Alcohol Detection-Based Car Engine Lock System

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ABSTRACT:

Driving while impaired by alcohol is a serious global safety issue. In this project, we presented the process of developing an inexpensive alcohol detection system based on the Arduino, specifications to ensure that drunk people never get in an automobile and start it. The system leverages an MQ-3 alcohol sensor that queries breath alcohol levels. If the sensor reading exceeds a determined alcohol level, the device terminates ignition through a relay. The device features an LCD for real-time feedback, and it utilizes a SIM900 GSM module to notify emergency contacts if the driver is hindered by alcohol while operating a vehicle. We tested this system under varying environmental conditions and suggest that the system can be relied upon and is useful as a practical deterrent to drunken drivers. Since the developing while relatively compact, inexpensive, and straight forward are able to be designed into newer vehicle and retrofitted into existing vehicles equally. The system is also particularly effective at combining a real-time monitoring system with automated alert messages.

Keywords: Preventing drunk driving, MQ-3 sensor, GSM alerting system, Vehicle ignition control, Alcohol detection, Arduino-based safety.

I.INTRODUCTION:

Driving under the influence is a large contributor to accidents and fatalities. Driving under the influence is a major cause of accidents and fatalities. This project proposes an Arduino-based alcohol detection and automated ignition control system for automobiles. Drunk driving is still a large cause of traffic accidents and fatalities worldwide. As suggested by international traffic safety reports, drivers who are intoxicated with alcoholic beverages are responsible for a large percentage of car accidents. Since not having real-time preventive systems in vehicle, incidents of impaired driving continues to be high globally, despite laws and awareness efforts made to regulation agencies.

To solve this issue, the development of intelligent vehicle integrated systems that can detect alcohol in a driver's breath and restrict vehicle functionality is gaining traction as a potential solution to this issue. One approach is to detect states of a driver's condition before the ignition using microcontrollers and ethanol gas sensors. The vehicle will disable and prevent the driver from driving a vehicle that can cause harm by automatically disabling the engine start function if alcohol is on a person's breath that exceeds a predefined signal level. This developed project uses an MQ3 gas sensor with an Arduino Uno microcontroller to design and develop an alcohol detection-based vehicle engine lock system. The project detects if a driver has alcohol on their breath in order to continue with their vehicle. Once the system detects alcohol using the MQ3 gas sensor, the system activates a relay that cuts off the ignition circuit. In addition to the alcohol detection and 280 vehicle immobilization parts, there are additional features that warn the driver and alert police or emergency contact. The goal is to create a viable, economical, and simple system that will be a viable safety feature for both consumer and commercial vehicles. This project is designed to add safety and protection to roadways by ensuring that drunk drivers cannot operate a car, potentially decreasing the number of people who become impaired vehicle operators.

System Architecture:

II.RELATED WORK: Many researchers have proposed automatic systems to prevent drunk driving and accidents related to alcohol while they are in the pursuit of improving road safety. Venu [1] reported a simple alcohol detection and engine disabling system using an MQ3 sensor and Arduino platform as a good first study in this area. Thakur [2] also showed a car ignition disabling system based on alcohol level detection, showing the future role of embedded systems in certain preventive systems. Pallavi et al. [3] proposed a sophisticated system using Raspberry Pi with included image processing in addition to alcohol detection to improve accuracy. Kousikan and Sundaraj [4] reported a system that disables ignition and notifies relatives, built towards real-time safety. Gupta et al. [5] proposed vehicle control methods that cut power (engine shut off) when alcohol is detected in addition to many other safety measures that contained simple automation. The most recent studies have explored various ways to use the Internet of Things (IoT) technologies that facilitate more capable implementations. Uzairue et al. [6] proposed an IoT-enabled system focused on smart city transportation solutions that allow remote monitoring of the vehicle condition to law enforcement and potential public safety officials. Swarna et al. [7] included the IoT-based alcohol identification system in their proposed architecture for driver safety, identified fundamental improvements in the responsiveness and reliability of the whole system. [8] demonstrate the commercial interest in

Ⅲ.. PROPOSED SYSTEM:

A. Overview of the Proposed System:

The system aims to minimize road accidents caused by drunkenness by putting an alcohol sensor into the vehicle that controls ignition. The MQ3 alcohol sensor can detect alcohol in the breath of the driver. When the unit detects alcohol above an established limit figure, this limit figure is called the threshold. The microcontroller Arduino Uno receives the data and prevents the engine of the vehicle from being turned on, and ultimately disables the ignition system using a relay switch. Also, an indication of the not-doing activity failure when the ignition and control system is activated using an LCD or liquid crystal display, a steady ON indicator light, and a buzzer. It may provide warning calls using a GSM module to alert and notify contacts, providing further monitoring and prevention of the driver at all times. While it is socially responsible, the overall price of the system is cheap and is used as a high-tech solution to curb irresponsible driving habits, especially when being intoxicated. B. Overall

The system framework for locking and unlocking car engines while using an alcohol-based detector system (Figure 1) is designed around the alcohol detecting system developed in an automobile based on an Arduino microcontroller (main processor unit). It serves to interface with various I/O devices (a subsystem that connects with and uses).

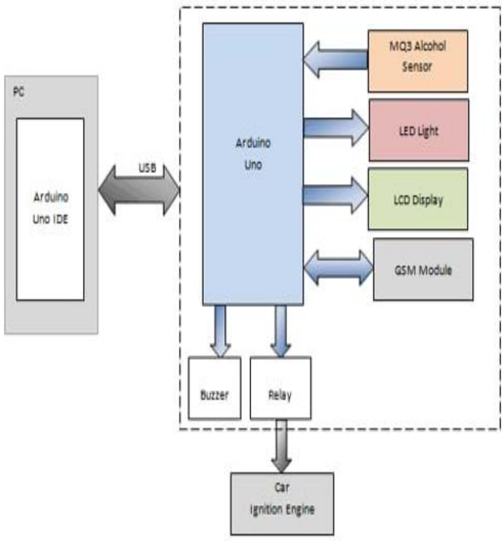

Fig.**1:** System architecture

When alcohol is detected, the buzzer will beep and the LED will flash, alerting both the driver and those in their proximity. Will display messages "Alcohol Detected", "Engine Locked", and "Safe to Drive", to provide the user with information about their real-time status. If alcohol is detected, it will send SMS alerts to a pre-determined mobile number (e.g., family member or emergency contact), improving the safety and accountability of the system. It is used for programming the Arduino Uno and uploading the control logic.

C. Working Principle:

The alcohol detection-based car engine lock system utilizes a simple control logic based on detecting alcohol concentration in the breath of the driver and making a decision to allow the car engine to be started or not.

When the vehicle ignition switch is ON, the Arduino Uno activates all connected components, including the MQ3 alcohol sensor, which begins measuring the air around the driver's seat. The MQ3 alcohol sensor can detect ethanol vapors in an exhaled breath sample and produces an analog voltage output that is proportional to the alcohol concentration (BAC – Blood Alcohol Content).

The analog voltage output is read by the Arduino, which compares the BAC value it has detected with a pre-determined safety threshold level. The logic to make a decision is as follows:

If BAC < Threshold:

The driver can be deemed as sober. The Arduino sends a signal to close the relay circuit to allow the ignition system to begin.

If BAC ≥ Threshold

The driver will be considered intoxicated (drunk) if their blood alcohol content is larger than the threshold. The Starting System cannot start because the relay will remain open. An LED will flash, and the buzzer will emit a tone warning. The LCD displays "Alcohol Detected - Engine Locked" and the amount of alcohol detected. The GSM module will send a text SMS to a defined contact (guardian or authority). By preventing drunk driving, the simple but effective system ensures a car cannot be able to be started when alcohol levels are detected to be above reasonable limits.

D. Circuit Diagram:

The Arduino Uno microcontroller is the central component of the circuit for the alcohol detection-based vehicle engine locking system. The Arduino's analogue input pin A0 is linked to the MQ3-alcohol sensor. This sensor measures the amount of alcohol in the driver's breath continuously and, in response to the level it detects, sends an analogue signal.

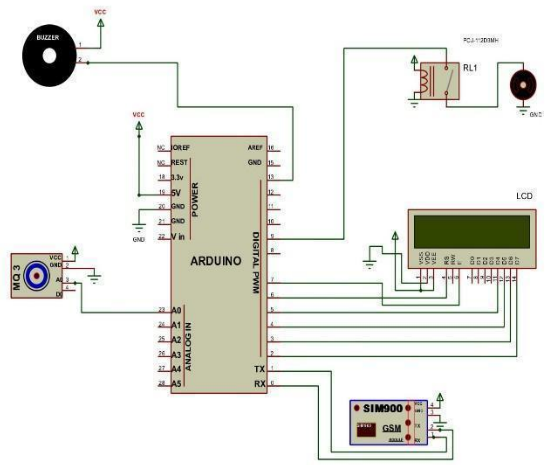

Fig.**2:** Circuit Diagram

Based on sensor readings, a 16x2 LCD interfaced with digital pins 2 through 7 of the Arduino is used to show real-time messages like "Safe to Drive" or "Alcohol Detected." A buzzer is attached to a digital output pin for alerting purposes; it emits an audible warning when alcohol is detected.

The engine locking mechanism is simulated by the relay. The ignition system (represented by a DC motor or any load) cannot function when alcohol is detected because the relay is de-energised.

Additionally, the Arduino's TX and RX pins (pins 0 and 1) are used to connect a SIM900 GSM module. If the driver is found to be intoxicated, this module notifies a pre-specified contact number via SMS.

A regulated power supply powers the entire system, and every component is correctly grounded and connected to VCC as required.

The circuit is designed to work efficiently, providing a reliable solution for detecting intoxicated driving conditions and responding appropriately to enhance road safety.

IV. IMPLEMENTATION DETAILS:

The implementation of the alcohol detection-based car engine locking system was carried out through a combination of hardware assembly, sensor calibration, software programming, and system testing. The goal was to create a functional prototype capable of detecting alcohol in the driver's breath and responding accordingly by controlling the car's ignition system.

A. Hardware Setup:

The MQ3 alcohol sensor is placed close to the driver's face, connected to an Internet of Things-based automobile engine lock system. One of the Arduino Uno's analogue input pins was linked to its analogue output pin. Digital output pins were used to connect a buzzer and an LED light for alert signaling. An appropriate interface, such as I2C, was used to connect a 16x2 LCD. A relay module was wired to control a simulated ignition system (a simple motor or LED to mimic the engine start function). The GSM module (SIM800L or similar) was integrated via UART (TX/RX pins) to send SMS notifications in case alcohol was detected. Power was supplied through the Arduino's USB connection during development and later switched to an external power source for field testing.

B. Software Development:

The system's software was built using Arduino I, and C was used to control and integrate the hardware components. First, the devices are initialized initializations for the MQ3 alcohol sensor, LCD, buzzer, relay, and GSM module are complete. The program will then loop into the main section to read the alcohol sensor's analog output, which is converted to a digital value. The detected alcohol level is then compared against a threshold value that was predetermined. The detected alcohol level is compared against a predetermined threshold value. The sensor value is compared against the threshold value. If the sensor value is below the threshold, the microcontroller enables the relay module, which engages the simulated ignition system. The buzzer stays off during this phase. Conversely, if the sensor value is above the threshold, the system assumes the driver is intoxicated. In this case, the microcontroller will disable the relay to keep the engine locked.

At the same time, the system will turn on the buzzer and LED to signal the driver while the LCD "Alcohol Detected Engine Locked" along with the BAC level.

Moreover, a GSM module is added where the program sends an SMS alert through serial communication to a specified contact number. The program was thoroughly tested and fine-tuned by calibrating sensor readings under different alcohol exposure conditions to ensure accurate and reliable detection.

C. Testing and Calibration:

i. The two aspects of testing and calibration were key components in verifying the use of the alcohol detection-based engine lock system for safety and accuracy. The first phase was to confirm the sensor was working from the beginning, then to test the system's reaction to various alcohol concentrations, and finally to test to confirm everything was working properly.

ii. The MQ3 alcohol sensor was first tested in the lab, under controlled conditions, to start learning how the sensor behaved. During the calibration phase, the sensor was first exposed to air with no alcohol, and readings were taken. Then the air sample was exposed to added alcohol vapor, beginning with lower amounts of alcohol vapor, until the sensor could measure this, and for each new alcohol concentration, subsequent readings were taken. This ultimately established a limit "threshold" value for use in programming the Arduino code to determine what could be considered the safe or unsafe level of BAC.

iii. No Alcohol Detected: Upon breath samples free of any alcohol vapour, the system activated the ignition (represented by a DC motor or LED). The LCD display read "Safe to Drive", and the buzzer and warning LED were not activated.

iv. Mild Exposure to Alcohol: when a low level of alcohol vapour was detected, close to the threshold. The system was showing signs of caution. For some tests, the ignition was locked to not taking a chance on safety, and the LCD registered a warning.

v. Borderline Readings
To demonstrate how each system would react when in range of the threshold limit, tests were conducted where little or no alcohol was present. In these instances, the system highly prioritised safety and responded conservatively, and locked the ignition. Therefore, it was confirmed that the threshold value was able to be set at such a level as to minimize false negatives while still being sensitive.

VI. DISCUSSIONS:

The evaluation demonstrated that the proposed system, combining real-time alcohol detection with the vehicle's ignition system, is a feasible solution for countering drunk driving. Two of the main benefits of the system are its modest cost and simplicity of use, which makes it very suitable for inclusion in public and private, and commercial fleets. After exposure to alcohol vapour, the system detected and intervened quickly within a matter of seconds.

However, a few limitations were identified. While the MQ3 sensor works effectively, it is subject to varying outside environmental factors such as sanitisers, perfumes, or other gases that have similar chemical properties. These threats can be reduced with the careful positioning and shielding of the sensor. Also, secure placement of the breath sensor means that the driver has to be in close proximity to the sensor, which will not always guarantee reliable detection if situated improperly.

Despite these minor constraints, the overall performance of the system was found to be arched, dependable, and consistent, fulfilling the project's objective of improving vehicle safety through alcohol detection.

VII. CONCLUSION:

The development of an alcohol detection-based vehicle engine locking system is a viable and cost-effective way of improving road safety. This system can detect alcohol in a driver's breath and react instantly, consisting of an Arduino Uno microcontroller, an MQ3 alcohol sensor, a relay, an LCD, a buzzer, and a GSM module. Testing and measurement of the system showed that it was capable of determining when the driver was drunk and would prevent the engine from starting in dangerous circumstances. The relay arrangement provides a multi-layered response that not only prevents the operation of the vehicle but also warns or alerts other people near the vehicle that there may be a possible danger present. The system met its design objective within a prototype system. However, it may require some modifications for more reliable operation in car deployment, such as improved resistance to the vehicle environment and sensor stabilisation. Nevertheless, this project supports efforts to reduce drunk driving accidents and proves the value of embedded systems to address an important safety concern.

References

1. Venu, Dr Nookala. "Alcohol detection and engine locking system." International Journal of Innovative Engineering and Management Research (IJIEMR) (2022).
2. Thakur, Nayan. “Drunk Driving Detection Using Car Ignition Locking.” International Journal of Advanced Research and Innovative Ideas in Education (2021): n. pag. Print.
3. . D Shanthi, N Swapna, Ajmeera Kiran, and A Anoosha, "Ensemble Approach Of GPACOTPSOAnd SNN For Predicting Software Reliability", International Journal Of Engineering Systems Modelling And Simulation, 2022.
4. Kousikan, M., and M. Sundaraj. "Automatic drunken drive prevention system." International Journal of Students Research in Technology and Management 2.2 (2014): 75-77.
5. Gupta, Abhishek, et al. "Alcohol detection with vehicle contcontrolnternational Journal of Engineering and Management Research (IJEMR) 6.2 (2016): 20-23.
6. Uzairue, Stanley, et al. "IoT-enabled alcohol detection system for road transportation safety in smart city." Computational Science and Its Applications–ICCSA 2018: 18th International Conference, Melbourne, VIC, Australia, July 2–5, 2018, Proceedings, Part IV 18. Springer International Publishing, 2018.
7. M. Swarna, G. Saranya, A. Vanathi, R. Ashwi, and B. Arunsundar, "An Improved Driver Safety System based on Drunk and Drive Analyzing Architecture using Internet of Things Assisted Alcohol Identification Sensor," 2024 International Conference on Advances in Computing, Communication and Applied Informatics (ACCAI), Chennai, India, 2024, pp. 1-7, doi: 10.1109/ACCAI61061.2024.10602064.
8. Zaouk, Abdullatif K., et al. "Driver alcohol detection system for safety (dadss)–a status update." 24th Enhanced Safety of Vehicles Conference. Gothenburg, Sweden: ESV, 2015.
9. Anthony, Melanie, et al. "Alcohol detection system to reduce drunk driving." International Journal of Engineering Research & Technology 9.3 (2021): 360-365.
10. Thejovathi, Murari, and M. V. P. Chandra Sekhara Rao. 2024. “An Integrated Approach for Time Series Forecasting of High-Demand Haircare Products in Rural and Urban Areas Using Machine Learning and Statistical Techniques”. International Journal of Intelligent Systems and Applications in Engineering 12 (3):154-63. https://ijisae.org/index.php/IJISAE/article /view/5233.
11. Muthukarpan, S. L. A., et al. "Drunken drive detection with smart ignition lock." Bulletin of Electrical Engineering and Informatics 10.1 (2021): 501-507.
12. Altaf, S. V., et al. "Alcohol detection and motor locking system." International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering 6.2 (2017): 989-993.
13. Das, Dilip Kumar, et al. "Vehicle Ignition Locking System and Analysis for Accident Prevention by Blood Alcohol Content Measurement." 2023 International Conference on Self-Sustainable Artificial Intelligence Systems (ICSSAS). IEEE, 2023.
14. D Shanthi, Smart Healthcare for Pregnant Women in Rural Areas, Medical Imaging and Health Informatics, Wiley Publishers,ch-17, pg.no:317-334, 2022, https://doi.org/10.1002/9781119819165.ch17

15. Shanthi, R. K. Mohanty and G. Narsimha, "Application of machine learning reliability data sets", Proc. 2nd Int. Conf. Intell. Comput. Control Syst. (ICICCS), pp. 1472-1474, 2018.
16. D Shanthi, N Swapna, Ajmeera Kiran and A Anoosha, "Ensemble Approach Of GPACOTPSOAnd SNN For Predicting Software Reliability", International Journal Of Engineering Systems Modelling And Simulation, 2022.
17. Shanthi, "Ensemble Approach of ACOT and PSO for Predicting Software Reliability", 2021 Sixth International Conference on Image Information Processing (ICIIP), pp. 202-207, 2021.
18. D Shanthi, CH Sankeerthana and R Usha Rani, "Spiking Neural Networks for Predicting Software Reliability", ICICNIS 2020, January 2021, [online] Available: https://ssrn.com/abstract=3769088.
19. Shanthi, D. (2023). Smart Water Bottle with Smart Technology. In Handbook of Artificial Intelligence (pp. 204-219). Bentham Science Publishers.
20. Shanthi, P. Kuncha, M. S. M. Dhar, A. Jamshed, H. Pallathadka and A. L. K. J E, "The Blue Brain Technology using Machine Learning," 2021 6th International Conference on Communication and Electronics Systems (ICCES), Coimbatre, India, 2021, pp. 1370-1375, doi: 10.1109/ICCES51350.2021.9489075.
21. Shanthi, D., Aryan, S. R., Harshitha, K., & Malgireddy, S. (2023, December). Smart Helmet. In International Conference on Advances in Computational Intelligence (pp. 1-17). Cham: Springer Nature Switzerland.
22. Babu, Mr. Suryavamshi Sandeep, S.V. Suryanarayana, M. Sruthi, P. Bhagya Lakshmi, T. Sravanthi, and M. Spandana. 2025. “Enhancing Sentiment Analysis With Emotion And Sarcasm Detection: A Transformer-Based Approach”. Metallurgical and Materials Engineering, May, 794-803. https://metall-mater-eng.com/index.php/home/article/view/1634.
23. Narmada, J., Dr.A.C.Priya Ranjani, K. Sruthi, P. Harshitha, D. Suchitha, and D.Veera Reddy. 2025. “Ai-Powered Chacha Chaudhary Mascot For Ganga Conservation Awareness”. Metallurgical and Materials Engineering, May, 761-66. https://metall-mater-eng.com/index.php/home/article/view/1631.
24. Geetha, Mrs. D., Mrs.G. Haritha, B. Pavani, Ch. Srivalli, P. Chervitha, and Syed. Ishrath. 2025. “Eco Earn: E-Waste Facility Locator”. Metallurgical and Materials Engineering, May, 767-73. https://metall-mater-eng.com/index.php/home/article/view/1632.
25. P. Shilpasri PS, C.Mounika C, Akella P, N.Shreya N, Nandini M, Yadav PK. Rescuenet: An Integrated Emergency Coordination And Alert System. J Neonatal Surg [Internet]. 2025May13 [cited 2025May17];14(23S):286-91. Available from: https://www.jneonatalsurg.com/index.php/jns/article/view/5738
26. D. Shanthi DS, G. Ashok GA, Vennela B, Reddy KH, P. Deekshitha PD, Nandini UBSB. Web-Based Video Analysis and Visualization of Magnetic Resonance Imaging Reports for Enhanced Patient Understanding. J Neonatal Surg [Internet]. 2025May13 [cited 2025May17];14(23S):280-5. Available from: https://www.jneonatalsurg.com/index.php/jns/article/view/5733
27. Srilatha, Mrs. A., R. Usha Rani, Reethu Yadav, Ruchitha Reddy, Laxmi Sathwika, and N. Bhargav Krishna. 2025. “Learn Rights: A Gamified Ai-Powered Platform For Legal Literacy And Children’s Rights Awareness In India”. Metallurgical and Materials Engineering, May, 592-98. https://metall-mater-eng.com/index.php/home/article/view/1611.
28. Shanthi, Dr. D., G. Ashok, Chitrika Biswal, Sangem Udharika, Sri Varshini, and Gopireddi Sindhu. 2025. “Ai-Driven Adaptive It Training: A Personalized Learning Framework For Enhanced Knowledge Retention And Engagement”. Metallurgical and Materials Engineering, May, 136-45. https://metall-mater-eng.com/index.php/home/article/view/1567.
29. P. K. Bolisetty and Midhunchakkaravarthy, "Comparative Analysis of Software Reliability Prediction and Optimization using Machine Learning Algorithms," 2025 International Conference on Intelligent Systems and Computational Networks (ICISCN), Bidar, India, 2025, pp. 1-4, doi: 10.1109/ICISCN64258.2025.10934209.
30. Priyanka, Mrs. T. Sai, Kotari Sridevi, A. Sruthi, S. Laxmi Prasanna, B. Sahithi, and P. Jyothsna. 2025. “Domain Detector - An Efficient Approach of Machine Learning for Detecting Malicious Websites”. Metallurgical and Materials Engineering, May, 903-11.
31. Thejovathi, Dr. M., K. Jayasri, K. Munni, B. Pooja, B. Madhuri, and S. Meghana

Priya. 2025. "Skinguard-Ai FOR Preliminary Diagnosis OF Dermatological Manifestations". Metallurgical and Materials Engineering, May, 912-16.

32. Jayanna, SP., S. Venkateswarlu, B. Ishwarya Bharathi, CH. Mahitha, P. Praharshitha, and K. Nikhitha. 2025. "Fake Social Media Profile Detection and Reporting". Metallurgical and Materials Engineering, May, 965-71.
33. D Shanthi, "Early-stage breast cancer detection using ensemble approach of random forest classifier algorithm", Onkologia i Radioterapia 16 (4:1-6), 1-6, 2022.
34. D Shanthi, "The Effects of a Spiking Neural Network on Indian Classical Music", International Journal of Emerging Technologies and Innovative Research (www.jetir.org | UGC and issn Approved), ISSN:2349-5162, Vol.9, Issue 3, page no. ppa195-a201, March-2022
35. Parupati K, Reddy Kaithi R. Speech-Driven Academic Records Delivery System. J Neonatal Surg [Internet]. 2025Apr.28 [cited 2025May23];14(19S):292-9. Available from: https://www.jneonatalsurg.com/index.php/jns/article/view/4767
36. Dr.D.Shanthi and Dr.R.Usha Rani, " Network Security Project Management", ADALYA JOURNAL, ISSN NO: 1301-2746, PageNo: 1137 – 1148, Volume 9, Issue 3, March 2020 DOI:16.10089.AJ.2020.V9I3.285311.7101
37. D. Shanthi, R. K. Mohanthy, and G. Narsimha, "Hybridization of ACOT and PSO to predict Software Reliability ", *International Journal Pure and Applied Mathematics*, Vol. 119, No. 12, pp. 13089 - 13104, 2018.
38. D. Shanthi, R.K. Mohanthy, and G. Narsimha, "Application of swarm Intelligence to predict Software Reliability ", *International Journal Pure and Applied Mathematics*, Vol. 119, No. 14, pp. 109 - 115, 2018.
39. Srilatha, Mrs. A., R. Usha Rani, Reethu Yadav, Ruchitha Reddy, Laxmi Sathwika, and N. Bhargav Krishna. 2025. "Learn Rights: A Gamified Ai-Powered Platform For Legal Literacy And Children's Rights Awareness In India". Metallurgical and Materials Engineering, May, 592-98.