IJEAST

INTERNATIONAL JOURNAL
OF ENGINEERING APPLIED SCIENCE
AND TECHNOLOGY

VOLUME : 7 ISSUE : 06 Print / Issue Publication Date: 24-Dec-2022

ISSN : 2455-2143

DOI : 10.33564/IJEAST.2022.v07i06.036

Indexed In

Google Scholar · Open Access · doi · Crossref

WWW.IJEAST.COM

editor@ijeast.com

International Journal of Engineering Applied Sciences and Technology, 2022
Vol. 7, Issue 6, ISSN No. 2455-2143, Pages 316-324
Published Online October 2022 in IJEAST (http://www.ijeast.com)

LI-FI BASED VEHICULAR COMMUNICATION NETWORK WITH ACCIDENT PREVENTION AND DRIVER ALERTING SYSTEM

K. A. R. D Perera, T. R Amarasena, L. H Edirisinghe, Dr. Anuradha Jayakody, N. K. A Dissanayake, Ms. Wellalage Sasini Nuwanthika
Department of Computer Systems Engineering
Sri Lanka Institute of Information Technology, Malabe, Sri Lanka

Abstract— **Many vehicle accidents were recorded because of the drowsiness or emotional instability of the drivers. There are many fatal cases and minor cases are being recorded every day and these numbers are on a gradual increase. Some vehicle manufacturers design several safety measures such as air bags, powerful roll cages, automated braking systems to mitigate the damage of the accidents. But always prevention is better than cure. There are occasions which accidents occur due to the malfunction of the vehicle, but most of the accidents are because of the human errors done by the driver. And these human errors can be happened by the driver inside the vehicle or any driver who is driving on the road. There can be a chance of preventing such accidents if the danger could be communicated earlier to the driver. Therefore, not only detecting the current state of the driver but also communicate such a situation to nearby vehicles is very important. The proposed solution of this report is a hardware-based system which explore the ability to detect the drowsiness of the driver using image processing technologies to prevent vehicle accidents by alarming the driver and as well as communicating the danger to the nearby vehicle using light fidelity technology.**

Keywords— **Li-Fi, formatting, Accident prevention, Drowsiness Detection**

I. INTRODUCTION

Road accidents are much prominent now days due to higher numbers of vehicles on the motorways. These accidents have caused minor and as well as fatal injuries to the drivers and passengers. There are approximately 1.3 million deaths reported due to road accidents on the year 2021. According to the previous records the number of deaths is on the rise. Therefore, researchers are constantly involved in innovating solutions to minimize these accidents. Many technologies such as drive assistance, lane departure warning and proximity warning have been developed and implemented to the vehicles. These technologies used many detection media such as Wi-Fi, Bluetooth, infrared, and ultra-sonic waves. These technologies have their own strengths and weaknesses. Proposed light fidelity-based vehicle to vehicle and vehicle to infrastructure technology warns the drivers of the vehicles to avoid a potential vehicle accident thus minimizing the accident completely or reducing fatality of the accident.

Light Fidelity (Li-Fi) is a recently discovered low cost and less complex technology which has a higher data transmission speed. Li-Fi uses visible light as the medium to transfer data. The binary data transmission from one node to the other is transmitted by using the light intensity changes. The infrastructure for the Li-Fi data transmission is already available in vehicles. The LED headlight of the vehicle will be acting as the transmitter while a separate connected module in the nearby vehicle on the line of sight will be acting as the receiver. The proposed solution consists with sub systems to identify the drowsiness of the driver, drunkenness of the driver, identification of the proximity of nearby vehicles and vehicle to infrastructure communication on controlling traffic lights to allow emergency vehicles to pass by any junction using Li-Fi technology. The solution has its own visual and audio warning system to warn the driver inside the vehicle of any of above hazards were detected.

II. RELATED WORK

Several approaches have been proposed related to this issue in many papers. Some specific papers have been analyzed in the following paragraphs.

The face is a significant organ because of how much information it communicates. Facial expressions, such as blink and yawn rate, change when a driver is fatigued. A research paper published by several students of Beijing University of Technology propose a technology called DriCare that analyzes video footage to determine a person's tiredness level based on telltale signs like yawning, blinking, and the length of time their eyes are closed. After realizing the limitations of existing methods, we develop a brand new face-tracking algorithm to address this issue. As an additional step, we developed a novel approach of facial area recognition using a set of 68 landmarks. Then, we analyze the drivers' mental health using these face features. DriCare's tiredness warning uses a combination of facial traits to identify signs of exhaustion in the driver. The testing findings demonstrated that DriCare was accurate to within 2%.

In this study, twelve participants' EEG data were subjected to several machine learning algorithms in order to assess their performance. The initial stage was to segment all recorded data for all subjects into second epochs. For each epoch, brain signals were classified as awake or sleepy. A preprocessing step is introduced before applying the machine learning algorithms to the epoched signal to extract the relevant characteristics. Naive Bayes (Diagonal Linear Discriminant Analysis), Support Vector Machines (Linear and Radial Basis Functions), K-Nearest Neighbor (KNN), and Random Forest Analysis are the methods used (RFA). Using only three electrodes, it was discovered that using more than one classifier resulted in the maximum accuracy of 100% for all participants included in this investigation.

This research includes a literature overview of machine learning algorithms for detecting driver sleepiness based on behavioral measurements. Expressions on people's faces might reveal their amount of sleepiness. A person's level of tiredness may be inferred from a number of facial cues. Movements of the eyes, the head, and the jaw are all examples. Creating a system for detecting sleepiness that is both accurate and resilient is difficult. In the past, many methods were tested for their ability to identify sleepy drivers. With the advent of deep learning, it is now necessary to reevaluate these sleepiness detection algorithms to see how well they perform. Therefore, this study provides a summary of relevant machine learning algorithms for detecting sleepiness, such as support vector machines, convolutional neural networks, and hidden Markov models. In addition, a meta-analysis of 25 studies is performed to examine the efficacy of machine learning methods in detecting sleepiness. Support vector machine technology was shown to be the most popular method for detecting sleepiness, while convolutional neural networks outperformed both of the other methods in the investigation. As a final deliverable, this work provides a catalog of publicly available datasets that may serve as sleepiness detection standards.

This study was done on five suburban drivers in 2015 in Tehran, Iran, utilizing a driving simulator based on the virtual reality laboratory of Khaje-Nasir Toosi University of Technology. The Violla-Jones algorithm was used to identify facial emotions and eye position. The criteria for identifying tiredness in drivers were eye blink length, blink frequency, and PERCLOS, which was used to corroborate the results.

Drivers' degrees of sleepiness are directly proportional to the duration and frequency of their eye closures and blinks. The mean squared errors for data trained by the network and data entered into the network for testing were 0.0623 and 0.0700, respectively. Meanwhile, the detection system's accuracy percentage was 93.

Melanie Anthony with the team have proposed Alcohol Detection System to Reduce Drunk Driving. They have used mainly MQ3 sensor and Arduino figure to detect alcohol. If the permissible limit exceeds their intention is to stop the ignition system of the car. Further authority would be alerted using an GSM module. According to the proposal, authors claim this method is way more effective to detect alcohol and it will improve the safety of the people not only inside the vehicle but also people in the surrounding of the car. Iwan Fitrianto Rahmad and team proposed research called Application of the Alcohol Sensor MQ-303A to Detect Alcohol Levels on Car Driver. This implementation is also used MQ3 sensor to detect alcohol and temperature sensor to increase the data accuracy. They tried to improve the data accuracy of the collected alcohol level, the variation of the alcohol level with the distance to the sensor and the effective data communication.

An implementation called Car Accident Prevention and Health Monitoring System for Drivers have done by Md. Hasibul Islam and his team. It will basically track heart rate, temperature, and whether the driver is drunk, as well as drowsiness. They intention was to start the car engine if only the driver is in good health. They have used ultrasonic sensor to identify the gap between nearby cars. In addition to that if driver is not in good condition with help of the GSM module an SMS will be generated to authorities. In this work overall idea is to make a health monitoring system to the driver.

There are some other methods to identify whether the driver is drunk. They are Iris recognition using Gabor filter, Neural network using face images, detection using speech and detection using Driving pattern. Kavish A. Sanghvi has done similar kind of research. He has considered Alcohol content, Eye blink rate and facial recognition, Acceleration and general movement of the car, Nature of the road and tried to improve the accuracy of alcohol detection. similarly, Lea A. Navarro and team has done alcohol detection work using Iris Recognition Patterns for cars using Wavelet Transform. The algorithm used for this work is Gabor filter with a MATLAB program. The concept of this Iris Recognition is the size due to the dilation and constriction of the pupil. First capture the iris image then process it to identify whether driver is influence under alcohol. if so, it will turn of the ignition system of the car. As a summary iris recognition has very good accuracy but it has its own complexities.

A blind spot detecting system used to prevent against misshapenness such as automotive collisions, impediments, and accidents, which result in significant loss of human life and can have fatal consequences. The technology utilized for this purpose detected other vehicles, barriers, and onlookers. When detected, the gadget activates a timer, delaying the activation of alarm circuits for a short period of time. This time delay is implemented to reduce the number of nuisance

International Journal of Engineering Applied Sciences and Technology, 2022
Vol. 7, Issue 6, ISSN No. 2455-2143, Pages 316-324
Published Online October 2022 in IJEAST (http://www.ijeast.com)

alarms triggered by a brief entrance into the hazard zone. If the existence of the barrier is still identified after the delay period, LEDs and auditory alerts are activated to warn the system operator of the potentially dangerous situation. For a limited time, the alarms stay triggered, allowing the operator to clear the hazard zone.

A blind spot detecting system used to prevent against misshapenness such as automotive collisions, impediments, and accidents, which result in significant loss of human life and can have fatal consequences. The technology utilized for this purpose detected other vehicles, barriers, and onlookers. When detected, the gadget activates a timer, delaying the activation of alarm circuits for a short period of time. This time delay is implemented to reduce the number of nuisance alarms triggered by a brief entrance into the hazard zone. If the existence of the barrier is still identified after the delay period, LEDs and auditory alerts are activated to warn the system operator of the potentially dangerous situation. For a limited time, the alarms stay triggered, allowing the operator to clear the hazard zone.

The creation of a unique contactless omnidirectional capacitive proximity sensor is described in this work. By duty-cycling the power supply, the described device has been intended to be energy-efficient (5 mW power usage). A thorough methodological experiment was carried out to thoroughly analyze the performance within the sensing range (5–10 cm). A digital potentiometer was used to build a basic boot-up self-adjustment system. This characteristic enables the suggested device to be used in a wide range of possible applications, including mobile robots and human-machine interaction.

Ahamed Yasar and Srinivasan Kuppuswamy has researched on vehicle-to-vehicle communication using Li-Fi technology. They have proposed a design using LEDs and microcontrollers to communicate between vehicles. Arduino programming and the hardware tool Proteus has been used to develop the two scenarios which are sending a warning signal to the vehicle in front whenever the brake is applied suddenly by the leading vehicle, while second scenario is sending a signal in an emergency situation alerting the front vehicle to give way. Riya John an Santumon S.D has proposed a system using Li-Fi based vehicle to infrastructure communication. The IR pair sensor is used to detect the density of the vehicles in a junction and turn on the green signal for a certain amount of time. Further, the APR module and the microcontroller in the vehicles are able to provide audio safety information inside the vehicle.

III. METHODOLOGY

The proposed Li-Fi Based Vehicular Communication Network with Accident Prevention and Driver Alerting System is consists of four main research areas. They are drowsiness detection, Drunkenness detection, vehicle to vehicle communication and proximity sensing using Li-Fi, Emergency vehicle alerting using vehicle to vehicle communication network and vehicle to infrastructure communication. The Figure 3.1.1.0 illustrates the Overall diagram of the research project.

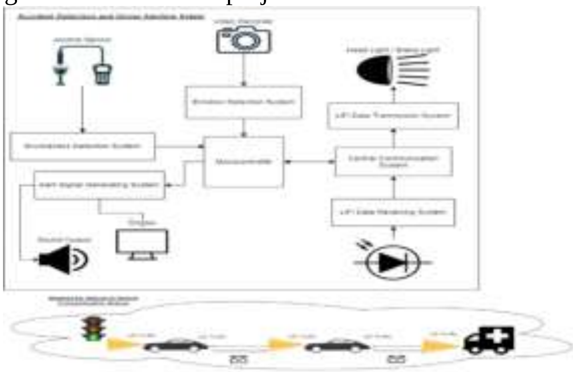

Figure 3.1.1.0: Overall System Diagram

The prototype of the proposing system will be implemented using in a miniature test environment. The Prototype consists with microprocessor and microcontroller base configuration with all the sensors, video camera, and other related components.

3.1 Drowsiness Identification System

The Drowsiness detection of the driver is determined by identifying the behavior of the driver. The main two aspects that reflects the sleepiness/drowsiness of an individual is the eye movement and yawning. The drowsiness detection system is consisting with a video capturing device pointed at the driver's face which captures the real time data of the driver's face and feed it to the system. The block diagram of the setup is as follows.

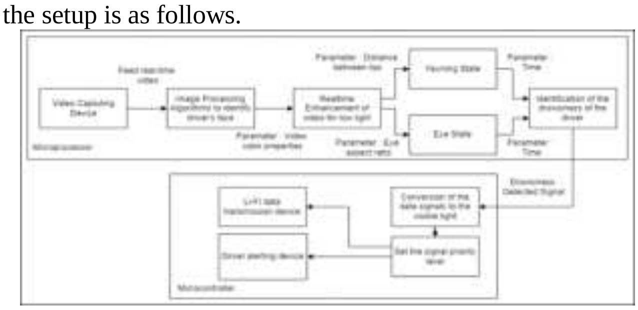

Figure 3.1.1 Drowsiness Detection System Flow Diagram

The following methods are then used to the captured real time video to detect whether the driver is drowsy.

1. Detection of the Eye movement

The rule-based image processing algorithms used to identify the Eye Aspect Ratio (EAR) of the driver's eyes. The EAR value will be determining whether the driver's eyes are open or closed.

The point of the face is determined by referencing the facial landmarks of the driver. The dlib library of python which uses the Kazemi and Sullivan's one millisecond face

Vol. 7, Issue 6, ISSN No. 2455-2143, Pages 316-324
Published Online October 2022 in IJEAST (http://www.ijeast.com)

alignment with an ensemble of regression trees technique to perform the facial landmark identification. The facial landmark uses 68 points of the facial recognition by estimating the probable distance between each point. The library is trained with an existing facial structure. The following formula is used to detect the length of the upper lid and lower lid of the eye.

$$\text{EAR} = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

Figure 3.1.2 Eye Aspect Ratio Calculation Equation

2. Detection of the Mouth movement

The real time video of the face is acquired using a video camera and processed in the opencv environment. The indices of mouth landmarks are recognized and marked. The MAR (Mouth Aspect Ratio) is calculated. When the mouth is closed, the value of MAR decreases. When the driver yawns, the MAR value rises. When the MAR value rises beyond a certain threshold, yawning is recognized. It estimates and maps a person's face as 68 cartesian coordinated facial points shown in the figure 3.1.3. The 68-point dataset, which is the source of these marks, was used to train the dlib face landmark predictor.

Figure 3.1.3 Facial Landmark Diagram

Lip distance is used to evaluate whether the subject's mouth is open. If the computed lip distance from the frame is more than the lip distance criterion, the person is declared to be yawning. If the subject yawns more than the defined number of times in a row, an alert is triggered. Small gaps that are created as a result of talking or eating are disregarded.

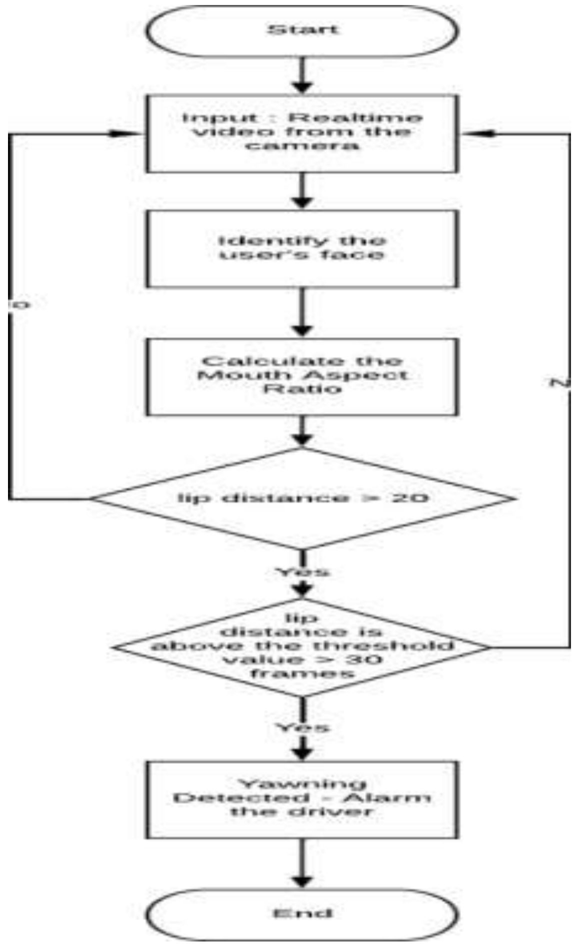

Figure 3.1.4 Yawning Detection Flow Diagram

If the driver's eyes were detected as closed for the predefined consecutive frames, the system will output the message as "Drowsiness Alert" and a voice command will be output as an audio to wake up the driver. The same design was integrated in yawning detection as well, the output message as "Yawning Alert" will be displayed to the driver and a voice command will be executed. Despite of the internal alarms, the drowsiness system has been connected to the Li-Fi based communication system to transmit the drowsiness alert data to the nearby vehicles using Li-Fi transmitter.

3.2 Driver Drunkenness Detection System

The purpose of Drunkenness Detection System is to identify whether the driver is drunk and if the driver is drunk, warning should be given to the drunk driver and the nearby vehicles using Li-Fi technology. Figure 3.2.1 will illustrate the diagram of Drunkenness Detection System.

International Journal of Engineering Applied Sciences and Technology, 2022
Vol. 7, Issue 6, ISSN No. 2455-2143, Pages 316-324
Published Online October 2022 in IJEAST (http://www.ijeast.com)

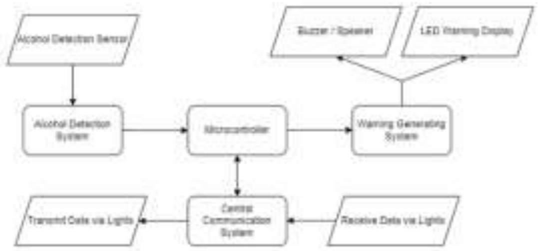

Figure 3.2.1 Diagram of Drunkenness Detection System

This system can further divide into subsystems according to Figure 3.2.1. They are Alcohol Detection subsystem, Warning/Alerts Generating subsystem and Central Communication subsystem.

Alcohol Detection subsystem will mainly use MQ3 sensor to detect alcohol concentration of the air. This sensor is basically used to get the breath alcohol content. A predefined maximum allowable limit or margin is set to decide whether the driver is drunk. It will provide which level of alcohol content detected. Then the algorithm will decide drunkenness. This detection should be identified quickly because after that the information need to be processed and deliver to warning generating system.

Warning/Alerts generating subsystem warns the driver to stop the vehicle immediately. This system will get the data from two ways. Firstly, is warning the driver in the vehicle. Secondly, warning/alert related data transmission to other nearby vehicles through the communication system via Li-Fi technology. LCD display and Buzzer/speaker configuration will be used in Warning/Alerts Generating system. Depending upon the warning type, Warning message will be displayed on the LCD. If the driver of the current vehicle is drunk, Buzzer will be going on continuously until breath alcohol content reduced. If that warning is getting form another nearby vehicle, LCD will show the type of the warning and there will be an audible warning from the speaker saying, there is a drunk driver behind.

Central communication system is used to deliver the messages/alerts to other vehicles and capture the alerts/warning of other vehicles using Li-Fi technology. Front light of the vehicle will use to transmit data to the vehicles in the front. If the algorithm decide that the driver is drunk, system will communicate or send digital message to the front vehicle using visible light communication. In this case it will send a letter “D” to front. The Li-Fi receiver of the front car will use to receive data. That will capture message and display alerts according to the message and further this subsystem will use to communicate to vehicles in the front.

3.3 Proximity Detection and Warning System

The proximity detection system identifies the distance between the vehicles and warn the driver if a vehicle is closer proximity. This sub system uses ultrasound sensors and light to identify the distance. The ultrasound sensors are connected to the micro controller and a derived algorithm is used to identify the distance and alert the driver.

The micro controller is programmed to take necessary decisions and calculate the distance with the aid of the connected ultrasound sensor. A threshold distance value (dt) has been feed to the micro controller to warn the driver and to transfer the data from Li-Fi transmitter to the Li-Fi Receiver.

Figure 3.3.1 Proximity Detection System Diagram

According to the distance calculated using the ultrasound sensor, Li-Fi Tx (transmitter) sends the signal via Li-Fi technology to the Li-Fi Rx (Receiver) with the information that both cars are at closer proximity. The maximum distance the ultrasound sensor measures is 100 centimeters / 1 meter.

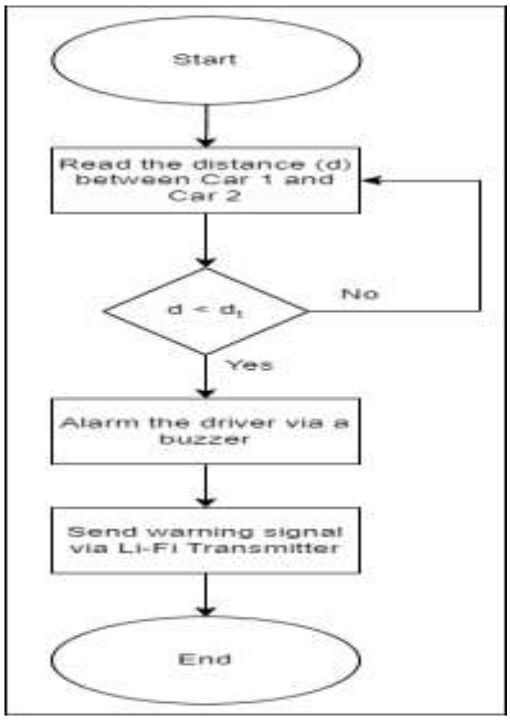

Figure 3.3.2 Proximity Detection System Flow Diagram

The distance calculation is real time, and the process is repeated continuously until the dt is less than the actual distance measured. As both vehicles are in the motion it is mandatory to calculate how fast the cars are approaching. To obtain the precise measurements, the following equation can be used.

International Journal of Engineering Applied Sciences and Technology, 2022
Vol. 7, Issue 6, ISSN No. 2455-2143, Pages 316-324
Published Online October 2022 in IJEAST (http://www.ijeast.com)

$$V_R = V_{car1} - V_{car2}$$

$$T_{(time\ to\ collide)} = V_{Relative} \times d_{actual}$$

Figure 3.3.3 Proximity calculation equation

In the above equation if the value of the actual is less than the time to collide will be calculated and display on the LCD display with the warning buzzer alarm (according to the dt). The actual speed of the car 1 and car 2 are obtained using the speedometers of the vehicles.

3.4 Emergency Vehicle Alerting System.

The emergency vehicle alerting system is implemented in a way that the vehicles in the front of the emergency vehicle are alerted of the arriving emergency vehicle. It is done via Li-Fi signals emitted from the emergency vehicles headlight. When an emergency vehicle switches on the system, the signal is generated and it is passed through the headlight of the emergency vehicle. The photo transistor receiver which resides on the rear end of the front vehicle captures the signal and displays a message on the screen that an emergency vehicle is arriving.

The emergency vehicle alerting system is also capable of communicating from vehicle to infrastructure, when the message that is passing from vehicle to vehicle reaches a traffic light, it is capable of capturing the message and turning the traffic light to green until the emergency vehicle has passed. The below figure shows the overall subsystem.

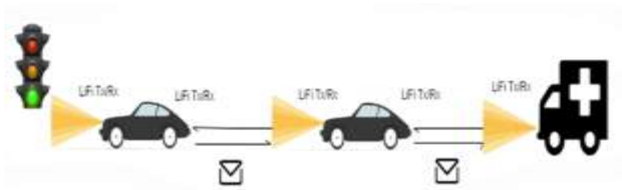

Figure 3.4.1 Li-Fi communication

Li-Fi communication concept is used where the LED is used as the transmitter of data and the LDR is used as the receiver. In order to transmit the data, the transmitter end and the receiver must agree upon a common protocol. Arduino is programmed to change the intensity of the light that could be captured by the LDR as 1 and 0s, which will be able to transmit the message from one vehicle to another.

IV. RESULTS AND DISCUSSION

4.1 Results

The drowsiness detection system used rule-based techniques to identify the drowsiness of the driver. As the main objectives of the drowsiness detection system, the programmed device should be able to accurately identify the user's eyes and lips. The following figure shows the mapped facial landmarks of the driver.

Figure 4.1.1Eye and mouth detection frame

The eye aspect ratio (EAR) value is used to identify the drowsiness of the driver. Therefore, the accuracy of identifying the eye closure is very important. The threshold to detect the eye is closed was set to 0.3 and to conclude that the driver is drowsy this value must persist for next 30 consecutive frames. Even the value has been detected as 0.3 and continued less than the mentioned number of frames, the system detects as eyes are blinking. The following figure shows the real time calculation of the EAR value.

Figure 4.1.2 Drowsiness detected frame

The rule-based architecture is also used in yawning detection mechanism. The yawning threshold has been set to 20. If the upper lip and lower lip distance exceeded the threshold value, the system detects that the driver is yawning. The driver will receive an alarm once the yawning is detected. The figure given below shows the yawning value and the output alert to the driver when yawning is detected.

Figure 4.1.3Yawning detected frame

The accuracy of the eye aspect ratio has been determined by testing the system to detect the drowsiness of the driver in different testing scenarios. The following figure shows the number of blinks detected by the system.

Figure 4.1.4 Blink Count Detection

To find the accuracy of the system, the number of blinks detected by the device versus the actual number of blinks of the driver is concerned. The following equation is used to identify the accuracy as a percentage.

$$Accuracy = \left(\frac{Number\ of\ blinks\ detected\ by\ the\ system}{Number\ of\ actual\ blinks\ of\ the\ driver}\right) \times 100\%$$

The system is tested with a fixed number of blinks and the following table has been developed with the results obtained.

Table 4.1 Accuracy of blink detection

Sample	Number of blinks detected by the system	Number of actual blinks of the driver	Accuracy
1	22	25	88%
2	23	25	92%
3	23	25	92%
4	24	25	96%
5	22	25	88%

The overall accuracy of detection of the eye closure is 91.2%.

The accuracy of the yawning detection functionality is also tested in the same technique. The yawning count detected by the system was compared with the actual yawning count of the driver. The figure given below shows the real time yawning count detected by the system.

Figure 4.1.5Yawning Count detection

The number of yawning tested per sample has been set to 15. The accuracy of the system was measured with the detected yawn count and actual count. The following equation depicts how the accuracy was calculated per sample.

$$Accuracy = \left(\frac{The\ yawn\ count\ detected\ by\ the\ system}{The\ actual\ yawn\ count\ of\ the\ driver}\right) \times 100\%$$

The following table was developed with the tested results of the yawns detected.

Table 4.2 Accuracy of yawn detection

Sample	Number of yawns detected by the system	Number of the actual yawns of the driver	Accuracy
1	14	15	93.34%
2	13	15	86.67%
3	13	15	86.67%
4	14	15	93.34%
5	14	15	93.34%

The overall accuracy of yawn detection by the system is 90.68%.

The alcohol detection system consists of MQ3 sensor. It has two outputs one is digital output other one is analog output. Analog output is used for this implementation. The output will give values from 0 to 1024. This particular value can be considered as alcohol parts per million(ppm). It represents the breath alcohol content from 0.05mg/L to 10mg/L.

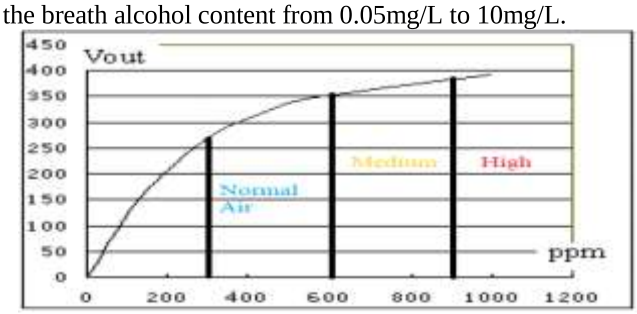

Figure 4.1.6 output value vs output voltage with alcohol level

According to the above values, the alcohol level will be decided. If the output values are more than or equal to 900, it will consider as a severe drunk person. If it is more than 600 and less than 900, it's still considered as drunk person. Mostly normal air value will have a range from 300 to 500.

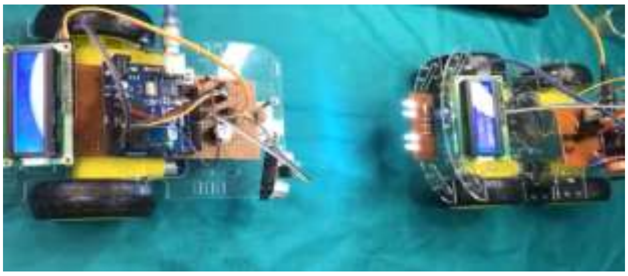

Figure 4.1.7: Li-Fi data transmission of the developed prototype

The above figure depicts the testing carried out to determine the accuracy of the Li-Fi data transmission of the proposed solution. The emergency vehicle alerting sub system outputs a string value 'A' from the transmitter via the pre-defined protocol and after it is captured by the LDR receiver of the front vehicle correctly, the message "Ambulance is in behind" is displayed. Following table shows the test results of Li-Fi data transmission of the developed prototype.

		Nighttime			Daytime		
		No of times data transmitted	No of times data received	Accuracy	No of times data transmitted	No of times data received	Accuracy
Distance (cm)	4	50	50	100%	50	50	100%
	8	50	50	100%	50	50	100%
	12	50	50	100%	50	50	100%
	16	50	50	100%	50	40	80%
	20	50	46	92%	50	0	0
	24	50	0	0%	50	0	0
	Nighttime Accuracy		98.4% up to 20 cm		Day time Accuracy	95% up to 16 cm	

The accuracy of the Li-Fi data transmission of the developed model was calculated using the following equation.

$$Accuracy = \left(\frac{\text{The number of times the data transmitted}}{\text{The number of times the data received}}\right) \times 100\%$$

The accuracy of the Li-Fi data transmission was tested in both day and night environments. As expected, the accuracy of the data transmission at night was higher than during the day. The main reason for this was identified as the noise (other light sources) are higher during the daytime. This reduces the maximum distance that the receiver can successfully receive the transmitted data from the Li-Fi transmitter. The accuracy of the Li-Fi data transmission at nighttime was obtained as 98.4% up to 20 centimeters and during the daytime the accuracy was identified as 95% up to 16 centimeters.

The vehicle to infrastructure communication is in the similar manner in this case from the vehicle in front of the traffic light passes the string value 'A' to the traffic light. The traffic light then turns green until the emergency vehicle passes the traffic light

V. CONCLUTION

The purpose of this implementation is to reduce vehicle accidents. The main difference from other works in this project is giving warning and alerts to nearby vehicles. Not only that but also the medium used to transfer the alert also unique in this work. Visible light communication is used to transmit warning and alerts to nearby vehicles. Further other vehicles will have a receiver which is consist of Light Dependent Resistor. In this implementation there are many types of alerts. They are Sleepiness or drowsiness, drunkenness, proximity detection, emergency vehicle alerting. Depending on the output of these alerts they will be appeared to current vehicle and nearby by vehicles after communicating through central communication system and vehicles alerting system. There will be visible alerts and audible alerts for the driver.

VI. ACKNOWLEDGMENT

We would like to express our sincere gratitude to several individuals and organizations for supporting us throughout this research. First, we would like to acknowledge and give warmest thanks to our supervisors Dr. Anuradha Jayakody and Ms.Sasini Wellalage for guidance, enthusiasm, patience, insightful comments, helpful information, practical advice carried through the previous stages. Their immense knowledge, profound experience and professional expertise in this area has enabled us to complete this research successfully.
We also wish to express our sincere thanks to Sri Lanka Institute of Information Technology for accepting us into the graduate program. In addition, we also deeply thankful to our team members. we want to acknowledge and appreciate their

help during our research. Our teamwork has helped us complete this project successful.
Finally, we would like to express our gratitude to all the people who help us by providing their valuable assistance and time during this research including our parents.

REFERENCE

[1]. Anthony, M., Varia, R., Kapadia, A., & Mukherjee, M. (n.d.). Alcohol Detection System to Reduce Drunk. International Journal of Engineering Research & Technology (IJERT), St. Francis Institute of technology (Mumbai University)(Special Issue - 2021).

[2]. Coko, D., Stan, I., Rodi, L. D., & Coši, D. (2022). TheraProx: Capacitive Proximity Sensing. MDPI Electronics, 11, 393.

[3]. DENG, W., & WU, R. (2019). Real-Time DriverDrowsiness Detection System Using Facial Features. IEEE Access. Beijing University of Technology, China, Yunnan University, China.

[4]. Fouad, I. A. (2022). A robust and efficient EEGbased drowsiness detection system. Ain Shams Engineering Journal. Biomedical Engineering Dept., MUST University, Giza, Egypt.

[5]. HANWEI ELETRONICS CO., L. (n.d.). TECHNICAL DATA MQ-3 GAS SENSOR. https://www.hwsensor.com/.

[6]. Islam, M. H., Khandoker, A. A., Sami, T. M., Talukder, T. I., Rahman, M. I., & Sarkar, P. K. (2021). Car Accident Prevention And Health Monitoring. IEEE Region 10 Symposium. Electrical and Electronic Engineering, American International University-Bangladesh.

[7]. Mahapatra, R. P., Kumar, K. V., Khurana, G., & Mahajan, R. (2008). Ultra Sonic Sensor Based Blind Spot Accident Prevention System. International Conference on Advanced Computer Theory and Engineering. Phuket, Thailand.

[8]. Mr.Z.Ahamad Yasar, M. M. (2019). DATA TRANSMISSION BETWEEN VEHICLES THROUGH Li-Fi. International Journal of Pure and Applied Mathematics, 117.

[9]. Navarro, L. A., Diño, M. A., Joson, E., Anacan, R., & Cruz, R. D. (2016). Design of Alcohol Detection System for Car Users thru Iris Recognition Pattern. 2016 7th International Conference on Intelligent Systems, Modelling and Simulation. Electronics Engineering Department, Technological Institute of the Philippines- Manila.

[10]. Ngxande, M., Tapamo, J.-R., & Burke, M. (2017). Driver drowsiness detection using Behavioral measures and machine learning techniques: A review of state-of-art techniques. Pattern Recognition Association of South Africa and Robotics and Mechatronics International Conference (PRASA-RobMech) . Bloemfontein, South Africa.

[11]. POURSADEGHIYAN, M., MAZLOUMI, A., SARAJI, G. N., BANESHI, M. M., KHAMMAR, A., & EBRAHIM, M. H. (2018). Using Image Processing in the Proposed Drowsiness Detection System Design. Iran J Public Health, 47(9), pp.1371-1378.

[12]. Rahmad, I. F., Nababan, E. B., Tanti, L., Triandi, B., Ekadiansyah, E., & Fragastia, V. A. (2019). Application of the Alcohol Sensor MQ-303A to Detect Alcohol Levels on Car Driver. The 7th International Conference on Cyber and IT Service Management. Faculty of Computer Science and Information Technology, Medan, Indonesia.

[13]. Riya John, S. S. (2016). LI-FI Based Vehicle to Infrastructure Communication. International Journal of Scientific Development and Research, 1(8).

[14]. Sanghvi, K. A. (2018). Drunk Driving Detection. Computer Science and Information Technology 6(2): 24-30. Mukesh Patel School of Technology, Management and Engineering, India .

[15]. Stjepanović, A., Ćurguz, Z., Kostadinović, M., Jotanović, G., Stojčić, M., & Kuzmić, G. (2022). Pedestrian detection in automated vehicles using ultrasonic and passive infrared sensors. 21st International Symposium INFOTEH-JAHORINA. Doboj, Bosnia and Herzegovina.

[16]. WHO. (2022, June 20). Global status report on road safety. (World Health Organization) Retrieved fromhttps://www.who.int/news-room/factsheets/detail/road-traffic-injuries

IJEAST

INTERNATIONAL JOURNAL OF ENGINEERING APPLIED SCIENCE AND TECHNOLOGY

ABOUT IJEAST

International Journal of Engineering Applied Science and Technology (IJEAST) is a peer-reviewed, open access journal that publishes high-quality research papers in the field of Engineering, Applied Science and Technology.

IJEAST aims to provide a platform for researchers, academicians, and professionals to share their innovative ideas, research findings, and practical experiences with the global scientific community.

FOCUS AREAS

- Engineering
- Applied Science
- Technology
- Innovation & Development
- Interdisciplinary Studies

PEER REVIEWED
All submissions are rigorously peer reviewed to ensure quality.

OPEN ACCESS
Free and unrestricted access to research for all.

GLOBAL REACH
Connecting researchers and professionals worldwide.

TIMELY PUBLICATION
We ensure a swift and efficient publication process.

For more information, visit our website
www.ijeast.com

INTERNATIONAL JOURNAL
OF ENGINEERING APPLIED SCIENCE
AND TECHNOLOGY

editor@ijeast.com
www.ijeast.com
India

2455-2143