

ONLINE TESTING & MONITORING OF QUALITY OF MEDICINE AND CONSUMABLE

¹Mrs. K. Sandhya Rani, ²Ms. N. Laxmi, ³Ms. P. Siri, ⁴Ms. G. Vasavi Amulya,
⁵Ms. CH. Vaishnavi

¹Assistant Professor, (^{2,3,4,5}) B.Tech 4th year Students,
Department of Information Technology,

Vignan's Institute of Management and Technology for Women, Ghatkesar, Telangana, India.

¹Sandhya.samskruti@gmail.com, ²laxmireddy2824@gmail.com, ³Polojusiri30@gmail.com,
⁴gundaamulya747@gmail.com, ⁵vaishnavi24ch@gmail.com

ABSTRACT

This Project aims to resolve The quality and safety of medicines and medical consumables are of utmost importance for the health of the public and the delivery of healthcare services. Traditional quality control procedures, such as laboratory testing, are time - consuming and may not detect the deterioration of products during storage and transportation. Thus timely deployment of the product may not be possible. This paper proposes an innovative method for the online testing and real-time monitoring of quality of medicines. It is performed through a secure online application. The application has an authentication mechanism, along with access control, which allows the efficient management of the inventory by authorized personnel, such as the administrator or the store manager. The Smart Medicine Storage, Quality Monitoring, and Expiry Alerting System using IoT is a system aimed at improving the safe storage of medicines. Medicines are very sensitive to environmental changes like temperature, humidity, and light. Also The Proposed system uses the IoT to monitor the storage environment of medicines using sensors. The collected data is processed by a microcontroller like Arduino or Node MCU and then sent to the cloud platforms like Think Speak or Blink for real-time monitoring and visualization. The collected dataset is then passed to the Machine Learning algorithm to perform the classification task to check whether the storage environment is safe or unsafe for the medicines. The users can access the system by using the mobile or web application to check the real-time data, the history of the medicines, and the alerts. The system also stores the essential information about the medicines, like manufacturing date and the expiry date, in the database. The system then sends notifications to the users about the expiry of the medicines and alerts about change in the environment, which can affect the medicines, to ensure proper storage of the medicines. This solution can be effectively implemented in hospitals, pharmacies, labs, and homes, thereby developing smart healthcare technology.

Keywords: *Internet of Things (IoT), Smart Medicine Storage, Medicine Quality Monitoring, Expiry Alert System, Machine Learning, Real-Time Environment Monitoring, Pharmaceutical Inventory Control.*

1. INTRODUCTION

Storing and managing medicines isn't just about stacking boxes neatly on a shelf—it's about making sure everything stays safe, effective, and ready when patients need it [1]. Medicines and medical supplies are really sensitive to their environment. Too much heat, too much humidity, the wrong lighting, or even changes in pressure—any of these can mess with how they work [2]. If things get out of control, medicines can lose their strength, or worse, start to harm instead of heal [3]. That's why hospitals, pharmacies, labs, and distribution centers can't afford to slip up on storage—they've got to get it right every time and keep a close eye on things as supplies sit in storage [4].

But here's the thing. In a lot of places, people are still checking on medicine storage the old-fashioned way—walking around, jotting down numbers, and making periodic inspections. Sure, those manual checks have been around forever, but honestly, they're not enough anymore. Things can slip by unnoticed: temperatures can spike, humidity can creep up, and nobody finds out until it's too late [5]. Plus, managing huge inventories and tracking expired drugs to slip through the cracks. That means more waste, more cost, and most importantly, more risk to patients [6].

That's where the Smart Medicine Storage, Quality Monitoring & Expiry Alerting System comes in. It's built to keep an eye on all the environmental factors that matter—like temperature and humidity. Sensors collect the data nonstop, feeding it into a microcontroller (like NodeMCU or Arduino), which then pushes that info up to the cloud [7]. Everything sits in a secure online space, where you can check graphs, dashboards, and reports from

your phone or computer.

One of the best things about this system? It doesn't just collect data—it reacts. If the temperature shoots up or humidity gets too high, the system sends an alert right away. Someone gets a message, takes action, and saves the medicines before there's any harm. That kind of speed can make all the difference in protecting medicine quality and patient safety [8]. The system also helps with inventory headaches. Every medicine lot is logged digitally, tracking what it is, the batch number, when it was made, when it expires, and how much is left. This keeps expired meds out

of use and helps organize inventory for better planning and less waste [9].

In the end, a Smart Medicine Storage, Quality Monitoring & Expiry Alerting System like this isn't just a fancy upgrade—it's a big step toward smarter healthcare. It protects medicine quality, cuts down on waste, guards against mistakes, and can fit into just about any kind of medical or even household setting. By blending IoT and smart monitoring, it pushes healthcare further toward a future where safety, reliability, and efficiency come standard [10].

1. RELATED WORK

There are several scientific works that have helped improve healthcare through technological advancements in the field of pharmaceutical monitoring. Drug recognition and notification systems have been created to help improve the monitoring of medicines in pharmacies through Internet-of-Things. There are other studies on smart control systems involving the Internet-of-Things and fuzzy logic in order to ensure an optimum environment for medicines. Quality control systems based on patient data have also been established to improve the results of tests made in laboratories. Intelligent monitoring systems have also helped improve operations in hospitals. Many scientific studies and advancements in technology have aided in creating smart healthcare systems, especially in the field of storing and monitoring medicines. IoT solutions have been extensively explored to create smart solutions for managing pharmaceuticals. Some of the studies include creating smart drug identification devices that leverage the use of IoT and RFIDs to manage medicines. These solutions help in decreasing medication errors and help manage inventory in real-time. Some of the other studies are about creating solutions to control environmental conditions in storage rooms with the help of IoT sensors and algorithms. Another innovation is the creation of intelligent monitoring systems for hospitals that incorporate many healthcare functions in one place with the help of cloud computing technologies. Mobile apps have helped in creating solutions for remote monitoring and alerts. It can be noted that the current research emphasizes the importance of automation, real-time new developments in the field of smart healthcare systems have been greatly attributed to the adoption of new technologies like Artificial Intelligence, Machine Learning, and Cloud Computing. They provide the means for conducting predictive analysis on medicine demand, expiration dates, and stock optimization. Blockchain technology is now widely used in smart healthcare systems to provide better data security and traceability, which prevents counterfeit medicines from being circulated in the healthcare market. Moreover, with the aid of sensor technology and other wearable devices that operate within the IoT environment, both medicines and patients can be tracked to monitor the effectiveness of treatment, providing timely alerts where necessary. In addition to that, edge computing has been found useful in processing data within a very short period. Analytics and data visualization tools can also play a key role in transforming big amounts of healthcare-related data into meaningful information. Communication security technologies, as well as user-friendly apps, allow the users to benefit from advanced solutions provided by a smart healthcare system.

PROPOSED METHODOLOGY

This system incorporates the use of advanced technology to automate the storage and management of medicines in healthcare facilities to address issues related to manual monitoring and poor inventory management. This system utilizes the use of advanced sensors including temperature sensors, humidity sensors, and light sensors to monitor the storage environment of the medicine cabinets. Temperature sensors help maintain the right conditions for storage since some medicines are temperature sensitive. Humidity sensors are used to ensure that humidity levels within the medicine cabinet do not have an effect on the quality of the pharmaceuticals stored. In addition, the light sensors help ensure that medicines are not degraded due to exposure to excessive light. The sensors collect data that is transmitted to the microcontroller that functions as the control unit of the system. It analyses the data in real-time, comparing it with preset values to identify anomalies.

The users have been offered a convenient online portal or mobile application to connect to the system. Using the application, users can check their environmental parameters in real-time using graphical representations on the dashboard. The application allows efficient management of the inventory of medicines by adding and modifying records of the medicines in the form of a digital database containing details about the medicine name, batch number, date of manufacture, and expiry date. One of the primary functions of the system is to check the expiry date of medicines and issue warnings before the expiry of the medicine to prevent its use accidentally. Also, in case any of the environmental parameters cross the safe threshold values, then alerts are generated via

notifications, messages, or emails. In short, the system allows remote monitoring, which is very helpful for hospitals, pharmacies, and medicine warehouses where there could be many storage facilities in one single place.

Data logging is another function of the system, wherein all the readings from the sensors are saved in the cloud for future analysis. This data could be used in the analysis of trends and creation of various reports. The process will be much more efficient with automation because it will eliminate any human mistakes, save much time, and make things more efficient. Data security is provided by such mechanisms as authentication and data encryption; therefore, no unauthorized users could get access to confidential information. Besides, the system is economically and environmentally viable because it can work for small clinics as well as for larger hospitals. Moreover, it can be improved using advanced technologies, for example, radio frequency identification and artificial intelligence for predictive analysis of the storage conditions.

Another option would be to incorporate an efficient alert mechanism into the system, which will ensure that all warnings and information is provided using several modes at once without any delays. For example, push alerts on mobile devices will provide immediate updates, whereas SMS alerts will facilitate communication in regions where the Internet coverage is poor. Email alerts could help prepare reports and other documentation. Another important aspect related to the alert mechanism is providing various levels of alerts such as warnings and critical alarms to make sure that the user prioritizes his/her action.

ADVANTAGES OF PROPOSED SYSTEM

A number of strengths that can be achieved through the proposed intelligent system for storing and monitoring medicines have been identified by the researchers. First of all, one of the strengths of this system is the ability to monitor environmental conditions. Real-time monitoring ensures that the environment in which medicines are kept is monitored at all times. It monitors conditions such as the level of temperature, humidity, and light to ensure that the medicines stay in good condition. Automation makes the monitoring process easier. As a result, human errors are avoided. Additionally, the system provides an alert any time environmental conditions exceed safe limits so that appropriate measures can be taken before medicines get damaged. Finally, the system's strength lies in the expiry date tracking option. With such a feature, identification of medicines that are about to expire becomes possible. Thus, one will not use medicines that have expired since they become unsafe.

This is a system that enhances the process of managing inventory through keeping an electronic record of the medications along with their relevant details such as name, batch number, date of manufacture, and expiration date. The tracking and management of inventory are simplified, and there will be no problem of over or under stocking of medicines since the system allows for making well-informed decisions. Access to the information is also made possible by remote access through the use of a web/mobile application to monitor the process. This makes the task easy even in bigger healthcare facilities as well as multiple sites. Recording of data through cloud-based storage allows for recording of historical data, which can be analyzed for future planning purposes.

Scalability is another strength of this system, since it allows easy expansion in case there are any requirements for future growth on the part of the company. Cost effectiveness is also a benefit, as the loss of drugs will be reduced because of effective management. Energy savings are achieved through the low-energy operation of both sensors and microcontrollers. An increase in transparency and accountability is made possible thanks to the detailed records kept by the system. Data protection is provided via security mechanisms like data authentication and data encryption. The system additionally, the system increases productivity because of the automation of repetitive tasks, which means that healthcare professionals can concentrate on more vital tasks. In terms of patient safety, it ensures that only properly stored medications that have not expired are administered to patients. The ease of use of the software application ensures that even those who have no technical background can use the software without difficulty. It also allows for seamless integration with other healthcare management systems, leading to a highly integrated environment. It is dependable and guarantees uninterrupted access to services.

Moreover, the system ensures good regulatory compliance through proper documentation of storage conditions and medicines, which will be provided to inspectors when requested. The system is sustainable in that it reduces wastage and efficient use of resources. Reporting features in the system provide useful information to be used in strategic decision-making.

EXISTING SYSTEM

The current model for handling medicine storage in hospitals and pharmacies relies on manual processes and the lack of implementation of advanced technology solutions. First, the environmental factors of medicine storage (temperature, humidity, light exposure), which play a significant role in the integrity of the product, are not monitored with the help of specialized sensors but by conventional devices, which monitor environmental parameters only during certain times of the day. Hence, the probability that some critical changes have occurred

will remain high because environmental changes will not be monitored continuously.

An equally significant flaw is the practice of manually keeping track of the expiry dates of medicine. Pharmacies are expected to continuously monitor and update expiry details, an activity that is tedious and prone to mistakes. In the absence of automated reminder and notification, the possibility of dispensing expired or near expiry medicines is very high. The use of such medicines will endanger patients' lives while at the same time inviting litigation. Also, without any strategy in place to manage near expiry medicines, wastage of drugs is inevitable. The inability to centralize the process of data management poses yet another challenge to the operation of pharmacies. Data and information are usually scattered across various sources, making it difficult to collect, share, and analyze them. The decentralized nature of data management limits cooperation between different units and lowers the level of transparency within the pharmacy operations. Besides, most of the conventional systems are not internet-enabled hence preventing remote monitoring and supervision. Pharmacy managers cannot keep track of storage and stock conditions remotely.

Furthermore, inventory management in current models is based on paper documentation or, alternatively, using conventional spreadsheet software. Such approaches carry a significant risk of human error such as entering data incorrectly or accidentally removing entries. The larger amounts of paperwork will complicate the process and increase the chance that errors will occur because of the time needed to manage them manually. Moreover, retrieving any data will be more time-consuming than when using digital databases. The issue of scalability also plays an important role in manual systems.

In case the amount of drugs used in a particular facility grows, it gets harder for such systems to operate, as they have problems with processing and storing information. Moreover, the manual system does not have the capacity to accommodate the needs of organization easily because it was not designed for large amounts of data. Such a dependency on human intervention leads to an increased workload and, thus, to decreased productivity and potential errors. Fatigue and other human factors might also cause issues when handling data.

Another issue with the current system is that there are no efficient ways for data analysis, reporting, and decision-making support. Lack of adequate methods to process data makes it hard to detect certain usage trends and make decisions accordingly.

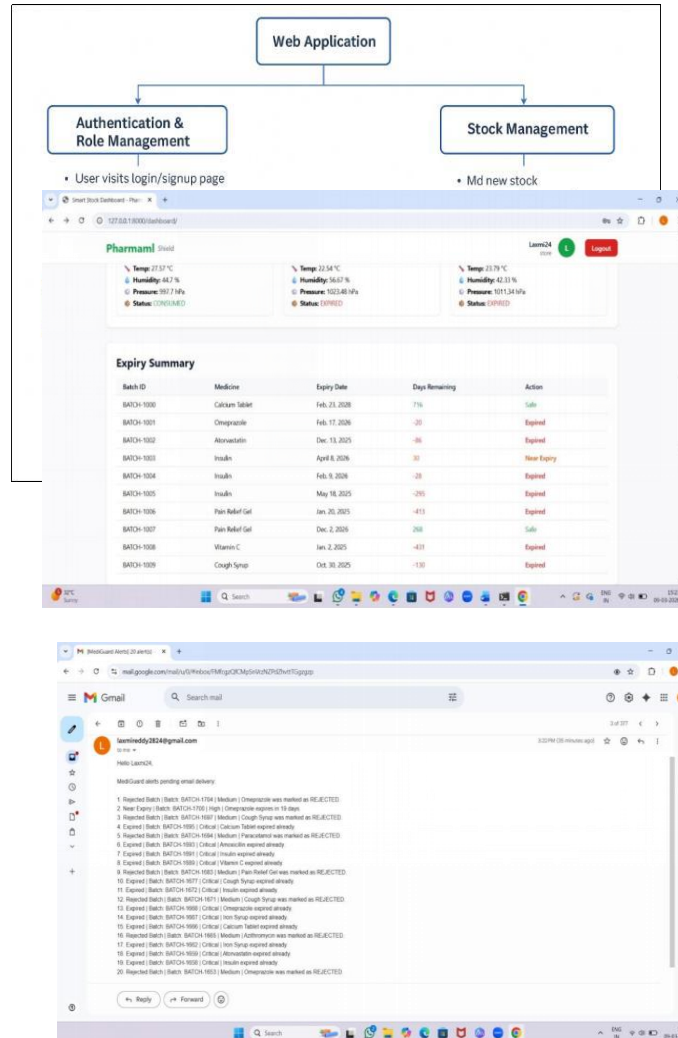
SYSTEM ARCHITECTURE

As stated above, the architecture of the proposed IoT medicine store management system is based on the modular design to guarantee effective storage, control, and monitoring of medicines in the store using IoT technology. The main components of the architecture include the web-based application used as the user interface and a number of modules for different functions of the system.

At the highest level, the Web Application Layer is the one responsible for providing the means for interaction with users (administration and store management). These users will receive information about the state of the system from dashboards, visualizations, and controls. Moreover, at this level, it is possible to monitor the activity in the system in real time and control certain processes. The Authentication and Role Management Module is intended to secure the access of certain users to the system. Users need to register themselves or enter login details into the system. In case of registration, a particular role of the user will be determined (administrator or store manager), and on this basis, permission access can be granted to perform specific actions.

Stock Management Module manages all inventory activities. It helps in adding new medicines, editing current stock information, and executing search and filter functions for easy access to relevant information. Moreover, it assists users in generating reports to analyze their stock and usage trends. The Quality Monitoring Module focuses on continuous monitoring of environmental variables like temperature, humidity, and light intensity. This monitoring is done with the help of IoT sensors. All these variables are then tested against predefined values to confirm that the environment is safe to store medicines. Apart from that, all data related to environmental variables is also logged in the form of records. These records can later be used by the system for both real-time and historical analysis.

Expiry Date Monitoring Module monitors the expiry date of all stored medicines. It checks the expiry date data periodically and classifies the medicines according to their expiry status. All medicines nearing expiration are identified automatically by this module.



2. RESULT

This is a dashboard for a Smart Medicine Storage and Monitoring System, which allows users to monitor in real time various parameters such as the environmental conditions in which the storage operates along with details regarding the expiry of the various medicines. The first part on top shows data provided by various IoT sensors such as the temperature, humidity, and pressure. Alongside these parameters, the system can also show the current status of the medicines stored within the storage unit. These could include whether the medicine has been consumed already or even whether it has expired. Moving below, there is an expiry summary that includes all kinds of details about each medicine stored in the facility. Such details include the batch ID, medicine name, date of expiry and days remaining before the expiry date. The system categorizes the medicines based on their condition into safe, near expiry, and expired. Safe medicines will have positive days remaining while those that are expired will show negative days remaining. Also included in the dashboard are login credentials and logout button.

Figure 4: Email Alert from Smart Medicine Storage and Monitoring System The image above is an email alert message received through Gmail regarding the statuses of several batches of medicines monitored by the Smart Medicine Storage and Monitoring System. The email includes several alerts organized according to different priority levels, for instance, medium, high, and critical.

Among the alerts provided by the system are those related to the following issues: rejected batch of medicines, soon-to-expire batch of medicines, and expired batch of medicines. Each individual alert is accompanied by several details, for example, batch number, medicine name, and condition. Examples of conditions included in the notifications are as follows: "Expired already," "Marked as rejected," and "Expiring in a few days." The email alert message helps to inform users about any issues related to medicine batches without having to watch out for such issues on the dashboard of the smart system constantly. The purpose is to promote the safety of users by encouraging the removal of expired medicines and utilization of soon-to-expire medicines.



The figure above is an automated alert message received from the Smart Medicine Storage and Monitoring System concerning the state of various medicine batches. The alert message is automatically sent via Gmail and lists alerts depending on their priorities, for example, medium, high, and critical alerts. Important alerts include rejection of batches, approaching expiry medicines, and medicines that have expired. Each alert provides details regarding the batch, including the batch number, name of the medicine, and its current state, which could be "expired already," "rejected," or "approaching expiry." The automated alerting system saves users the hassle of always checking the dashboard for new updates because they will receive relevant alerts in real-time concerning their batch of medicines. Users can also save on costs related to purchasing additional medicines because they will utilize their already available near-expiry medicines, thus cutting on wastage. In addition, the risk of health complications due to expired medicines will be minimized as they can be removed before they expire.

Moreover, there is a higher degree of efficiency in terms of inventory control since the medicine's condition is accurately and precisely recorded. As the alerts are created using real-time data, the chances of human errors in recording the medicine's expiry date and condition become highly unlikely. The incorporation of emails means that the alerts are accessible anywhere and on any device as long as the individual has an internet connection. Thus, it becomes easier for pharmacists or other medical personnel to track down the medicine conditions, even when far from the pharmacy.



The diagram above emphasizes yet again how reliable and multi-functional the fire detection mechanism is in this smart medicine storage system. The circuitry is arranged in such a way as to ensure constant operation, which

helps monitor the environment. The use of a fire detector and the microcontroller allows prompt detection of small fluctuations in temperature and flames. LCD screen displays such important information for users as "Fire Alert" or "System Condition," making on-site information available immediately. A buzzer serves as an auditory warning mechanism which ensures that everyone who is nearby will get informed about what is happening right away.

Not only does this system generate warnings that can be displayed locally, but it also allows sending relevant data to a user's mobile phone via network connections. In this example, the mobile Telnet shows clear messages, indicating that there is no problem with transmission of vital information. This is important particularly when it comes to unattended storage, as administrators can immediately get notified and do something right away. It is worth pointing out that messages like "Fire detected" and "Theft detected" appear simultaneously, showing that there is no conflict between two sensors.

In addition, the system increases the general security of storing medicines as it prevents any possible damage due to fire that might affect the efficiency and efficacy of the medications. With the implementation of this type of safety measure, there is less need for human monitoring, thus allowing a proactive way of dealing with risks. Moreover, the system can be made even more efficient through adding other kinds of sensors, like smoke or gas detectors, increasing the efficiency of identifying threats.

7. CONCLUSION

The Smart Medicine Storage, Quality Monitoring, and Expiry Alerting System using IoT offers a practical solution to the Problems in traditional medicine storage and management. In Typical systems, ongoing monitoring is often lacking. Manual record-keeping and a lack of timely alerts can lead to unsuitable storage conditions, increased medicine waste, and serious risks to patient safety. This project tackles these issues by introducing an automated, technology-driven method that ensures accuracy, reliability, and efficiency. The system uses IoT sensors, such as temperature and humidity sensors, along with a microcontroller to constantly monitor environmental conditions in real time. These factors are crucial for keeping medicines effective and safe.

The data collected is sent to a centralized web-based application developed with Django. Here, it is processed, stored, and shown on an interactive dashboard. Users can monitor storage conditions from a distance and make informed choices without constant manual checks. A key feature of this project is the automatic expiry tracking and alert system. It keeps detailed records of medicines, including batch numbers, manufacturing dates, and expiry dates. The system generates alerts for near-expiry and expired medicines based on this data. This helps prevent accidental use and cuts down on financial losses due to waste. The system also includes security features like unauthorized access detection with sensors, boosting the safety of stored medicines.

Another significant aspect of the project is the use of machine learning techniques. Algorithms like Random Forest, Decision Tree, and Support Vector Machine analyze data patterns and provide predictive insights. This helps in identifying potential risks, optimizing storage conditions, and improving inventory management strategies. Combining IoT and machine learning allows the system to be proactive in maintaining medicine quality. The project prioritizes usability, scalability, and cost-effectiveness. The web-based interface is simple and user-friendly. Healthcare staff can manage medicine records and monitor conditions easily. By using open-source technologies and affordable hardware, the system is suitable for various settings, including hospitals, pharmacies, laboratories, and rural healthcare centers. Additionally, its modular design allows for future upgrades like mobile app integration, cloud-based analytics, and AI-driven automation.

8. REFERENCES

- a. Agarwal, R., & Dhar, V. (2014). Big data, data science, and analytics: The opportunity and challenge for IS research. *Information Systems Research*, 25(3), 443–448.
- b. Al-Fuqaha, A., Guizani, M., Mohammadi, M., Aledhari, M., & Ayyash, M. (2015). Internet of Things: A survey on enabling technologies, protocols, and applications. *IEEE Communications Surveys & Tutorials*, 17(4), 2347–2376.
- c. Bishop, C. M. (2006). *Pattern recognition and machine learning*. Springer.
- d. Breiman, L. (2001). Random forests. *Machine Learning*, 45(1), 5–32.
- e. Chen, M., Ma, Y., Li, Y., Wu, D., Zhang, Y., & Youn, C. H. (2017). Wearable 2.0: Enabling human-cloud integration in next generation healthcare systems. *IEEE Communications Magazine*, 55(1), 54–61.
- f. Dey, N., Ashour, A. S., & Balas, V. E. (2018). *Smart medical data sensing and IoT systems*. Springer.
- g. Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep learning*. MIT Press.
- h. Hashem, I. A. T., Yaqoob, I., Anuar, N. B., Mokhtar, S., Gani, A., & Khan, S. U. (2015). The rise of “big data” on cloud computing: Review and open research issues. *Information Systems*, 47, 98–115.
- i. D. Shanthi, "Smart Water Bottle With Smart Technology", *Handbook Of Artificial Intelligence*, Bentham Science Publishers, Pg. No: 204-219, 2023.
- j. 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.
- k. 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>.
- l. 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.
- m. Shanthi, D., G. Narsimha, and R.K. Mohanthy. 2015. Human Intelligence vs. Artificial Intelligence. *International Journal of Electronics Communication and Computer Engineering* 6 (5): 30–34.
- n. D. Shanthi, Narla Swapna, Ajmeera Kiran, and Shaga Anoosha, Ensemble approach of GP, ACOT, PSO, and SNN for predicting software reliability, *International Journal of Engineering Systems Modelling and Simulation* Vol. 15, No. 2, March 1, 2024 pp 68-75.
- o. D. Shanthi, R. K. Mohanty, G. Narsimha and V. Aruna, "Application of partical swarm intelligence technique to predict software reliability," 2017 International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, 2017, pp. 629-

- 635, doi: 10.1109/ICCONS.2017.8250539.
- p. D. 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 (ICES), Coimbatre, India, 2021, pp. 1370-1375, doi: 10.1109/ICES51350.2021.9489075.
 - q. Shanthi, D., C. H. Sankeerthana, and R. Usha Rani. "Spiking Neural Networks for Predicting Software Reliability." ICICNIS. 2020. 179-185.
 - r. D. Shanthi, R. K. Mohanty and G. Narsimha, "Application of Machine Learning Techniques for Stastical Analysis of Software Reliability Data Sets," 2018 Second International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, 2018, pp. 1472-1474, doi: 10.1109/ICCONS.2018.8663005.
 - s. P. Endla, A. R, S. Suneel, A. P. Singh, P. A and D. Shanthi, "MedSensePathway: A Hybrid Framework for Real-Time Diagnosis of Malarial Parasites using Medical Imaging," 2025 9th International Conference on Electronics, Communication and Aerospace Technology (ICECA), Coimbatore, India, 2025, pp. 1972-1978, doi: 10.1109/ICECA66444.2025.11382939.
 - t. Shanthi, D. (2022). Smart Healthcare for Pregnant Women in Rural Areas. In Medical Imaging and Health Informatics (eds T.H. Jaware, K. Sarat Kumar, R.D. Badgujar and S. Antonov). <https://doi.org/10.1002/9781119819165.ch17>
2. Todupunuri, A. (2025). IMPROVING CUSTOMER EXPERIENCE WITH MODERN BANKING SOLUTIONS. SSRN Electronic Journal. <https://doi.org/10.2139/ssrn.5120615>
 3. Babburi, S. (2024). Explainable AI Framework for Policy-Compliant Anomaly Detection in Data Pipelines.
 4. Gaddam, S. Integrating Analytics into the Development Process: Bridging the Gap between Data Insights and Design Execution.
 5. Reddy, S. K. R. Developing a Modular AI Framework to Enhance Scalability and Personalization in Next-Generation Reward Platforms.
 6. Poojari, R. INTELLIGENT SYSTEMS+B108 AND APPLICATIONS IN ENGINEERING.
 7. Vasagam, M. (2024, August 30). Ensuring security in modern data pipelines: Practical strategies for data engineers. *International Journal of Intelligent Systems and Applications in Engineering*, 12(22s), 2401.
 8. Santhosh Saai Reddy Purmani. (2026). Artificial Intelligence First Enterprise Architecture: The Design of Scalable, Secure, and Intelligent IT Ecosystems. *American Journal of AI Cyber Computing Management*, 6(1(2)), 1–8. [https://doi.org/10.64751/ajaccm.2026.v6.n1\(2\).pp1-8](https://doi.org/10.64751/ajaccm.2026.v6.n1(2).pp1-8)
 9. Cyril, H. P., & Kumara, S. (2026, February). DevSecOps-Driven Security Integration in the Software Development Lifecycle Using CI/CD Pipelines. In 2026 IEEE 5th International Conference on AI in Cybersecurity (ICAIC) (pp. 1-6). IEEE.
 10. Kotte, G. (2025). Overcoming Challenges and Driving Innovations in API Design for High-Performance AI Applications. SSRN Electronic Journal. <https://doi.org/10.2139/ssrn.5283649>
 11. Mahtabi, M., Roshan, M., Muhit, M. M. I., Behvar, A., & Haghshenas, M. (2026). Cryogenic ultrasonic fatigue: Mechanisms, advancements, and insights. *Cryogenics*, 153, 104257. <https://doi.org/10.1016/j.cryogenics.2025.104257>
 12. Viswanathan, V. (2024). Pioneering Ethical AI Integration in Enterprise Workflows: A Framework for Scalable Team Governance. Available at SSRN 5375619.
 13. Akhilaiswarya, B., Sree, B. T., Lilly, K., Chowdary, K. H., & Sruthi, M. (2023). Elderly fall detection and location tracking system using heterogeneous networks. *Journal of Engineering Sciences*, 14(05).
 14. Viswanathan, V. (2025). Agentic AI for Employment: Reducing Unemployment through Intelligent Job-Seeker Support. *LEX LOCALIS–Journal of Local Self-Government*.
 15. Mudusu, S. K. (2026, February 9). AI-augmented data quality engineering. InfoWorld (Foundry Expert Contributor Network).
 16. Viswanathan, V., Shah, A. K., Kubam, C. S., Dontu, S., Gandhi, A., & Singla, P. (2025, August). Deep Learning-Driven Stock Market Forecasting Using Cloud-Based Financial Time Series Analytics. In 2025 International Conference on Emerging Trends in Networks and Computer Communications (ETNCC) (pp. 1-6). IEEE.
 17. Sruthi, M. V., Soundararajan, K., & Sree, V. U. (2012). Accurate Multimodality Registration of medical images. *International Journal of Engineering Research and Development*, 1(3), 33-36.
 18. Viswanathan, V., Polagani, S. S., Agarwal, R., Akula, S., Dey, S., & Kashyap, R. (2025, September). AI-Augmented Threat Intelligence for Proactive Intrusion Detection in Multi-Cloud



-
- Ecosystem. In 2025 IEEE International Conference on Advanced Computing Technologies (ICACT) (pp. 567-572). IEEE.
19. Mudusu, S. K., & Gentyala, S. (2026). Zero-Trust Data Pipelines for AI Systems: A Framework for Secure, Verifiable, and Auditable Data Engineering. *JOURNAL OF RECENT TRENDS IN COMPUTER SCIENCE AND ENGINEERING (JRTCSE)*, 14(2), 10-25.
 20. DEVARASETTY, N. (2023). SCALABLE DATA ENGINEERING APPROACHES FOR AI-DRIVEN INDUSTRIAL IOT APPLICATIONS. *INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH AND MANAGEMENT*, 11(06), 954-968.
 21. Agrawal, A. M., Gajula, S., Shinde, R. P., Shah, H., & Ghosh, H. (2025, July). Machine Translation for Long Sequences with Enhanced Attention Mechanisms. In 2025 5th International Conference on Electrical, Computer and Energy Technologies (ICECET) (pp. 1-6). IEEE.
 22. Dayal, P. S., Chandra, B. R., Keerthi, M., Sruthi, M., Venkatesh, K., Appalaraju, G., & Eswari, G. (2013). Design of Pyramidal Horn Antenna at 10GHz Using WIPL-D Optimizer. *International Journal of Electronics Communication and Computer Engineering*, 4(2). Maturi, S. Y. (2023). Crowdsourced frontier: Unveiling autonomous adversarial cybercapabilities via open AI competition. *International Journal of Intelligent Systems and Applications in Engineering*, 11(1s), 275–284.
 23. Hassan, T., Karim, M. F., Jeelani, H., Behnam, E., Green, R., & Syed, F. J. (2025). Optimizing Medical Question-Answering Systems: A Comparative Study of Fine-Tuned and Zero-Shot Large Language Models with RAG Framework. arXiv preprint arXiv:2512.05863.
 24. Manoharan, D. (2026). Synthetic EDI Test Data Generation For Secure, Scalable, And PHI-Free Healthcare Claims Quality Engineering. *Journal of International Crisis and Risk Communication Research*, 9(1).
 25. Ravishankara, M. (2026, February). CircuChain: Disentangling Competence and Compliance in LLM Circuit Analysis. In *SoutheastCon 2026* (pp. 1-7). IEEE.
 - a. Sruthi, M. V., Sree, V. U., & Soundararajan, K. (2012). Specific removal of motion artifacts in medical image processing. *IJECCE*, 3(3), 227-229.