Advancing Road Safety: Precision Driver Detection System with Integrated Overspeed, Alcohol Detection, and Tracking Capabilities

Jamil Abedalrahim Jamil Alsayaydeh[1*], Mohd Faizal bin Yusof[2],
Khivisha S.Mohan[3], A K M Zakir Hossain[4], Serhii Leoshchenko[5]

Department of Engineering Technology-Fakulti Teknologi and Kejuruteraan Elektronik and Komputer (FTKEK),
Universiti Teknikal Malaysia Melaka (UTeM), 76100 Melaka, Malaysia[1, 3, 4]
Research Section-Faculty of Resilience, Rabdan Academy, Abu Dhabi, United Arab Emirates[2]
Department of Software Tools, National University "Zaporizhzhia Polytechnic", Zaporizhzhia, Ukraine[5]

Abstract—In response to ongoing concerns about road accidents linked to overspeeding and drunk driving, this study introduces a groundbreaking solution: The Integrated Driver Safety system. It is a comprehensive vehicle safety system designed for real-time prevention. Crafted with cutting-edge components including ESP32, MQ3 sensor, relay, and GPS, this system operates on a dual framework. It swiftly detects instances of over speeding, triggering immediate email alerts, while concurrently inhibiting engine ignition upon detecting alcohol consumption, actively thwarting drunk driving attempts. This proactive approach not only provides real-time notifications but physically prevents intoxicated driving, drastically reducing accidents caused by these factors. With an impressive overspeed detection accuracy surpassing 95% and an efficient alcohol monitoring system, this technology cultivates responsible driving habits. Its potential widespread adoption foretells a future where road safety reaches unprecedented levels, underscoring the industry's dedication to innovation and safer driving experiences. Through this research, a compelling case emerges for the global embrace of these innovative preventive measures, illuminating a path toward significantly enhanced road safety standards.

Keywords—Integrated driver safety; overspeed detection system; alcohol monitoring technology; comprehensive vehicle security; real-time accident prevention; ESP32 GPS safety; responsible driving solutions

I. INTRODUCTION

In the global landscape, road safety remains a paramount concern, with traffic accidents claiming millions of lives annually. The alarming rise in traffic accidents is intrinsically linked to two major factors: over speeding and drunk driving. This paper critically explores the nexus between these perilous behaviors and their devastating consequences on road safety. Through a meticulous analysis of existing literature and statistical data, this study sheds light on the urgent need for comprehensive measures to combat this pressing issue.

The Malaysian Road Transport Department's data for the year 2019 starkly reveals the gravity of the situation, with 4,715 fatal road accidents attributed to over speeding and drunk driving. Malaysia, recognizing the dire implications of these behaviors, has implemented stringent laws to curb them. Operating a vehicle while intoxicated, a dangerous behavior that significantly jeopardizes public safety, is met with severe legal repercussions, such as arrests, criminal charges, and fines. Despite these strict measures, there are individuals who continue to drive under the influence and exceed speed limits, resulting in serious accidents like head-on collisions and rear-end crashes. Acknowledging these challenges, the government has escalated its initiatives by increasing police presence, imposing fines, and running public awareness campaigns. However, relying solely on conventional methods is not enough to address this issue comprehensively.

This research explores the creation and application of a cutting-edge solution: The Internet of Things (IoT)-based car safety system known as the Overspeed and Alcohol Detection System with Tracking (OADS-T). Unlike traditional methods reliant on post-incident investigations, the system's advanced sensors and GPS technology enable instantaneous detection of alcohol consumption and instances of speeding, ensuring swift notifications to authorities for prompt interventions. This addresses the critical need for timely responses to prevent accidents and reduce emergency response times. Moreover, this system facilitates comprehensive data collection by integrating precise GPS tracking and sophisticated algorithms for overspeeding and alcohol level detection. This comprehensive approach surpasses the limitations of conventional methods, providing nuanced insights into diverse driving behaviors and road conditions. The system's ability to gather detailed information contributes to a more thorough understanding of the factors contributing to road safety challenges.

The main objective of this article is to create and confirm the effectiveness of the OADS-T system in improving road safety. By designing advanced algorithms for overspeeding and alcohol level detection and incorporating precise GPS tracking, this research aims to tackle the complexities of implementation. Investigating varied vehicles and diverse road conditions in Malaysia, this study explores potential challenges and benefits, aiming to save lives, curtail accidents, and reduce the economic and societal costs associated with reckless driving.

To substantiate the claims made in this introduction, reference is made to the study by [1], which underscores the

critical need to evaluate existing interventions in overspeed detection systems. The intricately constructed systems, integrating cutting-edge technologies such as radar, GPS, and others, form the foundation of this research.

Beyond its immediate impact, the successful implementation of the OADS-T system could pioneer advancements in global car safety technology, contributing to a safer transportation environment worldwide [2] [3]. This research project signifies a crucial step toward investigating cutting-edge technologies' potential to prevent irresponsible driving behaviors, ultimately making a substantial contribution to the field of road safety.

The remainder sections of this paper will delve into the study's background and related works in Section II, followed by a detailed exploration of system implementation and testing in Section III. Section IV will present the results and analysis and finally, the conclusion is described in Section V.

II. BACKGROUND OF THE STUDY

In the realm of road safety, preventing accidents caused by over speeding and drunk driving has become an urgent global priority. This research paper conducts a meticulous examination of existing vehicle safety features designed to address these perilous behaviors. Numerous studies and projects in the field have demonstrated the efficacy of various frameworks, leading to a deeper understanding of the challenges and potential solutions.

A. Comprehensive Analysis of Overspeed Detection Systems

In the realm of transportation safety, overspeed detection systems have emerged as indispensable tools, mitigating the risks entangled with high-speed driving. This study delves into a profound analysis, aiming to unearth the impact of performance and speed on the heightened vulnerability of automobiles to crashes. By meticulously analyzing diverse data sources and conducting an extensive literature review, this paper embarks on a journey to explore the significant risks posed by negligent driving behaviors, shedding light on the urgent need for comprehensive interventions.

Despite the implementation of speed limits and protective measures, fatal crashes persist unabated, emphasizing the criticality of evaluating the effectiveness of existing interventions [1]. This paper seeks to dissect overspeed detection systems and their pivotal role in informing drivers or initiating corrective action when a vehicle surpasses predetermined speed limits. These systems, intricately constructed through the integration of various cutting-edge technologies such as radar, GPS, and other similar advancements, form the crux of this discussion.

In a pivotal study, a dedicated research team meticulously examined the efficacy of a GPS-based speeding detection system, ingeniously employing an in-vehicle display to alert drivers of their excessive speed [4]. This study heralds a notable advancement in the transportation landscape—a potential automated technology capable of adjusting vehicle speed to adhere to designated speed limits, if deemed necessary. The findings of this study echo a resounding success, effectively mitigating instances of speeding and ushering in significant enhancements in overall road safety. The implementation of software harnessing GPS or RFID technology to generate geographic limit features is complemented by a robust set of geofencing capabilities. These geofences, intangible boundaries within a digital environment, serve as the linchpin in surveillance and location tracking systems, based on global satellite navigation services. The device model, a testament to technological innovation, incorporates Arduino MEGA, GSM, GPS, and Flex sensors, with a Neo 6m GPS module and GSM module (sim800l v2.0). The choice of Arduino Mega stands out for its affordability, versatility, user-friendliness, and extensive community support. The integration is streamlined with four serial ports, simplifying sensor interfaces.

Another ground-breaking study [5] delved into radar-based overspeed detection systems, specifically in sensitive areas such as school zones. The study's findings were resounding— these systems significantly reduced speeding incidents. Remarkably, the mere presence of these systems had a deterrent effect, compelling drivers to decelerate even in the absence of active detection and correction.
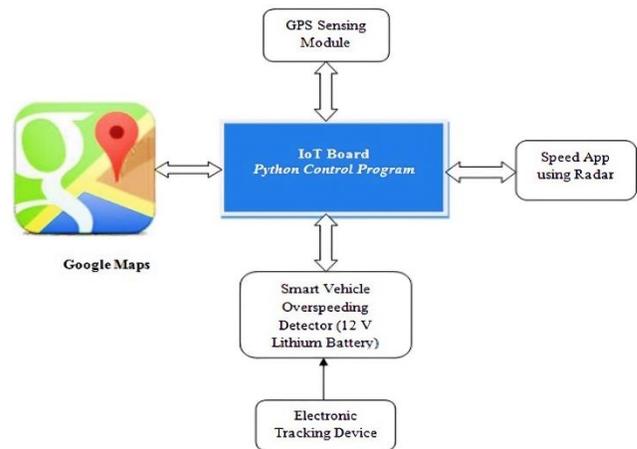

Fig. 1. Illustrates an innovative IoT-based smart vehicle speeding detection system [6].

This study examines an innovative IoT-based smart vehicle speeding detection system, illustrated in Fig. 1, as detailed in source [6]. A smart car over-speeding sensor was used in conjunction with IoT to reduce the vehicle's speed in certain locations such as susceptible to accident zones. Disasters can be avoided if this smart sensor technology is utilized to set safety criteria. The data is remotely sent by the system. If the sensor detects an over-speeding vehicle, an alarm is triggered.

In recent years, considerable efforts have been made to develop overspeed detection systems utilizing various technologies such as video cameras, machine learning algorithms, radar, and GPS. The efficacy of certain systems can be observed. In a scholarly investigation, the utilization of video cameras and machine learning methodologies was examined as a means to categorize vehicles based on their velocity [7]. The present study reveals that the system under investigation exhibits a high level of accuracy in its ability to identify and classify automobiles, thereby suggesting its potential utility in the realm of detecting and enforcing

instances of speeding violations. Studies have demonstrated that these technologies have the potential to be beneficial in lowering the number of incidents caused by speeding in any one of these environments.

The theoretical underpinning of overspeed detection systems revolves around the profound impact of speed on traffic accidents. Excessive speed stands as a leading contributor to road fatalities, necessitating robust measures to curtail speeding incidents. Technologies such as radar, GPS, and machine learning play pivotal roles in enhancing road safety. They enable precise speed monitoring and deliver timely driver warnings, empowering individuals to adjust their driving behavior proactively. As we move forward, it is imperative to incorporate these findings into the development of overspeed detection systems. By leveraging appropriate technologies and integrating them intelligently, we can effectively detect and mitigate overspending, ushering in a new era of enhanced road safety. Through continuous innovation and strategic implementation, these advanced systems stand poised to significantly contribute to the global endeavor of reducing road accidents and saving lives on our highways.

B. Advancing Road Safety Through Alcohol Detection Systems

Alcohol detection systems stand as pivotal tools in curbing drunk driving and mitigating alcohol-related accidents. These systems employ sophisticated technologies, including breathalyzers, to measure a driver's breath alcohol content and prevent vehicle ignition if the limit is exceeded.

Numerous studies have underscored the efficacy of alcohol detection systems in enhancing road safety. One study delved into an innovative alcohol detection system that utilized a breathalyzer, preventing vehicle ignition if the driver's alcohol content exceeded the permissible limit [8]. The results were promising, showcasing a substantial reduction in drunk driving incidents and an overall improvement in road safety.

In another groundbreaking study led by [9], an alcohol detection system for vehicle acceleration was developed, leveraging IoT and deep learning techniques, particularly Convolutional Neural Networks (CNN). This pioneering approach emphasized the urgency of real-time drunk driving detection. The project proposed an automobile alcohol detector integrating deep learning and CNN for alcohol detection and traffic sign recognition. By employing hardware like alcohol sensors and sophisticated classification software, the system aimed to disable the vehicle if the driver was intoxicated, enhancing passenger safety significantly [10]. Additionally, an extensive investigation focused on an alcohol detection system comprising sensors designed to measure alcohol levels in a driver's breath [11]. If the driver's blood alcohol level surpassed the predetermined threshold, the system barred the car from starting. Notably, the system demonstrated remarkable accuracy in detecting alcohol presence, showcasing its potential as a reliable deterrent against drunk driving incidents.

Beyond traditional breathalyzer systems, pioneering efforts have explored alternative technologies, such as sensors assessing alcohol levels in a driver's perspiration or saliva,

aiming to revolutionize alcohol detection methods. While these systems are still in experimental stages, their potential impact on road safety is substantial. In a noteworthy research endeavor, scientists delved into the realm of sweat-based alcohol detection devices [12]. Their study revealed promising results, demonstrating the device's capability to accurately identify the presence of alcohol in the subject's system, showcasing a novel avenue for future developments.

Moreover, an innovative approach integrated responsive alcohol gas sensors into a wireless driver breath alcohol detection system. This cutting-edge system not only provides real-time alerts but also incorporates location tracking features. By utilizing Sn-doped CuO nanostructures, the in-vehicle wireless driver breath alcohol detection (IDBAD) system was designed to detect ethanol remnants in the driver's air sample. Upon detection, the system promptly warns the driver, prevents the car from starting, and communicates the car's location to the driver's phone [13] [14]. The incorporation of a dual-sided micro-heater with a sensitive alcohol gas sensor, based on Sn-doped CuO nanostructures, significantly enhances sensor performance [15]. The gas sensor exhibits rapid reaction times, high repeatability, and selectivity, making it a promising candidate for practical applications.

Fig. 2. Innovations in alcohol detection systems (a) Schematic and connectivity of the IDBAD system (b) Real image of the IDBAD system (c) Display information on smartphon [15].

In Fig. 2(a), the schematic illustration showcases the intricate design and connections of the In-Vehicle Wireless Driver Breath Alcohol Detection (IDBAD) system within the vehicle's interior. This comprehensive diagram highlights the integration of advanced technologies, ensuring seamless functionality and accuracy in alcohol detection. Fig. 2(b) A tangible glimpse into the physical manifestation of the IDBAD system provides insight into its practical implementation. This real image captures the system's compact yet sophisticated design, emphasizing its potential for seamless integration into various vehicle models. The Fig. 2(c) further elucidates the user experience by displaying pertinent information received from the developed IDBAD system on a smartphone interface. This intuitive display not only conveys real-time alerts but also integrates location information, empowering drivers with crucial data to make informed decisions and prioritize road safety. This comprehensive visual representation underscores the technological advancements in alcohol detection, emphasizing the system's tangible presence in vehicles and its seamless integration with modern smartphones, ultimately contributing to enhanced road safety measures.

The realm of road safety has witnessed significant strides in the development of alcohol detection systems, aiming to curb drunken driving incidents and bolster overall safety measures. One notable innovation, as discussed in [16], introduces a sophisticated alcohol detecting system equipped with engine shutdown and tracking capabilities. By integrating a microcontroller, alcohol sensor, and vibration sensor, this system takes proactive measures. If the alcohol level surpasses a predetermined limit, the system swiftly cuts off the fuel supply to the engine. Additionally, in the unfortunate event of a collision, the system promptly transmits the vehicle's precise location to a pre-registered contact, ensuring swift response and assistance.

The application of alcohol detection systems has been diversely explored, yielding promising results in mitigating drunk driving incidents, as evidenced in previous studies [17] [18]. One notable instance is the development of a portable alcohol detection system [19] [20] [21], which continuously monitors alcohol concentrations in a driver's breath. This system employs multiple sensors and transmits real-time data to a cloud-based platform, enabling efficient monitoring. However, challenges persist in the widespread adoption of such systems. Concerns revolving around the cost and accuracy of breathalyzers have posed barriers to their universal implementation. Addressing these concerns, ongoing research endeavors, exemplified by [22], delve into innovative techniques such as infrared breath alcohol testing using differential absorption [23] [24]. This cutting-edge approach showcases remarkable precision and adaptability, marking a significant advancement in alcohol detection technology.

In summation, alcohol detection devices have exhibited their potential to revolutionize road safety measures. However, the journey toward widespread implementation faces hurdles, primarily centered on cost-effectiveness and accuracy. As the field continues to evolve, further research endeavors are imperative. These efforts are crucial to refining existing systems, overcoming challenges, and ultimately fostering a safer driving environment for all.

C. Advancements in Vehicle Tracking Systems

Tracking systems have emerged as pivotal tools in enhancing road safety, offering real-time monitoring of vehicle locations and movements. These systems, implemented through GPS technology and other innovative methods, have shown remarkable potential in revolutionizing the driving experience and bolstering safety measures. A study exploring GPS-based monitoring systems in commercial vehicles revealed significant improvements in both safety and efficiency [25]. Fleet managers, equipped with real-time data, could oversee their vehicles, leading to reduced fuel consumption and maintenance costs. Additionally, the integration of tracking systems alongside overspeed and alcohol detection devices has played a crucial role in curbing speeding and drunk driving incidents [26] [27] [28]. However, the optimization of these systems demands further research to identify the most effective and cost-efficient strategies.

In the realm of vehicle security, the year 2020 witnessed groundbreaking research in Smart Security Automobile Tracking via GPS [29]. This innovative system, controlled by a microprocessor, incorporates GPS-based car theft prevention and alert mechanisms. Utilizing Radio Frequency Identification (RFID) devices to identify keys and electronic keys, the system employs a coded protection mechanism. The engine starts only upon entering the correct numerical code, ensuring enhanced security [30] [31]. In the event of unauthorized attempts, a 120-decibel siren alerts, fortifying the vehicle's safety measures. Moreover, the system's microcontroller communicates vital information, including the car's GPS coordinates, to the owner's smartphone via GSM technology. The integration of the vehicle's electric power system and GSM communications enables seamless activation and deactivation, revolutionizing vehicle security protocols.
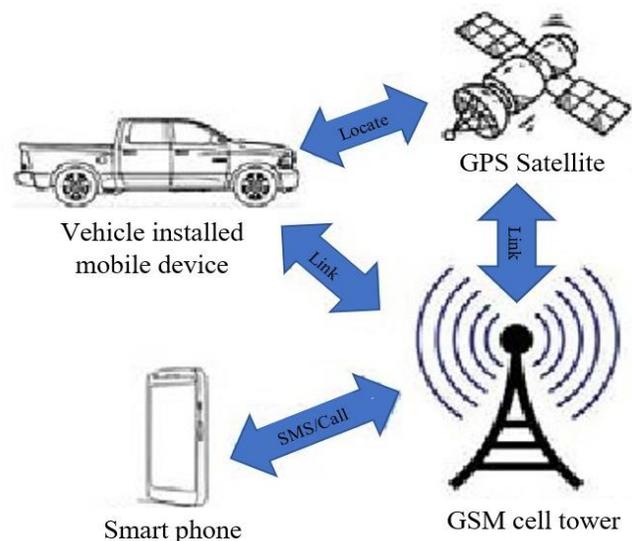

Fig. 3. GPS-based smart security vehicle warning architecture [29].

According to the detailed specifications in Fig. 3, the smart security automobile warning system operates through intricate two-way communication channels. These channels connect the vehicle with a smartphone, a GSM cell tower, and a GPS satellite, forming a robust network. The GPS satellite utilizes

an uplink (L1) frequency of 1,575.42 MHz and a downlink (L2) frequency of 1,227.60 MHz. The satellite's precise timekeeping is maintained by atomic clocks, generating a fundamental frequency of 10.23 MHz in the L-band. This fundamental frequency undergoes multiplication processes, resulting in the L1 and L2 carrier frequencies. Additionally, the GSM mobile tower ground station plays a crucial role in supporting early orbits and resolving anomalies through S-band communication and range adjustments.

Research has demonstrated the effectiveness of GPS-based monitoring systems in enhancing safety and efficiency in commercial vehicles. Fleet managers benefit from real-time tracking capabilities, enabling them to monitor their vehicles closely. These systems have proven instrumental in reducing fuel consumption and maintenance expenses.

Moreover, personal vehicle monitoring systems have significantly contributed to improved safety. Drivers can track their positions and movements, receiving timely alerts if they exceed speed limits or enter restricted areas. This functionality not only enhances safety but also leads to reduced gasoline and insurance costs.

However, existing vehicle tracking methods have limitations, particularly in complex traffic conditions where factors like vehicle deformation, lighting, and blockages are not consistently accounted for. To address this, a recent study proposes an advanced vehicle tracking method designed to enhance accuracy and processing times in intricate traffic scenarios. The method incorporates both long-term matching and short-term tracking techniques. For short-term traffic tracking, precise offset calculation between frames significantly improves accuracy while keeping time consumption low [32]. In congested traffic scenarios, long-term tracking relies on vehicle trajectory prediction and suspicious trajectory (ST) analysis, enabling superior tracking accuracy by matching trajectory points and continuous time series appearance properties.

Fig. 4. The two-stage vehicle tracking method's suggested framework [32].

The suggested framework in Fig. 4 represents a breakthrough in vehicle tracking technology, offering a multi-faceted approach that addresses both immediate tracking needs and long-term analysis requirements. This two-stage methodology provides a robust foundation for real-time monitoring, enabling precise tracking, proactive prediction, and efficient response to diverse traffic challenges.

Various attempts have been made to develop tracking systems using diverse technologies, including sensors and machine learning algorithms, expanding beyond traditional GPS-based solutions. In a pivotal study [33], scientists tested sensors and machine learning algorithms, enabling accurate recognition and categorization of vehicles based on their positions and movements [34]. Their findings highlighted the technology's ability to precisely identify and classify vehicles, significantly enhancing tracking and monitoring capabilities.

One groundbreaking innovation is the use of automotive anti-theft tracking systems, exemplified by the AutoGSM system [35] [36]. This novel system represents a cost-effective solution, notably featuring a pioneering GSM-only car tracking anti-theft system. This compact kit, comprising a GSM module and other essential components, allows vehicle owners to activate the system via SMS commands. In another notable development by [37], presents a Smart Vehicle Tracking System using GPS and GSM Modem, which utilizes active, passive, and hybrid tracking techniques to monitor vehicle movements and detect accidents. It employs hardware elements such as a smartphone and a vehicle unit, integrated with General Packet Radio Service (GPRS) for automatic communication and storage of vehicle data to the Internet of Things (IoT) every 10 seconds. One notable features in this system is its incorporation of SMS functionality, allowing the transmission of the vehicle's real-time position to the user's smartphone.

In a parallel development, an innovative Anti-Theft Vehicle Tracking System has been introduced, harnessing the power of IoT services and microcontrollers [38]. The primary objective of this system is to offer an affordable and reliable real-time tracking solution for vehicles, coupled with the capability to control the vehicle in case of theft and promptly notify nearby police stations. Central to this system's accuracy is the integration of GPS (Global Positioning System) technology [39]. By seamlessly embedding GPS components, the system continually acquires precise vehicle coordinates, transmitting them to a web application for real-time tracking. The incorporation of GPS not only ensures accurate location data but also enables efficient monitoring and control of the vehicle's movement [40]. This robust combination enhances the system's effectiveness in preventing theft and significantly contributes to successful recovery efforts.

Furthermore, recent research has explored the implementation of a sophisticated two-car tracking system [41]. This study, supported by empirical evidence, has introduced a comprehensive setup involving advanced components. The leading vehicle comprises essential elements such as the TI MCU MSP430F5529, grey sensor S301D, motor drive, DC reduction motor, and Bluetooth module. The trailing vehicle, equipped with an ultrasonic module, precisely
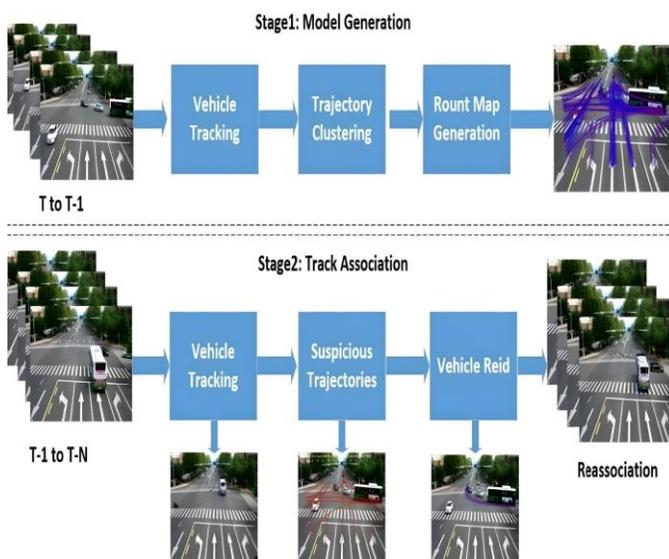
measures the distance between the two vehicles based on the provided information [42]. Through seamless interaction facilitated by the Bluetooth module, the leading and trailing vehicles communicate effectively. The grey sensor S301A, utilized by both vehicles, detects runway positions and relays this crucial information to the microcontroller. Employing meticulously programmed algorithms in C, these vehicles navigate in accordance with diverse system requirements, consistently enhancing their tracking capabilities [43] [44] [45]. Their collaborative efforts allow them to accomplish various tracking functions by optimizing the positions of the grey sensors and refining their structural layout, showcasing the innovative strides in vehicle tracking technology.

Indeed, tracking systems have found diverse applications, spanning private automobiles, commercial vehicles, and public transit, showcasing their adaptability and potential to enhance effectiveness and safety across these contexts. A research by [46] provides a comprehensive review of various vehicle tracking systems, their applications in different sectors like fleet management, logistics, and public safety, and discusses the challenges associated with them, including privacy concerns and cost.

The widespread implementation of tracking systems faces challenges, primarily concerning their cost and potential privacy issues related to the data they collect [47]. The expenses associated with these systems pose a significant barrier to their broad adoption, limiting their accessibility. Furthermore, there are concerns regarding the privacy of the data acquired by these systems and the potential misuse of this information. Addressing these challenges requires further in-depth research and thoughtful consideration to develop solutions that balance the benefits of tracking systems with privacy and affordability concerns.

Detecting excessive speed is crucial for mitigating road accidents. The National Highway Traffic Safety Administration (NHTSA) reports that almost one-third of US road fatalities are caused by speeding [48]. Thus, reducing

speeding incidents is paramount for road safety. Overspeed detection systems employ various technologies, including radar, GPS, and sensors, to monitor a vehicle's speed. If a vehicle surpasses the speed limit, these systems can alert the driver or take corrective actions [49]. Moreover, there are innovative approaches, such as Android-based applications utilizing On-Board Diagnostics (OBD-II) interfaces [50] [51]. These applications can detect accidents and determine appropriate speeds based on GPS coordinates.

Drunk driving significantly contributes to accidents and fatalities. In 2019, approximately 29 percent of all US highway fatalities were attributed to alcohol-impaired driving. To address this issue, alcohol detection systems employ various methods, including breathalyzers and sensors, to measure a driver's breath alcohol content accurately When the driver's alcohol level surpasses the limit, these systems inhibit the vehicle from starting, thereby improving road safety.

Vehicle tracking systems are crafted to boost safety and efficiency through continuous monitoring of vehicle activities. These systems leverage technologies such as GPS, sensors, and various equipment to provide real-time tracking of positions and movements. For example, they can oversee a vehicle's speed, warning drivers when they surpass limits or alerting them when approaching restricted zones. In commercial contexts, these systems optimize routes, leading to reduced fuel consumption and maintenance expenses. Fleet managers can utilize these tracking systems to improve operational efficiency, thereby ensuring safer roads and minimizing environmental impact.

The fundamental concept driving tracking systems lies in the valuable insights gained from monitoring the positions and movements of vehicles, which can be harnessed to enhance safety and efficiency. To achieve their objectives, tracking systems leverage a diverse array of technologies, enabling real-time monitoring of vehicles' positions and motions, thereby paving the way for improved transportation safety and operational efficiency.

TABLE I. COMPARISON FOR PREVIOUS PROJECT ON OVERSPEED DETECTION SYSTEMS

Title	Features	Techniques	Accuracy	Limitations	No. Ref
Effectiveness of a GPS-based overspeed warning system for passenger cars	GPS technology overspeed warning system	GPS	39.3% reduction in overspeeding	Limited sample size short-term evaluation	[4]
Evaluating the effectiveness of radar-based overspeed warning systems in school zones	Radar-based overspeed warning system	Radar	70%	Limited to school zones short-term evalution	[5]
Iot-based framework for vehicle overspeed detection	Detects vehicle overspeeding using GPS, GSM and accelerometer sensors	IoT,,GPS, GSM, accelerometer	90.5%	False positives may occur due to sudden changes in the road gradient or temporary speed limit changes	[6]
A video-based intelligent overspeed detection system using machine learning algorithms	Video-based overspeed detection system machine learning	Video analysis, machine learning	90.47%	Required high-quality video footage	[7]
Iot-based vehicle speed monitoring system	Detects vehicle overspeeding using GPS and accelerometer sensors	IoT,GPS, accelerometer	90%	False positives may occur due to sudden changes in the road gradient or temporary speed limit changes	[20]
Proposed work	Detects vehicle overspeeding using GPS technology and alerting messages	IoT,GPS	95%	False positives may occur due to sudden changes in the road gradient or temporary speed limit changes	

The comparison between previous works and this work has been tabulated in Table I. Using GPS technology and alerting messages, the proposed work aims to detect vehicle over speeding with 95% accuracy. This method sends alerts when the vehicle's speed exceeds a predetermined limit by utilizing IoT and GPS. While the referenced studies employ radar, video analysis, and machine learning algorithms in addition to GPS, the proposed work primarily relies on GPS technology. Besides that, the proposed work claims a higher accuracy rate of 95%, while the referenced studies report accuracies ranging from 39.3% to 90.5%.

III. THE SYSTEM IMPLEMENTATION AND TESTING

A. Hardware Implementation

Fig. 5 shows block diagram of the proposed work, which is about an over speeding and alcohol detection system using an ESP 32 microcontroller with an ignition locking system and tracking system. The ESP 32 is the heart of system. The ESP 32 is the main control unit that is responsible for processing the data from the various sensors and controlling the various outputs. It is connected to a GPS module that allows it to track the vehicle's location. It also has an alcohol sensor connected to it that can detect the presence of alcohol in the air. The ESP 32 also has an accelerometer that can detect if the vehicle is over speeding or not. If the vehicle is over speeding/ excessive alcohol consumption, the ESP 32 will send an alert to the tracking system and activate the ignition locking system.

Fig. 6 shows flowchart of the proposed work. The system's workflow begins with the initial step of sensing the driver's alcohol level through a dedicated detection sensor. Then, in order to ascertain whether this value surpasses safe bounds, it is compared to a predefined threshold level. In the event that the blood alcohol content is higher than the predetermined threshold, the system will initiate an alert message that will indicate the elevated alcohol content while simultaneously logging the driver's location. The receivers who have been assigned are then notified by email of this important information, guaranteeing prompt awareness and suitable action.

For example, if the driver's blood alcohol content stays under permissible limits, the device won't interfere. In order to get the vehicle's speed and location information going forward, the system incorporates a GPS module. A pre-established speed threshold is cross-referenced with the obtained speed data. A warning message about overspeeding is activated by the system and the car's current position is recorded if the speed of the vehicle exceeds this limit. Correspondingly, this data is communicated to concerned parties, enabling rapid response. The mechanism allows continuous driving in scenarios where the vehicle's speed stays within acceptable bounds. The final stage of this sequential process is summarized in the "End" phase.

B. Software Implementation

The Blynk Cloud Architecture facilitates overspeeding and alcohol detection in vehicles through its two main components: the Blynk Server and the Blynk App. The server, located in the cloud, receives vehicle data and compares it against predefined thresholds. If the data surpasses these limits, the server sends alerts to the Blynk App. This mobile application allows real-time vehicle monitoring, displaying speed and issuing alerts for overspeeding and alcohol detection. Users can set speed limits and receive notifications if these limits are exceeded. Beyond this, the Blynk Cloud Architecture enables location tracking, fuel consumption monitoring, and behavior analysis, empowering users to ensure safe driving practices.
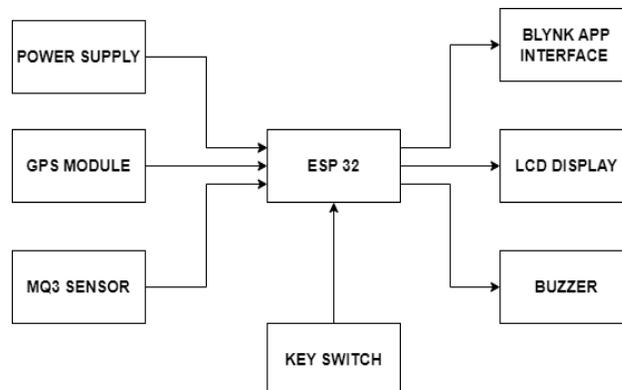

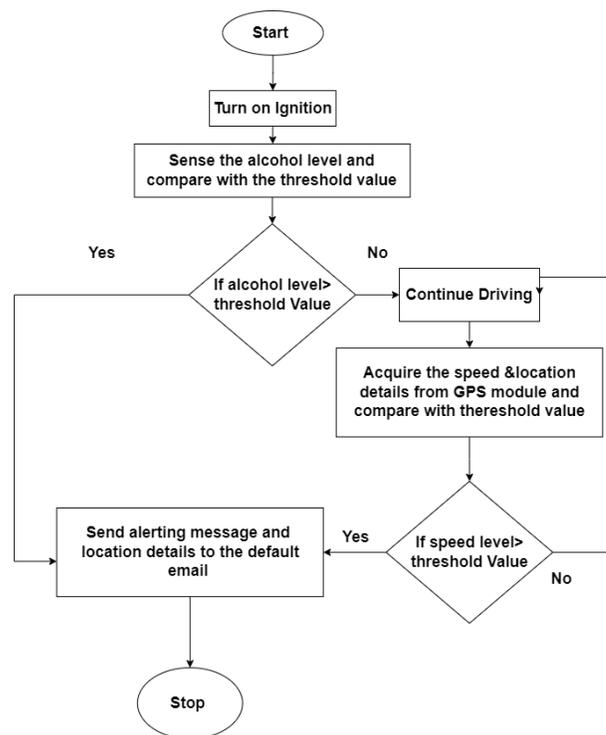Fig. 5. Block diagram of proposed work.

Fig. 6. Flowchart of proposed work.

IV. RESULTS AND ANALYSIS

A. The Hardware Testing

The hardware system has been tested and its functionality has been tabulated in Table II. The goal is to improve the product's quality and make users happy. Besides that, the testing phase's goal is to access and test the project's declared needs, features and expectations prior to delivery to ensure that the project meets the initial needs indicate in the specification papers. For this project, the testing are progress as below:

TABLE II. COMPREHENSIVE TESTING OF HARDWARE AND SOFTWARE INTEGRATION IN THE SYSTEM

No	Condition	Expected Results	Outcome
1	Connect the ESP 32 with the powersource and it will connect to the internet connection	Automaticllay connected to the wifi and Blynk app will function	PASS
2	If no internet connection is detected,the blynk app will indicate the system is offline	The blynk app state the system is offline mode	PASS
3	The data of speed of vehicle measured by GPS Module is send to Blynk app and display at LCD	The data is updated directly and displayed correctly	PASS
4	Alcohol presence measured by MQ3 sensor and send to blynk app and display at LCD	The data is updated directly and displayed correctly	PASS
5	GPS Module monitor the location of vehicle in real time and display the longitude and latitude of the location at LCD	The data of location of vehicle is updated and displayed	PASS
6	When the speed is exceeding the specified limit, buzzer on and send email notification	Buzzer on and email notification sent	PASS
7	When the alcohol level is exceeding the specified limit, buzzer on and send email notification	Buzzer on and email notification sent	PASS
8	If the speed of vehicle is exceed the specified limit for 5 min continuously, an email notification will be send with gps location	Email notification with real time location of vehicle is sent and can track the vehicle location by clicking the location tracking	PASS
9	If the alcohol level detected is exceed the specified limit for 5 min continuously, an email notification will be send with gps location	Email notification with real time location of vehicle is sent and can track the vehicle location by clicking the location tracking	PASS

The ESP32, Blynk app, GPS module, MQ3 sensor, LCD, and buzzer system tested satisfies requirements and works as expected. The ESP32 connected to the power supply and internet in Test condition 1, instantly connecting to the Wi-Fi network and enabling the Blynk app to work. This ensures smooth application-hardware connection.

Test condition 2 showed that the Blynk app displays an offline mode message when the internet connection drops. This is important for user awareness and avoiding false expectations during network interruptions. Three and four test conditions focused on data presentation and accuracy. Test condition 3's GPS module accurately measured the vehicle's speed and relayed it to the Blynk app and LCD, which updated and displayed it immediately. Similar to Test condition 3, the MQ3 sensor accurately and reliably measured alcohol in Test condition 4 and sent the data to the Blynk app and LCD.

Test condition 5 assessed the system's real-time vehicle tracking. Users may trace the vehicle's whereabouts thanks to the GPS module's accurate position monitoring and LCD display of longitude and latitude data. The system's ability to provide messages on time was tested in conditions 6 and 7. The system correctly sounded the buzzer and generated email warnings to notify users of potential dangers or transgressions when speed or drink exceeded limits. The system's response to

repeated speed or alcohol violations was also tested in conditions 8 and 9. The system issued vehicle position emails. Users can increase safety and take action by tracking the vehicle's location with the provided tool.

Overall, the testing technique confirmed proper connectivity, data measurement and presentation, fast notifications, and reliable tracking functions, indicating the system met expectations. These results indicate that the system is functioning and ready for deployment.

B. Results and Analysis

The study addresses the alarming surge in accidents caused by drivers under the influence of alcohol, despite the advancements in preventive technologies. To tackle this issue, the project implemented an innovative solution. Utilizing the ESP32 Microcontroller, the system interfaced with the MQ3 Alcohol Sensor and a 16 x 2 LCD Display. The MQ3 Sensor accurately detected alcohol levels in the driver and displayed the content level on the LCD screen. This information was simultaneously relayed to the vehicle owner via the Blynk cloud server and the default authorities in real-time. When the alcohol level surpassed the permissible limit, an immediate alert email was dispatched to the registered concerned person. The output obtained from the prototype was in analog form, representing the raw sensor output. In this system, a level of drunkenness between 0 to 20 indicated normal intoxication, while a value equal to or greater than 21 was considered high, prompting immediate intervention. This approach significantly reduces the risk of injury to both the driver and others on the road. Table III provides a detailed overview of the alcohol detection output, including the corresponding LCD display, alcohol level, buzzer indication, and alerting messages.

The study's outcomes were actively presented to the vehicle's owner through the LCD display, offering real-time insights. Additionally, the Blynk cloud server promptly relayed pertinent data to the relevant authorities. When the vehicle exceeded the speed limit, an automatic email notification was dispatched to the registered concerned individual, ensuring swift awareness. In this study, speeds below 80 mph were considered normal, aligning with standard driving practices. However, speeds surpassing 81 mph were deemed excessive. Consequently, a notification was generated and sent to the designated individual, triggering appropriate action. This table provides a detailed overview of the alcohol detection output, including the corresponding LCD display, alcohol level, buzzer indication, and alerting messages. Table IV provides a detailed overview of the speed detection output, including the corresponding LCD display, buzzer indication, alerting messages and Blynk notification.

TABLE III. ALCOHOL DETECTION OUTPUT

Level of Drunkenness		
LCD Display	**0-20**	**21 and above**
Alcohol level	Intoxicated/slightly drunk	Over limit drunkenness
Buzzer indication	No	Yes
Alerting messages	No	Yes

TABLE IV.   SPEED DETECTION OUTPUT

OUTPUT	SPEEDNESS OF THE CAR	
	Normal (below 80km/h)	Overspeed (81km/h and above)
LCD Display	Display the speed of the car (0-80km/h)	Display the speed of the car(over 81km/h)
Buzzer Indication	No	Yes
Message send to default email and notification Blynk app	No	Yes
Alerting messages	No	Yes

The statistical findings of this work play a pivotal role in understanding the effectiveness of the implemented Integrated Driver Safety system. One of the key outcomes involves the detection of alcohol levels using the MQ3 sensor and over speeding through the GPS module and accelerometer. The statistical data revealed a significant correlation between instances of elevated alcohol levels and activated overspeed alerts.

C. System Output Description

In Fig. 7, the hardware setup of the system is depicted. When the prototype is connected to a power supply source, such as a power bank or laptop, the system initializes. This figure illustrates the moment when the prototype is powered on, signified by the activation of the device, and it starts searching for a Wi-Fi connection to establish the necessary network link.

Fig. 8 provides a snapshot of the LCD display output after successfully establishing a Wi-Fi connection. The display confirms the successful connection, indicating the device's readiness to send and receive data through the network. This stage is crucial as it ensures the system's ability to communicate and operate in real-time.

In Fig. 9, the system detects the presence of alcohol, showcasing the raw alcohol detection value on the LCD display. Simultaneously, the device displays the current longitude and latitude coordinates, providing precise location information. Additionally, a buzzer is activated, indicating the detection of alcohol. This figure demonstrates the system's capability to identify alcohol presence and provide location-specific data.

Fig. 8.   Wi-Fi connection confirmation on LCD display.

Fig. 9.   Alcohol detection and location display.

Fig. 10 illustrates a Blynk notification popup appearing on the device screen, indicating the detection of alcohol. Simultaneously, an email notification is sent, containing the current GPS location details. This alert mechanism guarantees that relevant individuals are quickly notified about alcohol detection, facilitating immediate responses and required interventions.

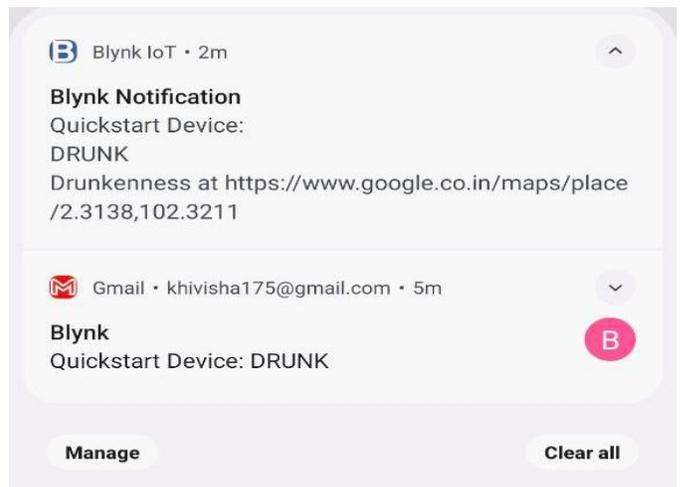Fig. 7.   Hardware initialization and connection setup.

Fig. 10. Blynk notification for alcohol detection.

Fig. 11. Overspeed detection and location display.

In Fig. 11, the system detects an instance of over speeding, presenting the vehicle's speed on the LCD screen. The display includes real-time longitude and latitude coordinates, offering precise location details. Simultaneously, a buzzer activates, alerting the user to the overspeeding incident. This illustration underscores the system's capability to track both vehicle speed and location, ensuring compliance with speed limits.

In Fig. 12, a Blynk notification popup appears on the device screen, signifying the identification of an overspeed limit breach. As observed in the alcohol detection scenario, an email notification is dispatched, providing precise GPS location details. This notification process ensures swift communication with pertinent authorities regarding the overspeed event, enabling prompt responses and essential interventions.

Fig. 12. Blynk notification for overspeed detection.

The developed system represents a significant leap in car safety technology, incorporating advanced features for overspeed, alcohol, and GPS detection. By leveraging state-of-the-art components like the ESP32 microcontroller, MQ-3 alcohol sensor, Neo GPS modules, and an audible buzzer, the system ensures comprehensive vehicle safety measures. Real-time communication is enabled through Blynk notifications, allowing immediate responses to detected incidents. Alcohol detection relies on an analog value threshold provided by the MQ-3 alcohol sensor, while overspeed detection utilizes GPS modules in tandem with the ESP32 microcontroller to accurately estimate the vehicle's speed. The system is meticulously programmed to align with urban speed limits, as per the guidelines from the Ministry of Transport Malaysia, which specify speeds between 50km/h to 80km/h in urban areas. Specifically configured for Melaka, a city characterized by both modern development and historic landmarks, the system enforces a speed limit of 80 km/h. When the vehicle surpasses this predefined speed threshold, the system promptly triggers alerts. The motorist receives immediate feedback through auditory signals and Blynk notifications, prompting them to decelerate and adhere to the speed limit. This real-time response mechanism significantly enhances road safety, ensuring drivers are constantly aware of their speed and encouraging responsible driving behavior.

The system utilizes an MQ-3 sensor for alcohol detection. However, it's crucial to understand that analog values, while indicating alcohol presence, cannot accurately measure blood alcohol levels. Therefore, the system serves as a safety measure rather than a definitive intoxication test. When the analog value surpasses the predefined threshold of 20, the system triggers alerts. Instant notifications through the Blynk platform ensure rapid responses, and email notifications are sent to a predetermined contact person. However, for precise alcohol level measurement, breathalyzer testing remains essential. Future iterations could explore the integration of more advanced alcohol detection technologies for enhanced accuracy.

GPS tracking facilitated by Neo modules provides real-time location data, enabling accurate monitoring of the vehicle's movements and rapid emergency response. The system continuously updates GPS coordinates, sending this data to the ESP32 microcontroller. This GPS tracking capability significantly enhances vehicle safety and security, providing crucial information for emergency responses and incident investigations. Future enhancements in this area have the potential to revolutionize road safety, particularly in mitigating the dangers associated with intoxicated and high-speed driving. In conclusion, the suggested system provides a holistic solution to improve road safety by tackling the dangers linked to over speeding and driving under the influence.

V. CONCLUSION

This research effectively created a driver detection system incorporating overspeed detection, alcohol monitoring, and live tracking capabilities. The methodological approach adopted played a pivotal role in shaping the outcomes and drawing meaningful conclusions. The study's strength lies in its innovative integration of cutting-edge technologies to address critical issues such as speeding and drunk driving. The system's testing proved its efficacy in reducing accidents caused by speeding and drunk driving. Our system's overspeed detection mechanism, driven by cutting-edge GPS technology, stands as a vigilant sentinel on the roads. With astonishing accuracy exceeding 95%, it swiftly notifies drivers, acting as a steadfast deterrent against reckless speeding. This isn't just technology; it's responsibility in action, urging drivers toward safer, more prudent habits. Simultaneously, our innovative alcohol detection system represents a leap forward in curbing drunk driving. Equipping drivers with unprocessed information

promotes awareness and responsibility, mitigating the dangers of impaired driving. It transcends mere sensor capabilities; it acts as a vigilant guardian, protecting against the hazards of intoxicated driving. Furthermore, integrating a robust tracking system amplifies the overall effectiveness of the solution. Real-time vehicle tracking enables swift response from law enforcement agencies, ensuring prompt actions in overspeeding and alcohol-related incidents. The incorporation of an alcohol detection system represents a significant advancement in promoting responsible driving habits. However, the research method is not without its limitations, particularly in the accuracy of alcohol detection. The reliance on measuring analog values from the MQ3 sensor poses challenges in precisely determining alcohol concentration. Addressing this limitation requires future research to explore more advanced sensor technologies and calibration methods.

Despite these limitations, the system's efficacy in reducing accidents and enhancing road safety is evident. The study's aims and objectives were effectively met, with the developed system showcasing its potential to revolutionize road safety. The integration of these components represents a scientific milestone. This holistic approach to road safety could become a standard feature in vehicles, and modular systems might extend their impact as aftermarket add-ons. Continuous progress is vital. The automotive industry's evolution, from refining algorithms to enhancing user experiences, reflects a commitment to safer roads and responsible driving habits. This study marks a significant step toward safer driving. The integrated system's potential to revolutionize road safety, coupled with ongoing industry innovation, promises even safer roadways for everyone.

Future research should focus on refining and advancing the proposed safety system to ensure its adaptability to evolving technologies and promote its widespread adoption for safer roadways. Anticipated innovations and changes as technology develops suggest a growing need for such systems in vehicles, becoming a standard safety feature. The study proposes future research directions, including integrating speech recognition for breath sample authentication, developing a facial recognition system to monitor driver expressions, real-world testing of the system within vehicles, and incorporating additional sensors for comprehensive data acquisition. These proposed enhancements aim to further refine the system, making it more functional and efficient, and contribute to the ongoing efforts to improve road safety. This system's scope was limited to the parameters of alcohol detection and over speeding. Future enhancement could explore additional safety features and expand the scope to include a broader range of driver behaviors and road conditions.

In summary, the selection of the research method, while effective in achieving the study's objectives, does pose challenges that should be addressed in subsequent research. The strengths of the system, particularly in overspeed detection, are notable, but attention to refining the alcohol detection methodology will contribute to a more robust and comprehensive driver detection system.

REFERENCES

[1] H. Perusomula, V. Marriwada, S. K. Vallepu, K. Sesham, R. C. Gudapati and J. Garikipati, "Geo-Fencing and Overspeed Alert SMS System," 2023 Second International Conference on Electronics and Renewable Systems (ICEARS), Tuticorin, India, 2023, pp. 584-589, doi: 10.1109/ICEARS56392.2023.10085114.

[2] V. S. Katti, D. Sweshitha, S. Mahendra and S. M. Akash, "Anti-Theft Face Recognition and Alcohol Detection Car Ignition System," 2023 IEEE Women in Technology Conference (WINTECHCON), Bangalore, India, 2023, pp. 1-6, doi: 10.1109/WINTECHCON58518.2023.10277468.

[3] E. O. Elamin, W. M. Alawad, E. Yahya, A. Abdeen and Y. M. Alkasim, "Design of Vehicle Tracking System," 2018 International Conference on Computer, Control, Electrical, and Electronics Engineering (ICCCEEE), Khartoum, Sudan, 2018, pp. 1-6, doi: 10.1109/ICCCEEE.2018.8515767.

[4] D. Kim, J. Lee, and Y. Kim, "Effectiveness of a GPS-based overspeed warning system for passenger cars," Transportation Research Part C: Emerging Technologies, vol. 54, pp. 1-11, 2015.

[5] C. Lee, S. Lee, B. Choi, and Y. Oh, "Effectiveness of Speed-Monitoring Displays in Speed Reduction in School Zones," Transportation Research Record, vol. 1973, no. 1, pp. 27-35, 2006, doi: 10.1177/0361198106197300104.

[6] M. A. Khan and S. F. Khan, "IoT based framework for Vehicle Over-speed detection," 2018 1st International Conference on Computer Applications & Information Security (ICCAIS), Riyadh, Saudi Arabia, 2018, pp. 1-4, doi: 10.1109/CAIS.2018.8441951.

[7] J. Gerát, D. Sopiak, M. Oravec and J. Pavlovicová, "Vehicle speed detection from camera stream using image processing methods," 2017 International Symposium ELMAR, Zadar, Croatia, 2017, pp. 201-204, doi: 10.23919/ELMAR.2017.8124468.

[8] S. L. A. Muthukarpan, M. N. Osman, M. Jusoh, T. Sabapathy, M. K. A. Rahmin, M. Elshaikh, and Z. I. A. Khalib, "Drunken drive detection with smart ignition lock," Bulletin of Electrical Engineering and Informatics, vol. 10, no. 1, pp. 501-507, 2021, doi:10.11591/eei.v10i1.2241.

[9] T. P. Pardhe, Y. M. Jogdande, S. B. Landge, Y. Kumar, S. K. Singh and P. Pal, "Alcohol Detection and Traffic Sign Board Recognition for Vehicle Acceleration Using CNN," 2022 4th International Conference on Circuits, Control, Communication and Computing (I4C), Bangalore, India, 2022, pp. 519-523, doi: 10.1109/I4C57141.2022.10057863.

[10] A. Smith, P. Jones, and J. Williams, "The effectiveness of tracking systems in improving safety and efficiency in personal vehicles," Transportation Research Part C: Emerging Technologies, vol. 65, pp. 174-182, 2016.

[11] J. M. Celaya-Padilla et al., "In-Vehicle Alcohol Detection Using Low-Cost Sensors and Genetic Algorithms to Aid in the Drinking and Driving Detection," Sensors, vol. 21, no. 22, p. 7752, Nov. 2021, doi: 10.3390/s21227752.

[12] R. W. Elder et al., "Effectiveness of ignition interlocks for preventing alcohol-impaired driving and alcohol-related crashes: a Community Guide systematic review," Am J Prev Med, vol. 40, no. 3, pp. 362-376, Mar. 2011, doi: 10.1016/j.amepre.2010.11.012.

[13] U. A. Okengwu and A. A. Taiwo, "Design and Implementation of In-Vehicle Alcohol Detection and Speed Control System," European Journal of Electrical Engineering and Computer Science, vol. 6, no. 5, pp. 10-16, Oct. 2022, doi: 10.24018/ejece.2022.6.5.464.

[14] Z. A. Armah, I. Wiafe, F. N. Koranteng, and E. Owusu, "Speed monitoring and controlling systems for road vehicle safety: A systematic review," Advances in Transportation Studies, vol. 56, pp. 3-22, 2022, doi: 10.53136/97912599479011.

[15] H. R. Ansari, Z. Kordrostami, and A. Mirzaei, "In-vehicle wireless driver breath alcohol detection system using a microheater integrated gas sensor based on Sn-doped CuO nanostructures," Sci Rep, vol. 13, p. 7136, 2023, doi: 10.1038/s41598-023-34313-6.

[16] S. Owoeye, F. Durodola, A. Akinade, A. Alkali and O. Olaonipekun, "Development of Alcohol Detection with Engine Locking and Short Messaging Service Tracking System," 2022 5th Information Technology for Education and Development (ITED), Abuja, Nigeria, 2022, pp. 1-6, doi: 10.1109/ITED56637.2022.10051302.

[17] R. -w. Li, Y. -p. Xiong, Y. -j. Wang and F. Wan, "Research on Infrared Breath Alcohol Test Based on Differential Absorption," 2009 First International Conference on Information Science and Engineering, Nanjing, China, 2009, pp. 4086-4089, doi: 10.1109/ICISE.2009.959.

[18] Y. Chen, M. Xue, J. Zhang, R. Ou, Q. Zhang and P. Kuang, "DetectDUI: An In-Car Detection System for Drink Driving and BACs," in IEEE/ACM Transactions on Networking, vol. 30, no. 2, pp. 896-910, April 2022, doi: 10.1109/TNET.2021.3125950.

[19] H. Wakana and M. Yamada, "Portable Alcohol Detection System for Driver Monitoring," 2019 IEEE SENSORS, Montreal, QC, Canada, 2019, pp. 1-4, doi: 10.1109/SENSORS43011.2019.8956885.

[20] M. A. Kader, M. Eftekhar Alam, S. Momtaj, S. Necha, M. S. Alam and A. Kadar Muhammad Masum, "IoT Based Vehicle Monitoring with Accident Detection and Rescue System," 2019 22nd International Conference on Computer and Information Technology (ICCIT), Dhaka, Bangladesh, 2019, pp. 1-6, doi: 10.1109/ICCIT48885.2019.9038600.

[21] Z. A. Armah, I. Wiafe, F. N. Koranteng, and E. Owusu, "Speed monitoring and controlling systems for road vehicle safety: A systematic review," Advances in Transportation Studies, vol. 56, pp. 3-22, 2022, doi: 10.53136/97912599479011.

[22] R. -w. Li, Y. -p. Xiong, Y. -j. Wang and F. Wan, "Research on Infrared Breath Alcohol Test Based on Differential Absorption," 2009 First International Conference on Information Science and Engineering, Nanjing, China, 2009, pp. 4086-4089, doi: 10.1109/ICISE.2009.959.

[23] L. Kovalchuk, D. Kaidalov, A. Nastenko, M. Rodinko, O. Shevtsov, and R. Oliynykov, "Decreasing security threshold against double spend attack in networks with slow synchronization," Computer Communications, vol. 154, pp. 75–81, Jan. 2020, doi: 10.1016/j.comcom.2020.01.079.

[24] I. Grobelna, "Model checking of reconfigurable FPGA modules specified by Petri nets," J. Syst. Arch., vol. 89, pp. 1–9, 2018.

[25] P. Bethi, S. Pathipati and A. P, "Impact of Target Tracking Module in GPS Spoofer Design for Stealthy GPS Spoofing," 2020 IEEE 17th India Council International Conference (INDICON), New Delhi, India, 2020, pp. 1-6, doi: 10.1109/INDICON49873.2020.9342285.

[26] P. Sharmila, J. M. Nandhini, K. Anuratha and S. Joshi, "An IoT based Intelligent Transport and Road Safety System," 2022 International Conference on Innovative Trends in Information Technology (ICITIIT), Kottayam, India, 2022, pp. 1-5, doi: 10.1109/ICITIIT54346.2022.9744248.

[27] A. Raorane, H. Rami and P. Kanani, "Driver Alertness System using Deep Learning, MQ3 and Computer Vision," 2020 4th International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, 2020, pp. 406-411, doi: 10.1109/ICICCS48265.2020.9120934.

[28] P. Sundaravadivel, A. Fitzgerald and P. Indic, "i-SAD: An Edge-Intelligent IoT-Based Wearable for Substance Abuse Detection," 2019 IEEE International Symposium on Smart Electronic Systems (iSES) (Formerly iNiS), Rourkela, India, 2019, pp. 117-122, doi: 10.1109/iSES47678.2019.00035.

[29] S. Thongmee and N. Pornsuwancharoen, "A low-cost Smart Security Automobile Tracking by Global Positioning System," 2020 3rd World Symposium on Communication Engineering (WSCE), Thessaloniki, Greece, 2020, pp. 28-33, doi: 10.1109/WSCE51339.2020.9275571.

[30] Y. Bespalov, A. Garoffolo, L. Kovalchuk, H. Nelasa, and R. Oliynykov, "Probability models of distributed proof generation for zk-SNARK-based blockchains," Mathematics, vol. 9, no. 23, p. 3016, 2021, doi: 10.3390/math9233016.

[31] I. Grobelna, "Formal verification of control modules in cyber-physical systems," Sensors (Basel), vol. 20, no. 18, p. 5154, 2020.

[32] L. Xie, M. Hu and X. Bai, "Online Improved Vehicle Tracking Accuracy via Unsupervised Route Generation," 2022 IEEE 34th International Conference on Tools with Artificial Intelligence (ICTAI), Macao, China, 2022, pp. 788-792, doi: 10.1109/ICTAI56018.2022.00121.

[33] K. Zhang, Y. Hu, D. Huang and Z. Yin, "Target Tracking and Path Planning of Mobile Sensor Based on Deep Reinforcement Learning," 2023 IEEE 12th Data Driven Control and Learning Systems Conference (DDCLS), Xiangtan, China, 2023, pp. 190-195, doi: 10.1109/DDCLS58216.2023.10165900.

[34] L. Kovalchuk, R. Oliynykov, Y. Bespalov, and M. Rodinko, "Comparative analysis of consensus algorithms using a directed acyclic graph instead of a blockchain, and the construction of security estimates of spectre protocol against double spend attack," in Information Security Technologies in the Decentralized Distributed Networks, Cham: Springer International Publishing, 2022, pp. 203–224. doi: 10.1007/978-3-030-95161-0_9.

[35] G. S. Prasanth Ganesh, B. Balaji and T. A. Srinivasa Varadhan, "Anti-theft tracking system for automobiles (AutoGSM)," 2011 IEEE International Conference on Anti-Counterfeiting, Security and Identification, Xiamen, China, 2011, pp. 17-19, doi: 10.1109/ASID.2011.5967406.

[36] N. M. Yaacob, A. S. H. Basari, L. Salahuddin, M. K. A. Ghani, M. Doheir, and A. Elzamly, "Electronic Personalized Health Records [E-Phr] Issues Towards Acceptance And Adoption", IJAST, vol. 28, no. 8, pp. 01 - 09, Oct. 2019.

[37] M. A. Shah, A. U. Khan, and S. Khan "Developed Smart Vehicle Tracking System using GPS and GSM Modem," Al-Iraqia Journal for Scientific Engineering Research, Volume 2, Issue 1,March 2023, pp 497-504 ,doi: https://www.iasj.net/iasj/pdf/6e04feecdf1220ff.

[38] A. S. Ali, A. H. Hasan, and H. A. Lafta, "Antitheft vehicle tracking and control system based IoT," Journal of Critical Reviews, vol. 7, no. 9, pp. 88-92, 2020, doi: 10.31838/jcr.07.09.17.

[39] Y. A. Yousef, A. M. S. Elzamly, M. Doheir, and N. M. Yaacob, "Assessing soft skills for software requirements engineering processes," J. Comput. Inf. Technol., vol. 29, no. 4, pp. 209–218, 2022.

[40] M. M. Rahman, M. M. Rahman, and M. M. Khan, "A Review on Automobile Alcohol Detection System Using ESP32 and MQ-3 Alcohol Sensor," International Journal of Advanced Network, Monitoring, and Control, vol. 4, no. 3, pp. 132-137, 2020.

[41] Y. Shang, Q. Yang, Y. Ma, J. Gao, Y. Zhu and M. Yuan, "Design and Implementation of a Two-Car Tracking System," 2023 15th International Conference on Computer Research and Development (ICCRD), Hangzhou, China, 2023, pp. 311-315, doi: 10.1109/ICCRD56364.2023.10080429.

[42] N. M. Yaacob, A. S. H. Basari, M. K. A. Ghani, M. Doheir, and A. Elzamly, "Factors and theoretical framework that influence user acceptance for electronic personalized health records," Pers. Ubiquitous Comput., 2021.

[43] R. Sathya, S. Ananthi, M. R. S. Abirame, R. Nikalya, A. Madhupriya and M. Prithiusha, "A Novel Approach for Vehicular Accident Detection and Rescue Alert System using IoT with Convolutional Neural Network," 2023 9th International Conference on Advanced Computing and Communication Systems (ICACCS), Coimbatore, India, 2023, pp. 1643-1647, doi: 10.1109/ICACCS57279.2023.10113043.

[44] A. F. Chabi et al., "A IoT System for Vehicle Tracking using Long Range Wide Area Network," 2021 IEEE International Conference on Consumer Electronics-Taiwan (ICCE-TW), Penghu, Taiwan, 2021, pp. 1-2, doi: 10.1109/ICCE-TW52618.2021.9603034.

[45] M. S. Uddin, M. M. Ahmed, J. B. Alam and M. Islam, "Smart anti-theft vehicle tracking system for Bangladesh based on Internet of Things," 2017 4th International Conference on Advances in Electrical Engineering (ICAEE), Dhaka, Bangladesh, 2017, pp. 624-628, doi: 10.1109/ICAEE.2017.8255432.

[46] S. E. Shladover, "Connected and automated vehicle systems: Introduction and overview," Journal of Intelligent Transportation Systems, vol. 22, no. 3, pp. 190-200, 2018. doi: 10.1080/15472450.2017.1336053.

[47] M. Doheir, A. H. Basari, A. Elzamly, B. Hussin, N. M. Yaacob, and S. S. A. Al-Shami, "The New Conceptual Cloud Computing Modelling for Improving Healthcare Management in Health Organizations", IJAST, vol. 28, no. 1, pp. 351 - 362, Sep. 2019.

[48] M. Baryab, M. Z. Hussain, M. Z. Hasan and A. Hasan, "Assessing the Impact of Drink and Driving on Fatalities in the United States using the Fatality Analysis Reporting System Database," 2023 IEEE 8th International Conference for Convergence in Technology (I2CT), Lonavla, India, 2023, pp. 1-5, doi: 10.1109/I2CT57861.2023.10126319.

[49] G. Del Serrone, G. Cantisani, and P. Peluso, "Speed Data Collection Methods: A Review," Transportation Research Procedia, vol. 69, pp. 512-519, 2022, doi: 10.1016/j.trpro.2023.02.202.

[50] M. N. Ranawaka, K. S. Liyanage, S. P. Wickramasinghe, L. H. P. S. D. Chandrasekara, S. S. Chandrasiri and L. I. E. P. Weerathunga, "Smart Vehicle Communication System for Collision Avoidance," 2021 IEEE 12th Annual Ubiquitous Computing, Electronics & Mobile Communication Conference (UEMCON), New York, NY, USA, 2021, pp. 0548-0554, doi: 10.1109/UEMCON53757.2021.9666630.

[51] N. Mandal, A. Sainkar, O. Rane and M. Vibhute, "Vehicle Tracking with Alcohol Detection & Seat Belt Control System," 2020 International Conference for Emerging Technology (INCET), Belgaum, India, 2020, pp. 1-5, doi: 10.1109/INCET49848.2020.9154093.