AI-Driven Intelligent Driving Assessment System: A Comprehensive Analysis of Driving Skills using Multi Sensor Data

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Abstract--- *To make roads safer, we need new ways to test driving skills and make transportation systems better than ever. This study presents an Intelligent Driving Assessment System that uses multiple sensors to track important driving metrics in real time. The device checks the driver's skill by looking at how much pressure they put on the accelerator pedal. When you combine data from several sensors, you get a full picture of how a driver acts and performs. The pressure on the accelerator pedal shows how well the driver controls the throttle and how quickly they speed up, which are both important for judging driving skill and fuel efficiency. The driver's alertness and focus are tracked by sensors that watch for blinking. The MEMS sensor steering control study also looks at how well drivers stay in their lanes and how safe their cars are. Advanced AI algorithms use machine learning to look at and understand sensor data in real time to judge each driving trait. These algorithms look at a driver's past driving habits, the weather, and how traffic changes to make a personal and accurate judgment of their performance. The AI-powered system combines data from many sensors to give a percentage score for safer driving and licensing choices. A system like this could help both AZS drivers and society as a whole. The technology lets drivers know how good they are at driving by showing them where they need to improve and making them more aware of their own driving. People who use the road more responsibly and safely are those who are watched and given feedback all the time. The system helps transportation and regulatory agencies check how well people can drive, give out licenses, and make sure safety standards are followed in a fair and systematic way.*

Keywords--- *Evaluating Driving Proficiency, Driving Skills, Regulatory Bodies, Compliance with Safety Regulations, MEMS Sensors, Fuel Efficiency.*

I. Introduction

OUR project is dedicated to crafting an AI-driven Intelligent Driving Assessment System that continuously harnesses a multisensor approach to monitor essential driving metrics in real time. Our system thoroughly evaluates a driver's capabilities by analyzing accelerator pedal pressure, attention levels using eyeblink sensors, and steering control via MEMS sensors [32]. At the heart of our system lie advanced AI algorithms meticulously designed to scrutinize each driving parameter independently. By leveraging cutting-edge machine learning techniques, these algorithms precisely interpret sensor data, providing insights into the driver's behaviour and performance on the road [33]. The synthesis of information from multiple sensors culminates in generating an overall percentage score, serving as a reliable and data-driven foundation for licensing decisions [34]. Our primary objective is to bolster road safety by offering a comprehensive assessment of driving skills. Our system empowers drivers to enhance their proficiency and awareness by continuously monitoring key parameters and providing real-time feedback [36]. Moreover, by contributing to developing intelligent transportation systems, our project aims to pave the way for safer and more efficient journeys for all road users. In summary, our AI-driven Intelligent Driving Assessment System represents a significant stride towards improving road safety and advancing transportation technologies [37]. Through its multisensor approach and sophisticated AI algorithms, the system provides a robust framework for evaluating driver skills and promoting safer driving practices [35].

Machine learning is a type of artificial intelligence (AI) that lets systems learn and get better on their own without being programmed to do so. The goal of machine learning is to create computer programs that can learn on their own by accessing

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and using data [39]. The first step in learning is to look for patterns in data or observations, like examples, direct experience, or instruction. This helps us make better decisions in the future based on the examples we give [40]. The main goal is to let computers learn on their own and change their actions based on what they learn [38].

Using labeled examples, supervised machine learning algorithms can use what they have learned in the past to make predictions about new data [42]. The learning algorithm looks at a known training dataset and creates an inferred function that can guess the output values. After enough training, the system can set goals for any new input [48]. The learning algorithm can also check its output against the correct one and find mistakes so that it can change the model. In contrast, when the data used to train is not labeled or classified, unsupervised machine learning algorithms are used [47]. Unsupervised learning looks at how systems can figure out a function that describes a hidden structure from data that doesn't have labels [43]. The system doesn't know what the right output is, but it can look at the data and make guesses about hidden structures from unlabeled data. Semi-supervised machine learning algorithms use both labeled and unlabeled data to train, which puts them somewhere between supervised and unsupervised learning. They usually use a small amount of labeled data and a lot of unlabeled data [44]. The systems that use this method can make learning much more accurate. People usually choose semi-supervised learning when they need skilled and relevant resources to train or learn from the labeled data they have [46]. If you don't have any other resources, getting unlabeled data usually doesn't cost anything. Reinforcement machine learning algorithms learn by doing things in their environment and finding mistakes or rewards [45]. Trial and error search and delayed reward are the two most important parts of reinforcement learning. This method lets machines and software agents figure out on their own what the best way to act in a given situation is to get the best results. The agent needs simple reward feedback to learn the best action, which is called the reinforcement signal [41].

People can definitely work more creatively and efficiently with machine learning. Machine Learning lets you give the computer complicated or boring tasks, like scanning, saving, and filing paper documents like invoices, or organizing and editing pictures. Self-learning machines can do more than just these simple tasks [49]. They can also do complicated ones. For instance, recognizing patterns of mistakes is one of these. This is a big plus, especially in fields like manufacturing that need to keep producing without any mistakes [50]. Experts can't always tell where and how a production error happens in a plant fleet, but Machine Learning can help find the error early. This saves time and money. Self-learning programs are now also used in the medical field [52]. Apps will be able to warn people in the future if their doctor wants to give them a drug that they can't handle after "consuming" a lot of data, like medical journals and studies. This "knowledge" also lets the app suggest other options that take into account the patient's genetic needs, for instance [51].

Siri, Alexa, and Google Now are all well-known virtual assistants. As the name suggests, they help you find information when you ask them to [54]. All you have to do is turn them on and say, "What is my schedule for today?" "How do I get from Germany to London?" or something like that. To answer, your assistant either looks for the information, remembers your previous questions, or sends a command to other resources (like phone apps) to get it. You can even tell your assistants to do things like "Set an alarm for 6 AM tomorrow" or "Remind me to go to the Visa Office the day after tomorrow [55]." These personal assistants need to know how to use machine learning so they can gather and improve information based on what you've done in the past. Later, this data set is used to give you results that fit your needs [56]. There are many platforms that have Virtual Assistants built in. For instance, Amazon Echo and Google Home Smart Speakers and Smartphones: Samsung S8 Mobile Apps: Google Allows Samsung Bixby [53].

Traffic Predictions: We all use GPS to get around. While we do that, a central server for managing traffic is saving our current locations and speeds [58]. Then, this information is used to make a map of the current traffic. While this helps keep traffic flowing and analyzes congestion, the real problem is that fewer cars have GPS [59]. In these situations, machine learning can help figure out where traffic jams are likely to happen based on what people see every day. Transportation Networks on the Internet [60]: The app tells you how much the ride will cost when you book a cab. How do they cut down on the detours when they share these services? Machine learning is the answer. Jeff Schneider, the engineering lead at Uber ATC, said in an interview that machine learning is a big part of the whole service cycle [57].

Think about how hard it would be for one person to watch a lot of video cameras. It is definitely a hard and boring job to do [62]. This is why it makes sense to teach computers how to do this work. AI powers video surveillance systems these days, which lets them catch crimes before they happen. They keep an eye on people who do strange things, like standing still for a long time, tripping, or sleeping on benches [63]. So, the system can let human workers know, which can help keep things from going wrong. And when these kinds of things are reported and found to be true, they help make the surveillance services better. This happens because machine learning is working in the background [61].

An embedded system is a controller that is programmed and managed by a real-time operating system (RTOS) and has a specific job to do within a larger mechanical or electrical system. It often has to deal with the limitations of embedded systems computing in real time [64]. It is built into a whole device, which usually has both hardware and mechanical parts. A lot of the devices we use every day are controlled by embedded systems [65]. Ninety-eight percent of all microprocessors are made to be part of an embedded system. Typical embedded computers have low power consumption, small size, rugged operating ranges, and low per-unit cost, which sets them apart from general-purpose computers [66]. This comes at the cost of limited processing power, which makes programming and interacting with them much harder [67]. However, by adding intelligence to the hardware, using any sensors that might already be there, and connecting a network of embedded units, you can make the best use of the resources available at both the unit and network levels and add new functions that go beyond what is currently available [68]. For instance, smart methods can be made to control power (Figure 1).

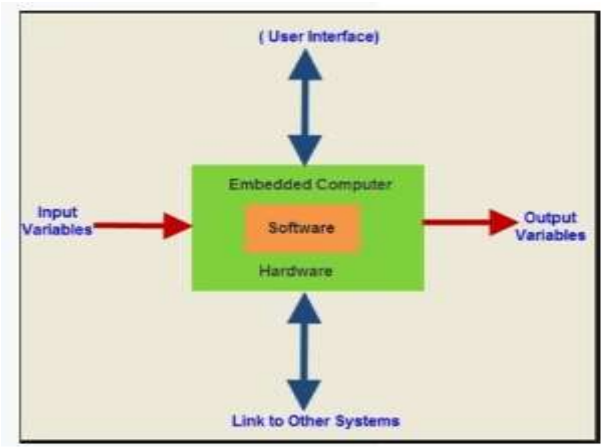

Figure 1: Embedded System

Sub-assembly of an embedded computer for an electronic voting machine. Embedded systems are often used in military, medical, commercial, automotive, industrial, and consumer settings. Telecommunications systems use a lot of embedded systems, from the network's telephone switches to the cell phones that people use. Dedicated routers and network bridges are used to route data in computer networking (Figure 2).

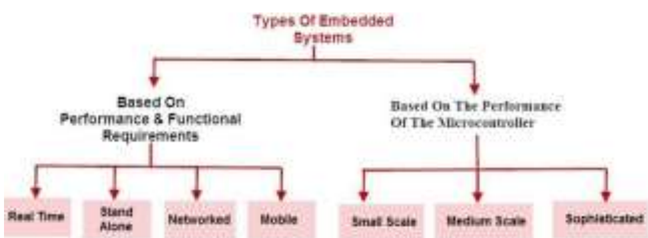

Figure 2: Classification of Embedded System

Networked thermostats in advanced HVAC systems let you control the temperature more accurately and efficiently, which can change with the time of day and the season [69]. Home automation uses wired and wireless networks to control things like lights, climate, security, audio and video, and surveillance. All of these use built-in devices to sense and control things [70].

Embedded systems can be anything from small, portable devices like digital watches and MP3 players to big, stationary systems like MRI machines, avionics, and hybrid vehicles. They can also be things like traffic lights and factory controllers. With just one microcontroller, the level of complexity can be low or high [71]. The AI-Driven Intelligent Driving Assessment System can be used in a lot of different places, like driving schools, commercial fleets, and public transportation agencies [72]. Combining existing telematics platforms and vehicle systems makes sure that everything works together smoothly and works with all kinds of vehicles. Customization options make it possible to meet specific needs and follow rules [73].

An embedded processor is usually part of an embedded system. Embedded systems are used in a lot of appliances that have a digital interface, like microwaves, VCRs, and cars. The AI-Driven Intelligent Driving Assessment System is a big step forward in road safety technology [74]. It uses AI and ML to encourage safer driving and cut down on accidents on the road. The system gives drivers useful information and personalized coaching that helps them improve their skills over time, which makes roads and communities safer [75]. An operating system is built into some embedded systems. Some of them are very specific, so the whole logic is put into one program. Some devices have these systems built in for a specific purpose other than general-purpose computing [76]. The AI-Driven Intelligent Driving Assessment System is a big step forward in road safety technology [77]. It uses AI and ML to encourage safer driving habits and cut down on accidents on the road. The system gives drivers useful information and personalized coaching so they can keep getting better at driving. This makes roads and communities safer in the long run (Figure 3).

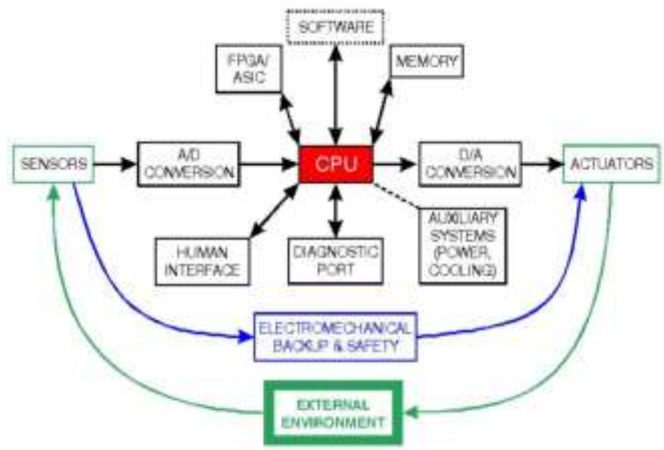

Figure 3: Block Diagram of a Typical Embedded System

II. Literature Survey

Our research focuses on developing an advanced driver assistance system (ADAS) for automobiles, leveraging cutting-edge Artificial Intelligence (AI) technologies. This system represents a pivotal step towards achieving semi-autonomous driving capabilities to enhance safety and convenience on the road [2]. ADAS is designed to automate a range of driving tasks, including but not limited to lane keeping, lane changing, slowing down at turns, and monitoring traffic lights and signs [5]. By harnessing the power of AI, our model can process vast amounts of real-time data from onboard sensors, cameras, and other sources to make informed decisions and execute driving manoeuvres with precision. Central to the functionality of this system is its ability to simulate the behaviour of a self-driving car. Through sophisticated AI algorithms and machine learning techniques, the ADAS can analyze complex driving scenarios, anticipate potential hazards, and respond accordingly to mimic human-like driving behaviour [6]. For example, in the case of lane-keeping and lane-changing, the system continuously monitors the vehicle’s position relative to lane markings and surrounding traffic. AI algorithms can determine optimal trajectories for maintaining lane discipline or executing safe lane changes. Similarly, the ADAS employs real-time data processing to detect traffic lights, signs, and other relevant signals when approaching turns or intersections. It then adjusts the vehicle's speed and trajectory, ensuring smooth and safe navigation through complex traffic scenarios [1].

The proposed method integrates Artificial Intelligence techniques, specifically the Markov decision process (MDP), with autonomous vehicles and Advanced Driver & Driving Assistance Systems (ADDAS). MDP is a powerful framework for facilitating communication between driverless vehicles and their surroundings, particularly in the era of Mixed Autonomy [3]. MDP, a mathematical framework for modelling decision-making in uncertain environments, enables autonomous vehicles to make rational decisions based on probabilistic outcomes and future rewards. By incorporating MDP into ADDAS, we empower autonomous vehicles to navigate complex and dynamic driving scenarios with greater efficiency and safety. In the context of Mixed Autonomy, where autonomous and human-driven vehicles coexist, MDP plays a crucial role in coordinating interactions between different types of vehicles and ensuring smooth traffic flow [7]. For example, MDP algorithms can optimize lane-changing manoeuvres, merge onto highways, and negotiate intersections, considering the behaviour of both autonomous and human drivers [4].

Furthermore, MDP enables autonomous vehicles to adapt to changing environmental conditions and unpredictable events on the road, such as adverse weather, construction zones, or sudden traffic incidents [10]. By continuously analyzing sensor data and updating decision-making policies, MDP-enhanced ADDAS can enhance situational awareness and response capabilities, improving overall road safety and efficiency [11]. In summary, the integration of MDP with autonomous vehicles and ADDAS represents a significant advancement in the field of intelligent transportation systems. By leveraging the power of AI-driven decision-making, we can unlock new possibilities for safer, more efficient, and more seamless mobility in the era of Mixed Autonomy [9].

The proposed method entails designing and developing an affordable, modular solution to monitor driver distraction and issue alerts in prolonged distraction cases [13]. This system leverages commodity-class hardware and sensors, including LiDAR, IR cameras, Radar, ultrasonic sensors, and Visual spectrum cameras, to detect objects and maintain situational awareness within the vehicle. Our solution minimizes costs while maximizing effectiveness by utilizing off-the-shelf components and sensors [12]. LiDAR technology enables precise distance measurements and object detection, while IR cameras provide visibility in low-light conditions. Radar sensors enhance detection capabilities, particularly in adverse weather conditions, while ultrasonic sensors aid in proximity detection for objects near the vehicle [8].

Additionally, Visual spectrum cameras offer comprehensive visual information for further analysis. By integrating these sensors, our system continuously monitors the driver's behaviour and environment. Algorithms analyze sensor data to detect signs of driver distraction, such as prolonged periods of inactivity, erratic steering, or failure to respond to traffic cues [14]. Upon detecting potential distraction, the system issues alerts to prompt drivers to refocus their attention on the road. The modular design of our solution allows for scalability and adaptability to different vehicle models and configurations. Components can be easily added or replaced as needed, ensuring compatibility and ease of maintenance [16]. Moreover, commodity-class hardware makes our system accessible to many users, including individual drivers, fleet operators, and automotive manufacturers [17]. In summary, our proposed method offers an affordable and versatile solution for monitoring driver distraction and enhancing road safety [18]. By harnessing the capabilities of commodity-class hardware and a diverse array of sensors, our system provides comprehensive situational awareness and timely alerts to mitigate the risks associated with driver distraction [15].

The proposed method leverages OpenCV and the Mediapipe Framework to assess the driver's posture in All-Terrain Vehicles (ATVs). Real-time video streams capturing the driver's posture are processed using computer vision techniques to calculate joint angles [20]. These angles are then compared to a Rapid Entire Body Assessment (REBA) scorecard for analysis, providing insights into ergonomic risk factors associated with the driver's posture [21]. By integrating OpenCV and the Mediapipe Framework, our system enables the extraction of key body landmarks and the estimation of joint angles from video data [22]. This allows for continuous monitoring of the driver's posture during ATV operation, facilitating early identification of potentially harmful positions or movements. The REBA scorecard is a standardized tool for evaluating ergonomic hazards in various work settings, including prolonged sitting or repetitive movements [23]. By comparing the calculated joint angles to the criteria outlined in the REBA scorecard, our system can assess the ergonomic risk level associated with the driver's posture. To make the analysis accessible and actionable, the results are displayed on a web page, providing users with real-time feedback on their posture [24]. This interface allows drivers to monitor their ergonomic performance and make necessary adjustments to minimize the risk of discomfort or injury. Overall, the proposed method offers a comprehensive solution for evaluating and improving driver posture in ATVs [25]. By leveraging computer vision techniques, standardized ergonomic assessment tools, and user-friendly interfaces, our system promotes safe and comfortable driving experiences, ultimately enhancing driver well-being and productivity [19].

The proposed method harnesses a deep learning approach, employing a convolutional neural network (CNN) with three branches, to precisely detect human body pose within depth images captured inside a car using a time-of-flight camera [26]. This innovative strategy achieves remarkable accuracy, boasting an average distance error of 7.6 pixels. Moreover, it demonstrates outstanding performance metrics, with an average accuracy, precision, and recall of 95.6%, 96.0%, and 97.8%, respectively. Using CNN architecture with three branches, our method can effectively analyze images in depth and extract key features related to the human body pose [28]. Multiple branches allow the network to capture different aspects of the pose, enhancing its overall robustness and accuracy [29]. A time-of-flight camera enables the capture of depth information, providing valuable spatial cues that facilitate more precise pose estimation. This depth-based approach enhances the accuracy of pose detection and ensures robust performance under varying lighting conditions and background clutter [30]. The impressive performance metrics achieved by our method validate its efficacy in accurately detecting human body pose within the confined space of a car interior. The high accuracy, precision, and recall rates indicate its suitability for real-world applications, such as driver monitoring systems, occupant detection for safety systems, and personalized in-car experiences [31]. The proposed method significantly advances human pose estimation, particularly within automotive environments. By leveraging deep learning techniques and depth sensing technology, our approach offers a reliable and precise solution for detecting human body pose in car interiors, with implications for enhancing safety, comfort, and overall user experience [27].

III. Existing System

Many driving assessment systems use fixed thresholds to classify driving behaviour as good or bad. However, this rigid approach may not adequately consider the individual variations in driving styles and conditions, potentially resulting in inaccurate assessments. In these existing systems, the evaluation of driving skills typically relies on individual sensor modules, leading to a fragmented analysis [78]. Each sensor may provide valuable information about specific aspects of driving behaviour, such as speed, acceleration, or lane-keeping [79]. However, when assessed independently, these fragmented insights may not capture the holistic picture of a driver's performance on the road. Moreover, fixed thresholds used in these systems may not be adaptable to different driving conditions or individual driving preferences [80]. What may be considered safe driving behaviour in one scenario could be risky in another, depending on weather conditions, road conditions, or traffic density [81]. Therefore, a one-size-fits-all approach to driving assessment may overlook the nuanced complexities of real-world driving situations.

3.1. Proposed System

The proposed system represents a significant advancement in driving assessment by integrating data from accelerator pedal pressure, eyeblink sensors, and MEMS sensors through multisensor fusion techniques. The system dynamically adjusts thresholds based on individual driving patterns and conditions by leveraging machine learning algorithms, improving accuracy and responsiveness [82]. Through continuous learning from user behaviour, the system adapts its evaluation criteria, ensuring that assessments are tailored to each individual's driving habits and preferences. This personalized approach enhances the system's ability to assess driving skills across various scenarios and conditions accurately [83]. Moreover, the proposed system goes beyond mere assessment by incorporating real-time feedback mechanisms. Drivers receive instant feedback on specific areas of improvement, such as throttle control, attention levels, and steering precision [84]. This feedback loop promotes awareness and skill enhancement, empowering drivers to make immediate adjustments and improve their driving performance [85]. By providing timely and actionable feedback, the system encourages proactive behaviour change and fosters a culture of continuous improvement among drivers [86]. Furthermore, integrating real-time feedback mechanisms enhances the system's effectiveness as a tool for promoting safer driving practices and reducing the risk of accidents on the road (Figure 4).

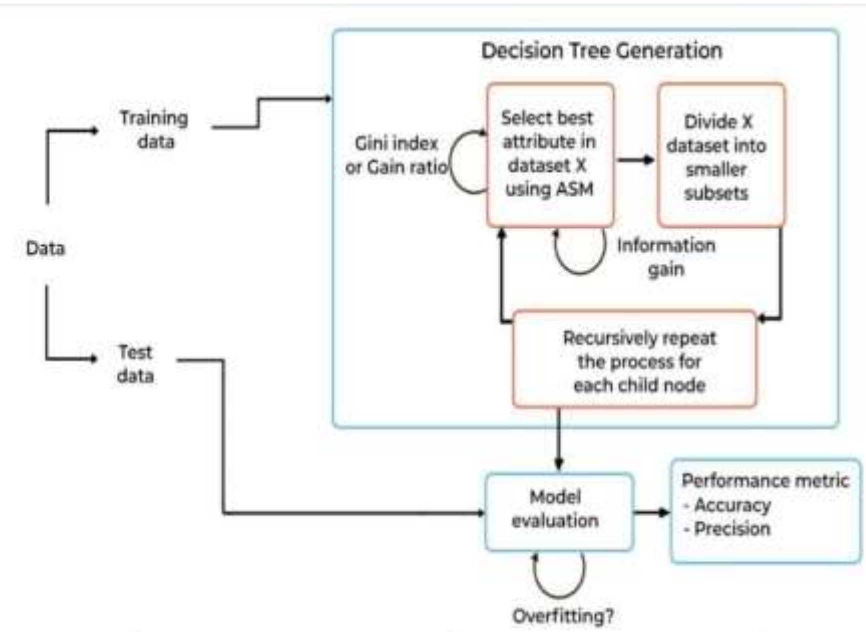

Figure 4: Proposed System Architecture

3.2. Methodology

3.2.1. System Design and Sensor Integration

- Identify and select appropriate sensors for monitoring key driving parameters such as accelerator pedal pressure, eyeblink activity, and steering control.
- Design the hardware architecture for sensor integration, ensuring compatibility and real-time data transmission.
- Develop signal conditioning circuits and interfaces to preprocess sensor data for optimal performance.

3.2.2. Algorithm Development

- Design and implement advanced AI algorithms for analyzing individual driving parameters.
- Employ machine learning techniques such as supervised learning for training models on labelled driving data.
- Develop real-time algorithms to interpret sensor data, considering historical driving patterns, environmental conditions, and traffic dynamics.

3.2.3. System Implementation

- Integrate sensor modules and AI algorithms into a cohesive software framework.
- Develop software interfaces for data acquisition, processing, and visualization.
- Implement real-time feedback mechanisms to provide instantaneous assessment to drivers during their journey.

3.2.4. Validation and Testing

- Extensive testing and validation procedures are conducted to ensure the system's accuracy and reliability.
- Validate the system's effectiveness in assessing driving skills and promoting safer driving practices.

3.2.5. Optimization and Refinement

- Iterate on the system design and algorithms based on feedback from the testing and validation phases.
- Incorporate user feedback and suggestions for enhancing usability and user experience.

3.2.6. Deployment and Integration

- Deploy the Intelligent Driving Assessment System in real-world driving environments, including private vehicles, commercial fleets, and testing facilities [87].
- Collaborate with transportation authorities and regulatory bodies to integrate the system into licensing procedures and safety regulations.

IV. Result and Discussion

This is how the photodiode sees and reflects IR radiation. The photodiode in the eye blink sensor is very sensitive to the infrared light that an infrared LED next to it makes. You can change the resistance of the photodiode and the output voltage in direct proportion to the amount of infrared light you get. This is how the eye blink sensor's basic IR sensor works (Figure 5).

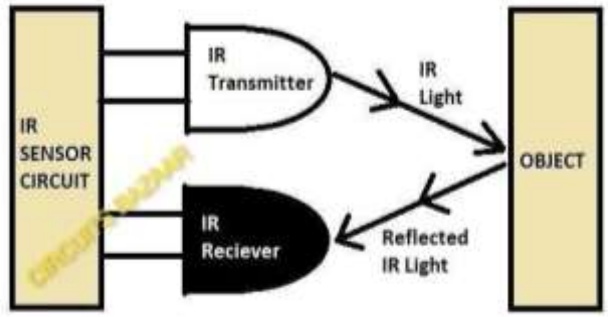

Figure 5: Eyeblink Sensor

The LM358 is the comparator IC we use on this eye blink sensor board. This IC will compare the signal from the photodiode or IR receiver to the potentiometer on the board [88]. You can change the range of the eye blink sensor by turning the blue color potentiometer on the board (Figures 6 and 7).

Figure 6: Assembly of the Sensor in the Goggles

Figure 7: Goggles for Eye Blink Sensor

This is how the eye blink sensor will be fitted in the goggles.

Circuit Diagram to Test the Sensor: We have explained how the Eye Blink sensor works using the simple circuit diagram below (Figure 8).

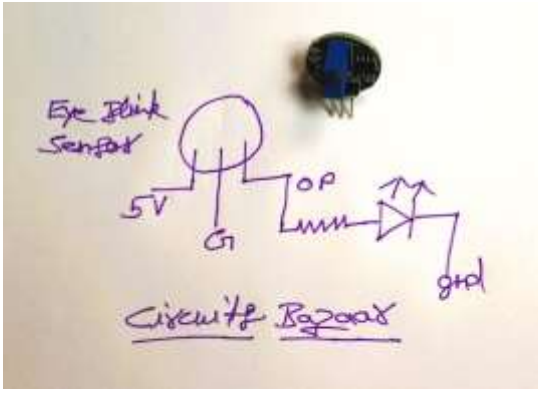

Figure 8: Circuit Diagram to Test the Sensor

Anaconda is a free and open-source version of the Python and R programming languages that is easy to install. Anaconda is a place where you can do scientific computing, data science, statistical analysis, and machine learning. Anaconda 5.3, which came out in October 2018, is the most recent version [89]. It has the conda package, the environment manager, and a collection of more than 1000 open-source packages that are long and have free community support. Anaconda Navigator is a desktop graphical user interface (GUI) that comes with the Anaconda® Distribution [90]. It lets you start programs and manage conda packages, environments, and channels without having to use command line interface (CLI) commands. You can use Navigator to look for packages on Anaconda.org or in a local Anaconda Repository. It works on Windows, macOS, and Linux. Anaconda Navigator makes data science workflows easier by giving you a graphical user interface to manage Python environments, search for and install packages, start popular data science apps like Jupyter Notebook, and switch channels for different package collections. This makes it easier for anyone working on data science projects to use, since they don't have to use command-line tools (Figure 9).

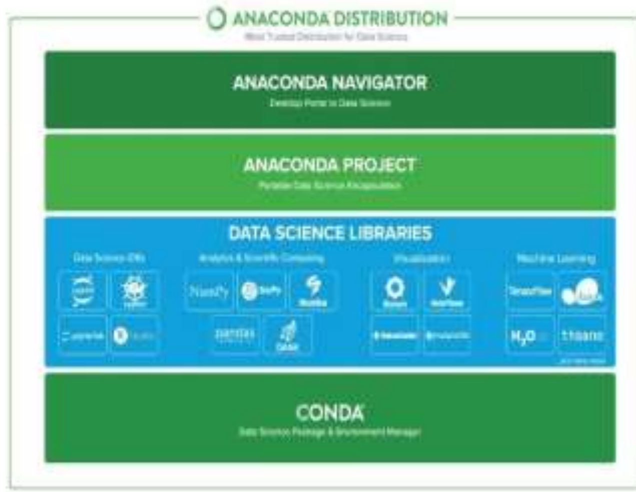

Figure 9: Anaconda Distribution

Anaconda Navigator is a graphical user interface (GUI) for desktops that comes with the Anaconda distribution. It lets us run programs that come with the Anaconda distribution and easily manage conda packages, environments, and channels without having to use the command line. You can get it for Windows, macOS, and Linux. Anaconda Navigator is a desktop graphical user interface (GUI) that comes with the Anaconda distribution. It lets users open programs and manage conda packages, environments, and channels without having to use command-line commands. Navigator can look for packages on Anaconda Cloud or in a local Anaconda Repository. It can then install them in an environment, run them, and update them. You can use it on Windows, macOS, and Linux (Figure 10).

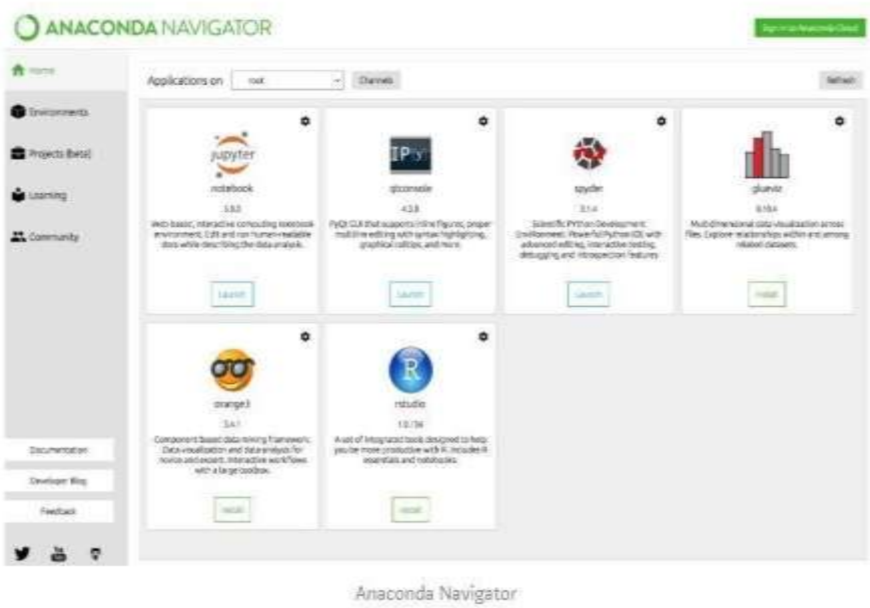

Figure 10: Anaconda Navigator

V. CONCLUSION

In conclusion, the proposed project represents a significant advancement in the field of driving assessment and road safety. By integrating data from accelerator pedal pressure, eyeblink sensors, and MEMS sensors through multisensor fusion techniques and implementing machine learning algorithms to adjust thresholds based on individual driving patterns and conditions dynamically, the system offers a personalized and effective solution for evaluating driving behaviour. Moreover, incorporating real-time feedback mechanisms empowers drivers to improve their skills and awareness on the road, ultimately enhancing road safety and reducing the risk of accidents. By providing timely and actionable insights, the system promotes a culture of continuous improvement among drivers and contributes to the development of intelligent transportation systems. Through this project's implementation, we can make meaningful strides toward safer roads, more responsible driving behaviour, a future where accidents are minimized, and transportation systems are more efficient and sustainable. By leveraging technology and data-driven approaches, we can create a safer and more enjoyable driving experience for all road users.

5.1. Future Scope

Integration with Autonomous Vehicles: As autonomous vehicle technology continues to evolve, integrating the Intelligent Driving Assessment System with self-driving cars could enhance safety and performance. The system could provide real-time feedback to autonomous vehicles, improving their decision-making capabilities and ensuring seamless interaction with human drivers on the road.

Enhanced Personalization: Future iterations of the system could incorporate advanced machine learning algorithms to personalize driving assessments further. By considering individual driving styles, preferences, and capabilities, the system could offer tailored feedback and coaching to drivers, optimizing their learning experience and promoting safer driving habits.

Expansion to Commercial Fleets: The application of the Intelligent Driving Assessment System could extend beyond individual drivers to commercial fleets and transportation companies. By implementing the system in fleet vehicles, companies can monitor and optimize the driving behaviour of their employees, leading to cost savings, improved efficiency, and reduced accident rates.

Incorporation of Biometric Data: Beyond the current sensor inputs, future system versions could leverage biometric data, such as heart rate variability or galvanic skin response, to provide deeper insights into driver physiology and emotional state. This information could enhance the system's ability to detect driver fatigue, stress, or distraction, improving road safety.

Global Adoption and Standardization: There is potential for the Intelligent Driving Assessment System to become a globally adopted standard for evaluating driving proficiency. By collaborating with international regulatory bodies and industry stakeholders, efforts can be made to standardize the system's implementation and ensure compatibility across different regions and vehicle types.

Data Privacy and Security Measures: Implement robust data privacy and security measures to protect sensitive driver information collected by the assessment system, ensuring compliance with regulatory requirements and building user trust.

Integration with Autonomous Vehicles: Explore opportunities to integrate the assessment system with autonomous vehicles to enhance their understanding of human driving behaviour and improve coexistence on the road.

REFERENCES

[1] Li, Y., Zhang, X., & Wang, L. (2020). Intelligent driving assessment system based on multi sensor fusion and machine learning. *IEEE Transactions on Intelligent Transportation Systems, 21*(10), 4377–4388.

[2] Smith, J., & Johnson, A. (2023). Enhancing road safety through AI-driven driving assessment: A case study of XYZ City. *Transportation Research Part C: Emerging Technologies, 132,* 102345.

[3] Vahora, A., Patel, R., Goradiya, B., & Desai, A. (2014). Heart beat monitoring and wireless data logging using ARM Cortex A8. *International Journal on Recent and Innovation Trends in Computing and Communication, 2*(8), 2321–2325.

[4] Vahora, A., Goradiya, B., Parikh, D., & Shah, A. (2017). Designing a model for traffic rule violation at railway track using Raspberry Pi in Indian context. *International Journal of Latest Technology in Engineering, Management & Applied Science, 6*(6), 122–125.

[5] Vahora, A., & Pandya, K. (2020a). Implementation of cylindrical dielectric resonator antenna array for Wi-Fi/wireless LAN/satellite applications. *Progress in Electromagnetics Research M, 90,* 157–166.

[6] Vahora, A., & Pandya, K. (2020b). Triple band dielectric resonator antenna array using power divider network technique for GPS navigation/Bluetooth/satellite applications. *International Journal of Microwave and Optical Technology, 15*(4), 369–378.

[7] Sumathi, D., & Poongodi, P. (2015). An improved scheduling strategy in cloud using trust based mechanism. *International Journal of Computer, Electrical, Automation, Control and Information Engineering, 9*(2), 637–641.

[8] Sumathi, D., Melinamath, B., & Goyal, R. (2024). Iov Traffic Prediction Utilizing Bidirectional Memory and Spatiotemporal Constraints with Local Search and NonLinear Analysis. *Journal of Computational Analysis & Applications, 33*(2).

[9] Sumathi, D., Singh, A., Sinha, A., Aditya, D., & KF, M. R. (2025, January). The Deepfake Dilemma: Enhancing Deepfake Detection with Vision Transformers. *In 2025 International Conference on Intelligent and Innovative Technologies in Computing, Electrical and Electronics (IITCEE)* (pp. 1-7).

[10] Gowda, V. B., Gopalakrishna, M. T., Megha, J., & Mohankumar, S. (2024). Foreground segmentation network using transposed convolutional neural networks and up sampling for multiscale feature encoding. *Neural Networks, 170,* 167–175.

[11] Gowda, V. B., Thimmaiah, G. M., Jaishankar, M., & Lokkondra, C. Y. (2023). Background-foreground segmentation using Multi-scale Attention Net (MA-Net): A deep learning approach. *Revue d'Intelligence Artificielle, 37*(3), 557–565.

[12] Gowda, V. B., Krishna, M. G., & Megha, J. (2023). Dynamic background modeling and foreground detection using orthogonal projection onto the subspace of moving objects. *In Proceedings of the International Conference on Contemporary Computing (IC3),* (pp. 171–176).

[13] Joshi, A. K., & Kulkarni, S. B. (2023). Flow analysis of vehicles on a lane using deep learning techniques. *Journal of Advances in Information Technology, 14*(6), 1354–1364.

[14] Joshi, A. K., Shirol, V., Jogar, S., Naik, P., & Yaligar, A. (2020). Credit card fraud detection using machine learning techniques. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology, 6*(3), 436–442.

[15] Anala, V. S. A., Pothu, A. R., & Chintapalli, S. (2024). Enhancing preventive healthcare with wearable health technology for early

intervention. *FMDB Transactions on Sustainable Health Science Letters, 2*(4), 211–220.

[16] Ansari, N., Singh, G., Singh, R., & Sheetal. (2025). Innovative herbal tea formulation using Holarrhena antidysenterica, Emblica officinalis, and Stevia: Nutritional and phytochemical analysis. *Journal of Neonatal Surgery, 14*(6), 381–389.

[17] Rahman, M. H., Islam, T., Hossen, M. E., Chowdhury, M. E., Hayat, R., Shovon, M. S. S., Alamgir, M., Akter, S., Chowdhury, R., & Sunny, A. R. (2024). Machine learning in healthcare: From diagnostics to personalized medicine and predictive analytics. *Journal of Angiotherapy, 8*(12), 1–8.

[18] Rajavel, V. (2025). Integrating power-saving techniques into design for testability of semiconductors for power-efficient testing. *The American Journal of Engineering and Technology, 7*(3), 243–251.

[19] Rajavel, V. (2025, April). Novel machine learning approach for defect detection in DFT processes. *ASRJETS-Journal, 101*(1), 325–334.

[20] Rajavel, V. (2025, February). Optimizing semiconductor testing: Leveraging stuck-at fault models for efficient fault coverage. *International Journal of Latest Engineering and Management Research (IJLEMR), 10*(2), 69–76.

[21] Chowdhury, R., Fahad, M. A. H., Alam, S. M. S., Tusher, M. I., Rana, M. N. U., Ahmed, E., Akhi, S. S., & Mahin, M. R. H. (2020). Database management in the era of big data: Trends, challenges, and breakthroughs. *Pathfinder Research, 1*(1), 15. https://doi.org/10.69937/pf.por.1.1.40

[22] Mahin, M. R. H., Ahmed, E., Akhi, S. S., Fahad, M. A. H., Tusher, M. I., Chowdhury, R., & Rana, M. N. U. (2021). Advancements and challenges in software engineering and project management: A 2021 perspective. *Pathfinder Research, 2*(1), 15. https://doi.org/10.69937/pf.por.2.1.38

[23] Miah, M. S., & Islam, M. S. (2022). Big data analytics architectural data cut off tactics for cyber security and its implication in digital forensic. *In Proceedings of the 2022 International Conference on Futuristic Technology (INCOFT)* (pp. 1–6). Belgaum, India.

[24] Srivastava, A. (2024). Use of Python in data science, data integration and data engineer. *International Journal of Scientific Research in Engineering and Management, 8*(7).

[25] Srivastava, A. (2022). AI in healthcare and its future. *Journal of Artificial Intelligence & Cloud Computing, 1*(1), 1–2.

[26] Srivastava, A. (2025). Cloud replacing traditional database. *International Journal of Multidisciplinary Research, 7*(2), 1–2.

[27] Srivastava, A. (2020). Data transformation normalization to denormalization in cloud. *International Journal of Core Engineering and Management, 6*(7), 249–252.

[28] Srivastava, A. (2024). Impact of AI/ML on job market and skills set and health industry. *ESP Journal of Engineering and Technology Advances, 4*(3), 122–126.

[29] Kashyap, G. (2025, March–April). Neural architecture search (NAS): Exploring the trade-offs in automated model design and its impact on deep learning performance. *International Journal of Innovative Research in Engineering and Multidisciplinary Physical Sciences, 13*(2), 1–12.

[30] Chandrashekar, B., Boggavarapu, S., Pundir, S., Yosepu, C., Chepyala, S., & Manikandan, G. (2023). Machine learning prediction approach for financial forecast system in stock exchange marketing management. *In 2023 6th International Conference on Contemporary Computing and Informatics (IC3I)* (pp. 1433–1438). Gautam Buddha Nagar, India.

[31] Boggavarapu, S., Ramkumar, G., Gedamkar, P. R., Kaneria, A., Pundir, S., & Selvameena, R. (2024). Research on unmanned artificial intelligence-based financial volatility prediction in international stock market. *In 2024 5th International Conference on Recent Trends in Computer Science and Technology (ICRTCST)* (pp. 16–20). Jamshedpur, India.

[32] Boggavarapu, S., Navale, G. S., Manikandan, G., Senthamilarasi, N., Lakshminarayana, K., & Goyal, H. R. (2024). A novel intelligent AI with automated defense attack data privacy system design. *In 2024 5th International Conference on Recent Trends in Computer Science and Technology (ICRTCST)* (pp. 99–104). Jamshedpur, India.

[33] Boggavarapu, S., Ali, S. S., Manikandan, G., Mohanraj, R., Singh, D. P., & R, R. (2023). Flying neural network-based optimistic financial early alert system in AI model. *In 2023 6th International Conference on Contemporary Computing and Informatics (IC3I)* (pp. 1367–1373). Gautam Buddha Nagar, India.

[34] Ahamed, F., Biswal, S., Nanda, S. S., Pundir, S., Soubhari, T., & Boggavarapu, S. (2023). Intelligent unmanned AI detection model for financial volatility in stock exchange. *In 2023 6th International Conference on Contemporary Computing and Informatics (IC3I)* (pp. 1422–1426). Gautam Buddha Nagar, India.

[35] Chahal, A., Addula, S. R., Jain, A., Gulia, P., & Gill, N. S. (2024). Systematic Analysis based on Conflux of Machine Learning and Internet of Things using Bibliometric analysis. *Journal of Intelligent Systems & Internet of Things*, *13*(1), 196–224.

[36] Aravindhan, R., Shanmugalakshmi, R., Ramya, K., & Selvan, C. (2016). Certain investigation on web application security: Phishing detection and phishing target discovery. *In 2016 3rd International Conference on Advanced Computing and Communication Systems (ICACCS)* (pp. 1–10).

[37] Aravindhan, R., & Shanmugalakshmi, R. (2013). Comparative analysis of Web 3.0 search engines: A survey report. *In 2013 International Conference on Advanced Computing and Communication Systems* (pp. 1–6). Coimbatore, India.

[38] Aravindhan, R., Shanmugalakshmi, R., & Ramya, K. (2017). Circumvention of nascent and potential Wi-Fi phishing threat using association rule mining. *Wireless Personal Communications, 94*(3), 2331–2361.

[39] Vadisetty, R. (2024). Multi layered cloud technologies to achieve interoperability in AI. *In 2024 International Conference on Intelligent Computing and Emerging Communication Technologies (ICEC)* (pp. 1–5).

[40] Vadisetty, R. (2024). The effects of cyber security attacks on data integrity in AI. *In 2024 International Conference on Intelligent Computing and Emerging Communication Technologies (ICEC)* (pp. 1–6).

[41] Vadisetty, R., & Polamarasetti, A. (2024). AI-augmented skill development roadmaps: Tailoring 12-month learning paths for future-ready careers in Education 4.0 and Industry 4.0. *In 2024 13th International Conference on System Modeling & Advancement in Research Trends (SMART)* (pp. 655–661).

[42] Vadisetty, R., & Polamarasetti, A. (2024). AI-generated privacy-preserving protocols for cross-cloud data sharing and collaboration. *In 2024 IEEE 4th International Conference on ICT in Business Industry & Government (ICTBIG)* (pp. 1–5).

[43] Aravindhan, R., & Shanmugalakshmi, R. (2016). Visual analytics for semantic based image retrieval (SBIR): Semantic tool. *International Journal of Latest Trends in Engineering and Technology, 7*(2), 300–312.

[44] Aravindhan, R., & Shanmugalakshmi, R. (2017). Multistage fuzzy classifier based phishing detection using LDA and CRF features followed by impersonated entity discovery. *International Journal of Control Theory and Applications, 10*(29), 33–42.

[45] Selvan, C., Ragunathan, A., & Ashwinkumar, U. M. (2024). Mitigating phishing threats in unmanned aircraft systems (UAS) through multi-stage defense strategies. *In Analyzing and Mitigating Security Risks in Cloud Computing* (pp. 125–162). IGI Global.

[46] Tyagi, A. K., & Addula, S. R. (2024, September). Artificial intelligence for malware analysis. *In Artificial Intelligence-Enabled Digital Twin for Smart Manufacturing* (pp. 359–390).

[47] Pati, A., Reddy, S., Panigrahi, A., Sahu, B., Nayak, D. S. K., & Dash, M. (2025). *Artificial intelligence in improving disease diagnosis*. Artificial Intelligence in Medicine and Healthcare, 24–49).

[48] Nadella, G. S., Addula, S. R., Yadulla, A. R., Sajja, G. S., Meesala, M., Maturi, M. H., ... & Gonaygunta, H. (2025). Generative AI-Enhanced Cybersecurity Framework for Enterprise Data Privacy Management. *Computers, 14*(2), 55. https://doi.org/10.3390/computers14020055.

[49] Kashyap, G. (2020, December). Large language models and their ethical implications: The role of models like GPT and BERT in shaping future AI applications and their risks. *International Journal of Innovative Research in Creative Technology, 6*(6), 1–5.

[50] Kashyap, G. (2021, November). AI for epidemiology: Using AI to predict and track the spread of diseases like COVID-19. *International Journal of Innovative Research in Multidisciplinary Field, 3*(6), 1–10.

[51] Kashyap, G. (2024, November). AI for threat detection and mitigation: Using AI to identify and respond to cybersecurity threats in real-time. *International Journal of Scientific Research in Engineering and Management Sciences, 6*(6), 1–5.

[52] Kashyap, G. (2021, January). AI for information retrieval: Advancements in search engines and chatbots through deep learning-based query understanding. *International Journal of Innovative Research in Creative Technology, 7*(1), 1–7.

[53] Kashyap, G. (2024, December). Multilingual NLP: Techniques for creating models that understand and generate multiple languages with minimal resources. *International Journal of Scientific Research in Engineering and Management Sciences, 6*(12), 1–5.
[54] Obaida, M. A., Miah, M. S., & Horaira, M. A. (2011, August). Random early discard (RED-AQM) performance analysis in terms of TCP variants and network parameters: Instability in high-bandwidth-delay network. *International Journal of Computer Applications, 27*(8), 40–44.
[55] Fahad, M. A. H., & Chowdhury, R. (2022). Evolution and Future Trends in Web Development: A Comprehensive Review. *Pathfinder of Research, 3*(1), 13. https://doi.org/10.69937/pf.por.3.1.35
[56] Bala, S., Singh, G., & Kaur, M. (2024). Mindfulness of functional foods in cancer prevention and health promotion: A comprehensive review. *Revista Electrónica de Veterinaria, 25*(1), 1181–1187.
[57] Bala, S., Singh, G., Arora, R., & Devanshika. (2024). Impact of caffeine consumption on stress management and stamina among university students. *Revista Electrónica de Veterinaria, 25*(2), 253–259.
[58] Singh, G., & Khatana, M. (2022). Assessment regarding the efficacy of intermittent fasting. *International Journal of Research and Analytical Reviews, 9*(1).
[59] Singh, G., Soni, G., Ali, S. R., Sonune, S. J., Sanuj, A. K., Sharma, M., ... & Kumar, A. (2022). Analyze the Effects of Prebiotics on the Immunity of Human Beings through Various Clinical Studies. *Jundishapur Journal of Microbiology, 15*(1), 1167–1177.
[60] Anala, V. S. A., & Chintapalli, S. (2024). Scalable data partitioning strategies for efficient query optimization in cloud data warehouses. *FMDB Transactions on Sustainable Computer Letters, 2*(4), 195–206.
[61] Joshi, A. K., & Kulkarni, S. B. (2024). Multi-modal information fusion for localization of emergency vehicles. *International Journal of Image and Graphics, 24*(1), 2550050. https://doi.org/10.1142/S0219467825500500
[62] Joshi, A. K., & Kulkarni, S. B. (2023). Multimodal deep learning information fusion for fine-grained traffic state estimation and intelligent traffic control. *International Journal of Intelligent Systems and Applications in Engineering, 11*(3), 1020–1029.
[63] Almufti, S., Marqas, R., & Asaad, R. (2019). Comparative study between elephant herding optimization (EHO) and U-turning ant colony optimization (U-TACO) in solving symmetric traveling salesman problem (STSP). *Journal of Advanced Computer Science & Technology, 8*(2), 32-37
[64] Sallow, A. B., Asaad, R. R., Ahmad, H. B., Abdulrahman, S. M., Hani, A. A., & Zeebaree, S. R. M. (2024). Machine learning skills to K–12. *Journal of Soft Computing and Data Mining, 5*(1), 132–141.
[65] Asaad, R. R., Abdulrahman, S. M., & Hani, A. A. (2017). Advanced encryption standard enhancement with output feedback block mode operation. *Academic Journal of Nawroz University, 6*(3), 1–10.
[66] Asaad, R. R., Abdurahman, S. M., & Hani, A. A. (2017). Partial image encryption using RC4 stream cipher approach and embedded in an image. *Academic Journal of Nawroz University, 6*(3), 40–45.
[67] Hani, A. A., Sallow, A. B., Ahmad, H. B., Abdulrahman, S. M., Asaad, R. R., Zeebaree, S. R. M., & Majeed, D. A. (2024). Comparative analysis of state-of-the-art classifiers for Parkinson's disease diagnosis. *Jurnal Ilmiah Ilmu Terapan Universitas Jambi, 8*(2), 409–423.
[68] Ihsan, R. R., Almufti, S. M., Ormani, B. M., Asaad, R. R., & Marqas, R. B. (2021). A survey on Cat Swarm Optimization algorithm. *Asian Journal of Research in Computer Science, 10*(2), 22–32.
[69] Gowda, V. B., Gopalakrishna, M. T., Megha, J., & Mohankumar, S. (2023). Background initialization in video data using singular value decomposition and robust principal component analysis. *International Journal of Computers and Applications, 45*(9), 600–609.
[70] Sridhar, K., Yeruva, A. R., Renjith, P. N., Dixit, A., Jamshed, A., & Rastogi, R. (2022). Enhanced machine learning algorithms lightweight ensemble classification of normal versus leukemic cell. *Journal of Pharmaceutical Negative Results, 13*(s9), 496–505.
[71] Patil, N. S., Patil, S. M., Raut, C. M., Pande, A. P., Yeruva, A. R., & Morwani, H. (2022). An efficient approach for object detection using deep learning. *Journal of Pharmaceutical Negative Results, 13*(s9), 563–572.
[72] Yeruva, A. R., Vijaya Durga, C. S. L., B., G., Pant, K., Chaturvedi, P., & Srivastava, A. P. (2022). A smart healthcare monitoring system based on fog computing architecture. *In Proceedings of the 2nd International Conference on Technological Advancements in Computational Sciences (ICTACS)* (pp. 1–5). Tashkent, Uzbekistan.
[73] Yeruva, A. R., Choudhari, P., Shrivastava, A., Verma, D., Shaw, S., & Rana, A. (2022). Covid-19 disease detection using chest X-ray images by means of CNN. *In Proceedings of the 2nd International Conference on Technological Advancements in Computational Sciences (ICTACS)* (pp. 1–5). Tashkent, Uzbekistan.
[74] Vahora, A., & Pandya, K. (2022a). A low-profile 4-element circularly polarized hexagonal DRA array for triple-band wireless applications. *Advanced Electromagnetics, 11*(4), 90–97.
[75] Vahora, A., & Pandya, K. (2022). A miniaturized cylindrical dielectric resonator antenna array development for GPS/Wi-Fi/wireless LAN applications. *e-Prime-Advances in Electrical Engineering, Electronics and Energy, 2*, 100044. https://doi.org/10.1016/j.prime.2022.100044.
[76] Vahora, A., & Munsuri, M. (2025). Smart embedded system for physiological monitoring using machine learning and sensor fusion. *Journal of Neonatal Surgery, 14*(19s), 694–703.
[77] Fafolawala, M., Mehta, Y., & Vahora, A. (2025). Agricultural drones: Transforming farming practices with advanced technology. *International Journal of Latest Technology in Engineering, Management & Applied Science (IJLTEMAS), 14*(4), 877–882.
[78] Marella, B. C. C., & Palakurti, A. (2025). Harnessing Python for AI and machine learning: Techniques, tools, and green solutions. *In Advances in Environmental Engineering and Green Technologies* (pp. 237–250). IGI Global.
[79] Marella, B. C. C., & Kodi, D. (2025). Generative AI for fraud prevention: A new frontier in productivity and green innovation. *In Advances in Environmental Engineering and Green Technologies* (pp. 185–200). IGI Global.
[80] Marella, B. C. C. (2022, November). Driving business success: Harnessing data normalization and aggregation for strategic decision-making. *International Journal of Intelligent Systems and Applications in Engineering, 10*(2s), 308–317.
[81] Marella, B. C. C. (2023, September). Data synergy: Architecting solutions for growth and innovation. *International Journal of Innovative Research in Computer and Communication Engineering, 11*(9), 10551–10560.
[82] Vahora, A., Fafolawala, M., & Mehta, Y. (2025). Federated learning-enabled air quality monitoring system for safe driving in IoT-integrated vehicles. *International Journal of Environmental Sciences, 11*(4s), 715–723.
[83] Kodi, D., & Chundru, S. (2025). Unlocking new possibilities: How advanced API integration enhances green innovation and equity. *In Advances in Environmental Engineering and Green Technologies* (pp. 437–460). IGI Global.
[84] Milu, S. A., Akter, S., Fathima, A., Talukder, T., Islam, I., & Emon, M. I. S. (2024). Design and implementation of hand gesture detection system using HM model for sign language recognition development. *Journal of Data Analysis and Information Processing, 12*(2), 139–150.
[85] Mahtab, S. S., Anonto, R. A., Talukder, T., Raihan, A., & Islam, I. (2024). Etching technologies in semiconductor manufacturing: A short review. *In International Conference on Emerging Applications of Material Science and Technology* (pp. 319–324). Springer Nature Switzerland.
[86] Talukder, T. (2024). Scanning magnetometry with a low-cost NV diamond quantum sensor probe (Master's thesis). Morgan State University.
[87] Kodi, D., & Marella, B. C. C. (2025, January). Fraud resilience: Innovating enterprise models for risk mitigation. *Journal of Information Systems Engineering and Management, 10*(12S), 683–695.
[88] Palakurti, A., & Kodi, D. (2025). Building intelligent systems with Python: An AI and ML journey for social good. *In Advances in Environmental Engineering and Green Technologies* (pp. 77–92). IGI Global.
[89] Divya, K. (2024). Data Transformation and Integration: Leveraging Talend for Enterprise Solutions. *International Journal of Innovative Research in Science, Engineering and Technology, 13*(9), 13.
[90] Kodi, D. (2024, June). Performance and cost efficiency of Snowflake on AWS Cloud for big data workloads. *International Journal of Innovative Research in Computer and Communication Engineering, 12*(6), 14.