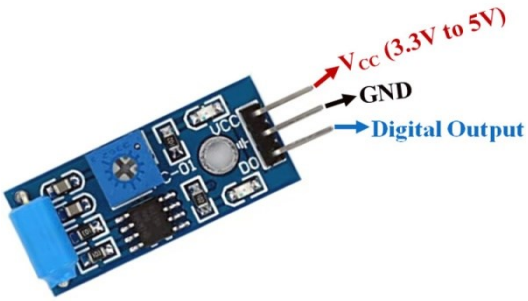

Figure 5: Vibration sensor

➢ *EYE BLINK SENSOR*

An infrared sensor includes two parts, the emitter (transmitter) & the receiver (receiver), so this is jointly called an optocoupler or a photo-coupler. Here, IR LED is used as a transmitter whereas the IR photo-diode is used as a receiver for reflected IR radiations. The resistance of photo-diode & output voltage can be changed in proportion to the infrared light obtained. This is the fundamental IR sensor working principle for the eye blink sensor.

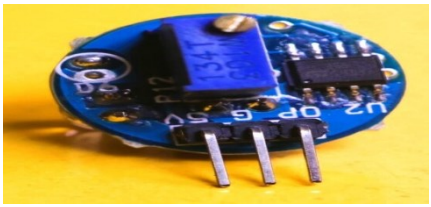

Figure 6: Eye blink sensor

➢ *ALCOHOL SENSOR*

The sensor and load resistor form a voltage divider, and the lower the sensor resistance, the higher the voltage reading will be Structure and configuration of MQ-3 gas sensor is shown in the figure above for Configuration A or B, sensor composed by micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net.

Figure 7: Alcohol sensor

VIII. HARDWARE

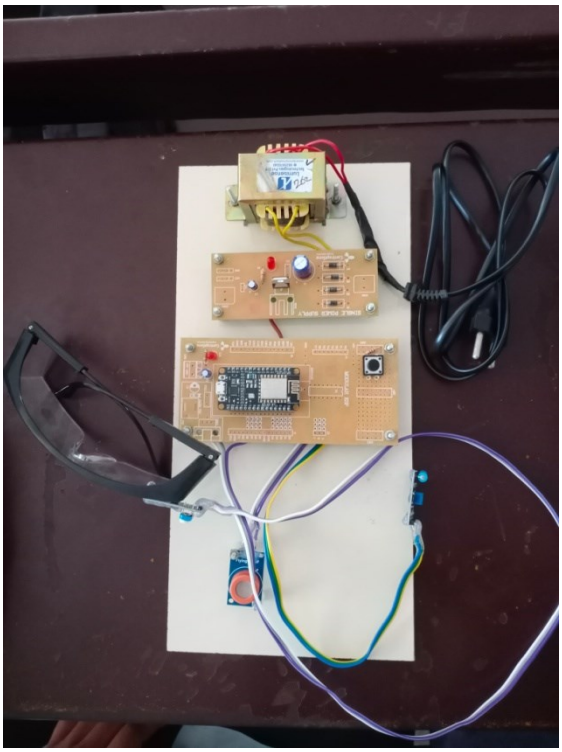

Figure 8: Hardware image

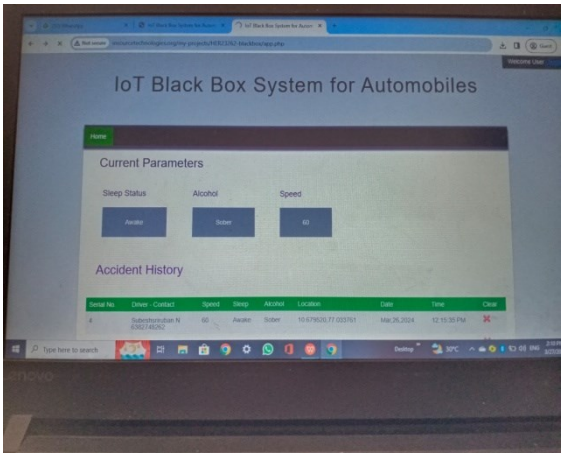

Figure 9: Output of the project

Figure 3:Output Image of smart charging

5.CONCLUSION

An Artificial Neural Network (ANN) based Vehicular Black box using edge computing revolutionizes how we approach vehicular safety and data processing. By harnessing the power of edge computing, the black box can analyze data in real-time directly within the vehicle or at the edge of the network. This results in swift decision-making and reduced latency, critical for ensuring prompt responses to potential hazards on the road. Moreover, the edge deployment model minimizes reliance on centralized servers, leading to bandwidth savings and improved privacy and security by keeping sensitive data localized. The adaptability of edge computing allows for customizing the ANN model to suit diverse vehicular environments, optimizing performance and efficiency tailored to specific needs. In essence, ANN-based Vehicular Black box empowered by edge computing signify a paradigm shift towards safer, more efficient transportation systems for the future.

REFERENCES

1) S Sethuraman, S Santhanalakshmi ” Implementing Vehicle Black Box System by IoT based approach” Proceedings of the Fourth International Conference on Trends in Electronics and Informatics (ICOEI 2020) IEEE Xplore Part Number: CFP20J32-ART; ISBN: 978-1-7281-5518-0 System by IoT based approach” Proceedings of the Fourth International Conference on Trends in Electronics and Informatics (ICOEI 2020) IEEE Xplore Part Number: CFP20J32-ART; ISBN: 978-1-7281-5518-0

2) Kumar, M. Anil, M. Venkata Suman, Yogesh Misra, and M. Geetha Pratyusha. "Intelligent Vehicle Black box using IOT." International Journal of Engineering & Technology (UAE)-SCOPUS March-2018 7, no. 2.7 (2018): 215-218.

3) R Dimple, Nanda B S. “Design and implementation of smart black box system for gathering the safety information in vehicles”. International Journal of Advance Research, Ideas and Innovations in Technology. Volume 4, Issue 3,2018

4) S. Shahzad , U. F. Shaikh , A. A. Shaikh , P. K.Mathurkar. “Black Box in Car”. Vishwakarma Journal of Engineering Research www.vjer.in Volume 2 Issue 3, September 2018.

5) A. Das, A. Ray, A. Ghosh, S. Bhattacharyya, D Mukherjee and T. K. Rana, "Vehicle accident prevent cum location monitoring system," 2017 8th Annual Industrial Automation and Electromechanical Engineering Conference (IEMECON), Bangkok, 2017, pp. 101-105

6) Manish Bhelande, Viraj Chaudhari, Prathamesh Gore, Raj Dhure, Abhishek Bhayye.” Car Black Box”. International Journal of Advanced Research in Computer and Communication Engineering Vol. 5, Issue 3, March 2016.

7) Dimple R, Nanda B S. “Design and implementation of smart black box system for gathering the safety information in vehicles”. International Journal of Advance Research, Ideas and Innovations in Technology. Volume 4, Issue 3,2018.

8) Tushar shelke, NilimaRaut, Swati Sayare, Shital Bhade, Shital Manmode5, Rajashri Sadawarti. “Accident Detection System using Black Box System” International Journal of Engineering Science and Computing, Volume 7, Issue No.3, March 2017.

9) Dr. Senthil Kumar T., Vishak, J., Sanjeev, S., and Sneha, B., “Cloud Based Framework for Road Accident Analysis”, International Journal of Computer Science and Mobile Computing, vol. 3, pp. 1025 - 1032, 2014.