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Sensor-Based Personal Vehicle Driver Assistance System

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Abstract: This research paper presents a novel sensor-based wireless device designed to mitigate the risk of car accidents. The proposed system incorporates three major features: an anti-sleep alarm for drivers, a rain sensor for automatic activation of wipers, and a jerk sensor for automatic emergency alerts to nearby hospitals, police stations, and family members in case of accidents. The anti-sleep alarm feature utilizes a sensor that detects if the driver's eyes are closed for more than eight seconds, triggering an alarm and automatically parking the car to prevent a potential accident. The rain sensor feature automatically activates the wipers when it detects rain, improving the driver's visibility and reducing the risk of accidents. The jerk sensor feature detects sudden jerks in the vehicle's motion, which could indicate an accident, and immediately sends alerts to the appropriate authorities and the driver's family members. The proposed system employs wireless technology to enable seamless communication between the device and the authorities. In conclusion, this research presents a valuable contribution to the field of road safety. The proposed sensor-based wireless device offers a comprehensive solution to prevent car accidents, incorporating anti-sleep alarm, rain sensor, and jerk sensor features.

Keywords: Driver Assistance System, Arduino, Rain Sensor

I. INTRODUCTION:

This research paper presents a novel sensor-based wireless device designed to mitigate the risk of car accidents. The proposed system incorporates three major features: an anti-sleep alarm for drivers, a rain sensor for automatic activation of wipers, and a jerk sensor for automatic emergency alerts to nearby hospitals, police stations, and family members in case of accidents. The anti-sleep alarm feature utilizes a sensor that detects if the driver's eyes are closed for more than eight seconds, triggering an alarm and automatically parking the car to prevent a potential accident. The rain sensor feature automatically activates the wipers when it detects rain, improving the driver's visibility and reducing the risk of accidents. The jerk sensor feature detects sudden jerks in the vehicle's motion, which could indicate an accident, and

immediately sends alerts to the appropriate authorities and the driver's family members. The proposed system employs wireless technology to enable seamless communication between the device and the authorities. In conclusion, this research presents a valuable contribution to the field of road safety. The proposed sensor- based wireless device offers a comprehensive solution to prevent car accidents, incorporating anti-sleep alarm, rain sensor, and jerk sensor features.

II. LITERATURE SURVEY:

In the year 2022, Prof. Rajnandini Kumawat, Nehal Kawalekar, Rahul Pawar, Sand andeep Medar published a paper entitled “Anti-Sleep Alarm using IoT”[1]. The creation of a prototype sleepiness detection system is the goal of this research. Designing a system that can precisely track the driver's eyes' open or closed condition in real-time will be the main emphasis. It is thought that the signs of driver weariness might be identified early enough to prevent an automobile collision by keeping a watch on the eyes. When viewing a series of photographs of a face, eye movements and blink patterns are watched for signs of weariness. Additionally, it will notify the owner when the driver is sleepy.

In the year 2022, Mohammed MoinullaShariff, Syed Abu Anas, FaizanShariffN, Ms. Manasa E,Ms. GloriyaPriyadarshini published a paper entitled “Driver’s Anti-Sleep Device”[2]. The objective of this project is to design a gadget that can detect tired driving correctly and sound alerts in response, preventingdrivers from doing so and fostering a safer driving environment. The project was completed by a tilt sensor, which activates a buzzer whenever a driver tilts their head when driving while fatigued until they return to their regular position.

In the year 2021, Marianne B. Calayag, Diana Marie S. Cortez, Jasmine I.Gaspar, Junell R. Mananquil,John Leslie B. Manuzon published a paper entitled “Driver Sleep Detection and Alarming System”[9]. The goal of this research is to create a system that can recognise driver drowsiness and issue appropriate alarms. A chip with an ECG sensor will be used. The electrical and muscular activities of the heart are regularly evaluated using a diagnostic tool called an electrocardiogram (ECG).

In the year 2020, Adnan Ahmad, Anjali Sharma, Astha Singh, Sumanta Chatterjee, Apurba Paul published a paper entitled “Microcontroller Based Anti Sleep Alarm System”[4]. The device's built-in infrared sensor detects obstacles and sends a signal to the Arduino, which then sends a signal to the buzzer.This gadget can be used by a person who is physically paralyzed to converse with others, by security officers at night, and by a patient who is in a coma.

In the year 2023, Mr.M.B.Thorat, Mr.A.R.Gavhane, Mr.R.M.Kanse, Mr.E.R.Ghogare published a paperentitled “Advance Safety System With Anti Sleep Alarm”[5]. The circuit is designed around an infrared module. When the driver closes his eyes, the sensor generates a signal. After five seconds, a relay automatically starts a sound. If the driver hears that sound and opens his eyes, the vehicle will stop after eight seconds.

In the year 2022, Aparna Kamble, Pranjal Bansode, and Vikas Solanke published a paper entitled “Driver Anti Sleep Detector”[6]. The goal of this project is to develop a system that can accurately detect sleepy driving and make alarms accordingly, which aims to prevent drivers from drowsy driving and create a safer driving environment. The project was accomplished by a Webcam that constantly takes an image of the driver, a beagle board that implements an image processing algorithm of sleep detection, anda feedback circuit that could generate an alarm and a power supply system.

In the year 2017, Suganya G*, Premalatha M, Bharathiraja S, Rohan Agrawal published a paper entitled“A Low-Cost Design To Detect Drowsiness Of Driver”[7]. The aim of the paper is to design an economical system that monitors the drowsiness of the driver. The system will use a camera to monitor the driver’s eyes. To achieve this, the system will capture video from a day–night sensitive cameraand use image processing algorithms running on a Raspberry Pi board to detect any drowsiness in the eyes.

III. PROPOSED SYSTEM:

A. Workflow Diagram of Anti-Sleep Alarm System:

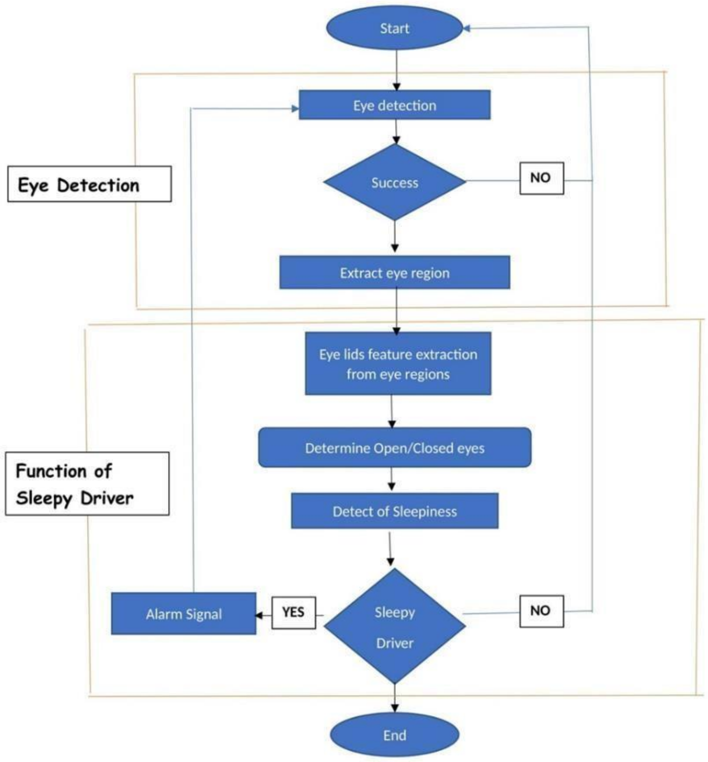

Figure 1. Work Flow Diagram for Anti-Sleep Alarm System

B. Work Flow Diagram for Automatic Wiper System:

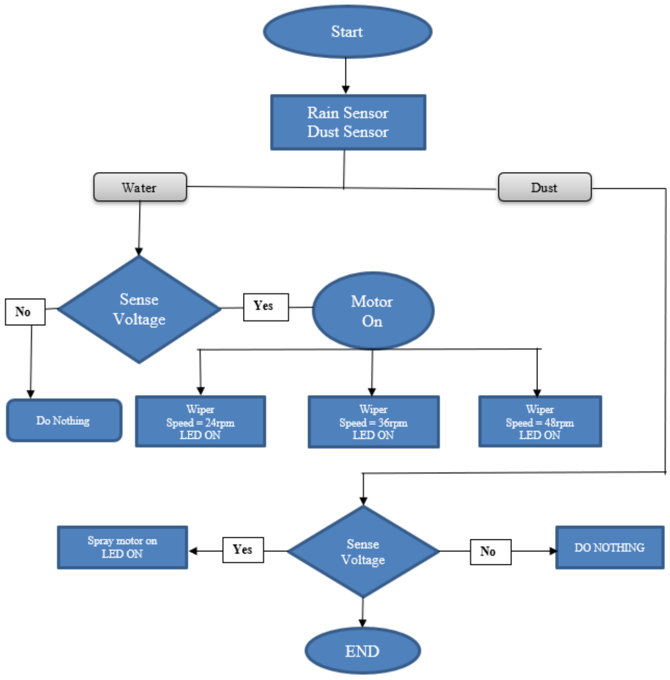

Figure 2. Work Flow Diagram for Automatic Wiper System

Circuit Diagram for Anti-Sleep Alarm System:

Transmitter :

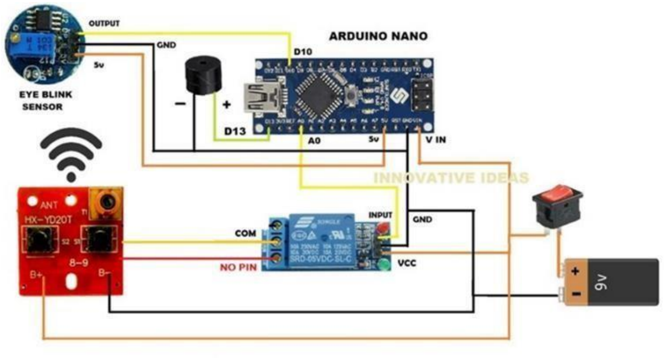

Figure 3. Circuit Diagram of Anti-Sleep Alarm (Transmitter Part)

Receiver:

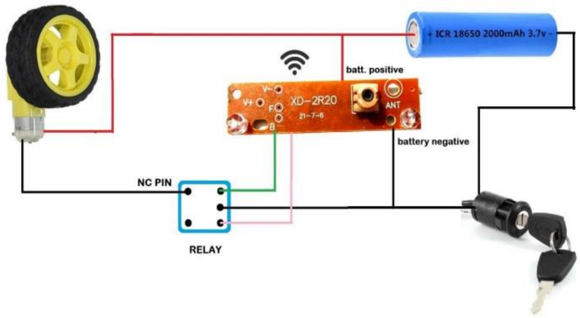

Figure 4. Circuit Diagram of Anti-Sleep Alarm (Receiver Part)

Circuit Diagram For Rain Sensor to automatic car wiper System :

For Rain Sensing

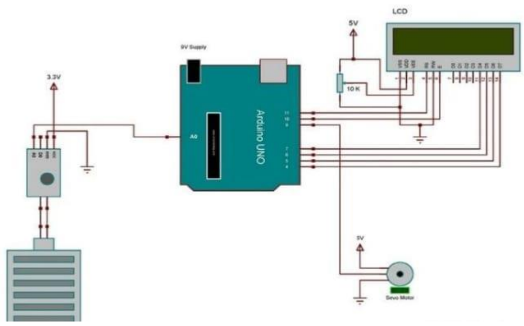

Figure 5. Circuit Diagram for Rain Sensor to Automatic Car Wiper

For Dust Sensing:

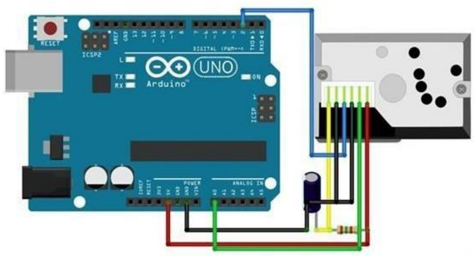

Figure 6. Circuit Diagram for Dust Sensor to Automatic Car Wiper

Hardware Components:

1. **Relay** – Relays are electromagnetic devices that are used to regulate the electricity flowing across a circuit. It is made up of a coil, a fixed contact, and an adjustable contact. Electrical current can flow across the circuit when an electrical current is applied to the coil, which creates a magnetic field that pushes the moveable contact in the direction of the fixed contact.
2. **Arduino UNO** - Popular open-source microcontroller board is known as the Arduino Uno is used extensively in the electronics and prototyping industries. It is a component of the Arduino platform, which consists of a programming environment and a sizable user and developer community, and is based on the ATmega328P microcontroller. For novices and amateurs, the Arduino Uno board offersa straightforward and user-friendly method of interacting with numerous electronic parts and sensors. To connect to and operate external devices like LEDs, motors, sensors, and more, it features a set of digital and analog input/output pins.
3. **Eye Blink Sensor** - A sensor that measures eyelid movement or inactivity is known as an eye blink sensor. This sensor may be used for a variety of tasks, including keeping track of a driver's or heavy equipment operator's state of awareness or sleepiness. In order to detect changes in the reflection of light off the surface of the eye, the sensor commonly uses infrared light. The sensor is able to recognize this shift when the eye blinks because the movement of the eyelid disrupts the infrared light's reflection.
4. **Rain Sensor** - In order to automatically detect rain and turn on the windscreen wipers, rain sensors are employed in cars. It operates by utilizing optical or acoustic techniques to find raindrops on the windscreen. The quantity of light reflected back to the sensor by the windscreen is measured by optical rain sensors using infrared light. The sensor can detect changes in light reflection brought on by raindrops striking the windscreen. On the other side, acoustic rain sensors employ sound waves to find the impact of raindrops on the windscreen.
5. **Dust Sensor** - A dust sensor, sometimes referred to as a particulate matter (PM) sensor, is a tool used to gauge and identify the amount of airborne particulate matter present in the immediate environment. Particulate matter, which includes dust, smoke, pollen, pollution, and other microscopic particles, refers to the tiny solid and liquid droplets hanging in the air. Dust sensors are frequently utilized in research applications, industrial settings, interior spaces, and air quality monitoring systems. They offer useful data on the presence and concentration of particulate matter, which is crucial for determining the severity of air pollution and any associated health hazards.

IV. EXPERIMENTAL RESULT:

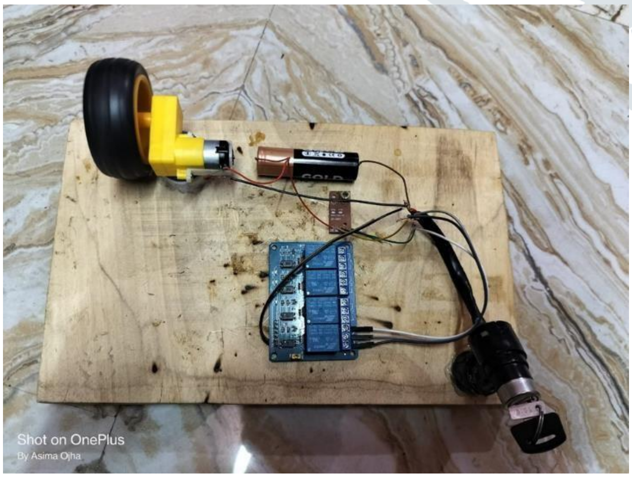

Figure 5. Anti-Sleep Alarm Device

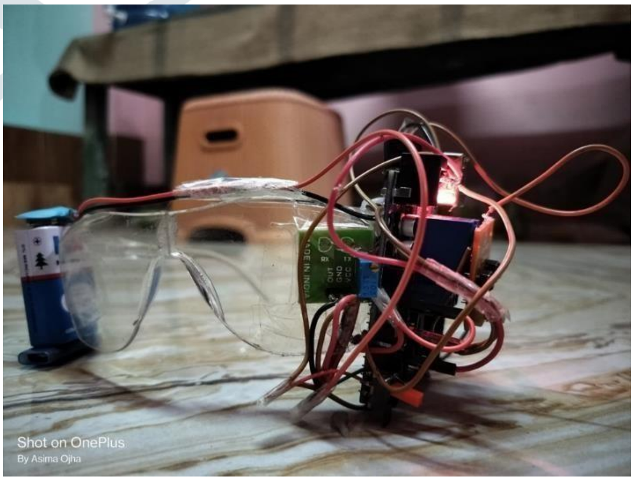

Figure 6. Eyeglass With the Eyeblink Sensor

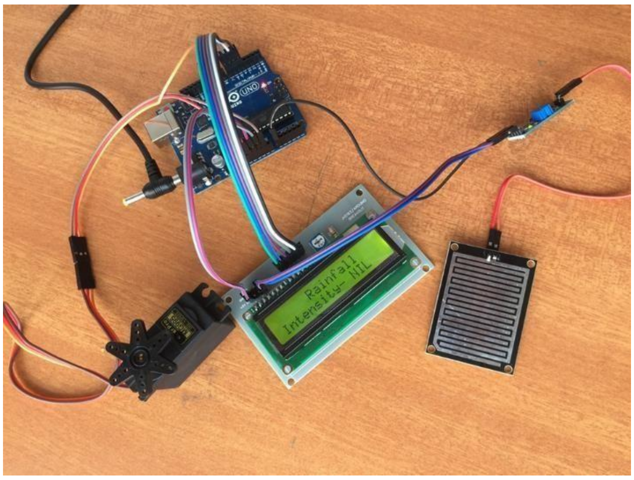

Figure 7. Automatic Rain Sensing Wiper Using Arduino

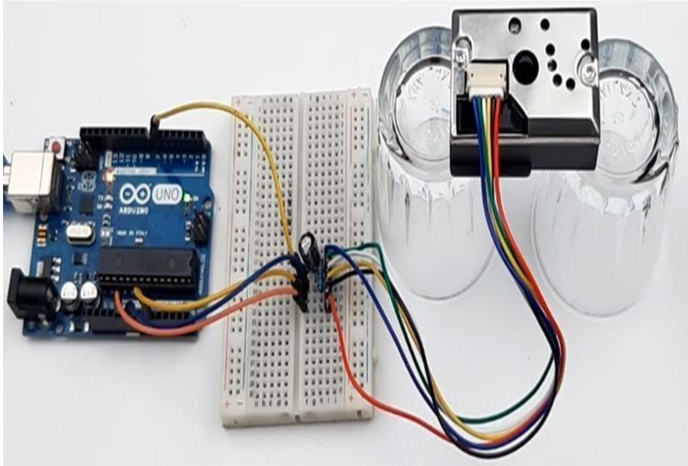

Figure 8. Automatic Dust Sensing Wiper Using Arduino

Table 1. Experimental result analysis for Sensor-based driver assistance system

Sl. No.	Sample	Time	Action
1.	1	<8 sec.	Buzzer Not Activated
2.	2	<8 sec.	Buzzer Not Activated
3.	3	<8 sec.	Buzzer Not Activated
4.	4	<8 sec.	Buzzer Not Activated
5.	5	<8 sec.	Buzzer Not Activated
6.	6	<8 sec.	Buzzer Not Activated
7.	7	<8 sec.	Buzzer Not Activated
8.	8	<8 sec.	Buzzer Not Activated
9.	9	<8 sec.	Buzzer Not Activated
10.	10	<8 sec.	Buzzer Not Activated
11.	1	8 sec.	Buzzer Activated
12.	2	8 sec.	Buzzer Activated
13.	3	8 sec.	Buzzer Activated
14.	4	8 sec.	Buzzer Activated
15.	5	8 sec.	Buzzer Not Activated
16.	6	8 sec.	Buzzer Activated
17.	7	8 sec.	Buzzer Activated
18.	8	8 sec.	Buzzer Activated
19.	9	8 sec.	Buzzer Activated
20.	10	8 sec	Buzzer Not Activated
21.	1	9 sec	Buzzer Activated
22.	2	9 sec	Buzzer Activated
23.	3	9 sec	Buzzer Activated
24.	4	9 sec	Buzzer Activated
25.	5	9 sec	Buzzer Not Activated
26.	6	9 sec	Buzzer Activated
27.	7	9 sec	Buzzer Activated
28.	8	9 sec	Buzzer Activated
29.	9	9 sec	Buzzer Not Activated
30.	10	9 sec	Buzzer Activated
31.	1	10 sec.	Buzzer Activated
32.	2	10 sec.	Buzzer Activated
33.	3	10 sec.	Buzzer Activated
34.	4	10 sec.	Buzzer Activated
35.	5	10 sec.	Buzzer Not Activated
36.	6	10 sec.	Buzzer Activated
37.	7	10 sec.	Buzzer Activated

38.	8	10 sec.	Buzzer Activated
39.	9	10 sec.	Buzzer Not Activated
40.	10	10 sec.	Buzzer Activated
41.	1	11 sec.	Buzzer Activated
42.	2	11 sec.	Buzzer Activated
43.	3	11 sec.	Buzzer Activated
44.	4	11 sec.	Buzzer Activated
45.	5	11 sec.	Buzzer Not Activated
46.	6	11 sec.	Buzzer Activated
47.	7	11 sec.	Buzzer Activated
48.	8	11 sec.	Buzzer Activated
49.	9	11 sec.	Buzzer Not Activated
50.	10	11 sec.	Buzzer Activated
51.	1	12 sec.	Buzzer Activated
52.	2	12 sec.	Buzzer Activated
53.	3	12 sec.	Buzzer Activated
54.	4	12 sec.	Buzzer Activated
55.	5	12 sec.	Buzzer Not Activated
56.	6	12 sec.	Buzzer Activated
57.	7	12 sec.	Buzzer Activated
58.	8	12 sec.	Buzzer Activated
59.	9	12 sec.	Buzzer Not Activated
60.	10	12 sec.	Buzzer Activated
61.	1	13 sec.	Buzzer Activated
62.	2	13 sec.	Buzzer Activated
63.	3	13 sec.	Buzzer Activated
64.	4	13 sec.	Buzzer Activated
65.	5	13 sec.	Buzzer Not Activated
66.	6	13 sec.	Buzzer Activated
67.	7	13 sec.	Buzzer Activated
68.	8	13 sec.	Buzzer Activated
69.	9	13 sec.	Buzzer Not Activated
70.	10	13 sec.	Buzzer Activated
71.	1	14 sec	Buzzer Activated
72.	2	14 sec	Buzzer Activated
73.	3	14 sec	Buzzer Activated
74.	4	14 sec	Buzzer Activated
75.	5	14 sec	Buzzer Not Activated
76.	6	14 sec	Buzzer Activated
77.	7	14 sec	Buzzer Activated
78.	8	14 sec	Buzzer Activated
79.	9	14 sec	Buzzer Not Activated
80.	10	14 sec	Buzzer Activated
81.	1	15 sec.	Buzzer Activated
82.	2	15 sec.	Buzzer Activated
83.	3	15 sec.	Buzzer Activated
84.	4	15 sec.	Buzzer Activated
85.	5	15 sec.	Buzzer Not Activated
86.	6	15 sec.	Buzzer Activated
87.	7	15 sec.	Buzzer Activated
88.	8	15 sec.	Buzzer Activated
89.	9	15 sec.	Buzzer Not Activated
90.	10	15 sec.	Buzzer Activated
91.	1	16 sec.	Buzzer Activated
92.	2	16 sec.	Buzzer Activated
93.	3	16 sec.	Buzzer Activated
94.	4	16 sec.	Buzzer Activated
95.	5	16 sec.	Buzzer Not Activated
96.	6	16 sec.	Buzzer Activated
97.	7	16 sec.	Buzzer Activated
98.	8	16 sec.	Buzzer Activated
99.	9	16 sec.	Buzzer Not Activated
100.	10	16 sec.	Buzzer Activated

In the above table, we can easily understand that the accuracy of the system is **90%.**

V. CONCLUSION AND FUTURE WORK:

In conclusion, the sensor-based driver assistance system presents a significant advancement in automotive technology, offering enhanced safety, convenience, and efficiency on the roads. This project report has aimed to explore and analyze various aspects of the system, including its components, working principles, and benefits. A driver assistance system is a rapidly evolving technology that has the potential to improve road safety and reduce accidents. The following things can be done in the future. Integration with smart city infrastructure: As more cities become "smart,"there will be opportunities to integrate driver assistance systems with city infrastructure. Forexample, the system could communicate with traffic lights and road sensors to provide real-time information to the driver. Integration of Additional Sensors: The current sensor-based driver assistance system primarily relies on a specific set of sensors for its operation. In the future, it is essential to explore the integration of additional sensors to enhance the system's capabilities. For example, incorporating lidar sensors could provide more accurate depth perception and object recognition, further improving the system's ability to detect and react to potential hazards. Human- Machine Interface Enhancements: The interaction between the driver and the assistance system plays a crucial role in ensuring the system's effectiveness and user acceptance. Future work should focus on improving the human-machine interface (HMI) to provide intuitive and user-friendly feedback and alerts. This could involve designing a more comprehensive visual display, implementing voice-based instructions, or incorporating haptic feedback to provide tactile cues to the driver.

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