Archives available at journals.mriindia.com

International Journal on Advanced Computer Theory and Engineering

ISSN: 2319-2526

Volume 15 Issue 01, 2026

Shourya Prashikshan Simulator: An AI-Powered Digital Training and Management System for Defence Institutions

[1]G. G. Desai, [2]D. S. Gejage, [3]D. K. Gopalkar, [4]V.K. Bhonde, [5]S. S. Desai, [6]D. S. Pawar

[1]Assistant Professor Dept. of Artificial intelligence and Data science, Dr.J.J.Magdum College of Engineering, Jaysingpur, Maharashtra, India.

[2-6] Dept. of Artificial intelligence and Data science, Dr.J.J.Magdum College of Engineering, Jaysingpur, Maharashtra, India.

[1]gousiya.desai@jjmcoe.ac.in,[2]dattatraygejage8@gmail.com,[3]darshanigopalkar@gmail.com, [4]bhondevaishnavi92@gmail.com, [5]sharvaridesai2311@gmail.com, [6]dhanuspawar11@gmail.com

Peer Review Information

Submission: 18 March 2026

Revision: 05 April 2026

Acceptance: 27 April 2026

Keywords

Artificial Intelligence, Face Recognition, Defence Training System, Learning Management System, FastAPI, React.js, MySQL, Mental Health Monitoring, Virtual Simulation, Digital Training Platform

Abstract

The growing need for efficiency, accuracy, and real- time monitoring in defence training environments has exposed the limitations of traditional manual systems. Conventional methods for attendance tracking, trainee evaluation, and training management are often dependent on paper-based processes and isolated data records, resulting in operational inefficiencies, lack of transparency, and limited scalability. For prevention from these challenges, our research presents the **Shourya Prashikshan Simulator**, an intelligent, web-based platform designed to digitally transform defence training and management systems.

The solution we propose offers technologies like artificial intelligence, machine learning, and modern computer vision techniques to identify trainees and eliminate proxy attendance. Additionally, it incorporates a mental health monitoring module that evaluates trainee responses using structured questionnaires to assess stress levels and provide appropriate feedback. The platform also includes virtual training modules, such as weapon handling simulations and first aid training, enabling safe, repeatable, and interactive experiences for learning without any risk associated with physical training.

The design of the system is based on a client–server architecture, where the frontend is developed using React.js to provide a responsive user interface, and the backend is implemented using FastAPI for handling business logic and API communication. A web development frameworks to create a centralized and automated training ecosystem. A key feature of the platform is the facial recognition-based.

The use of MySQL database is for structured data storage, while RESTful APIs ensure efficient and exchange of secure data. Authentication mechanisms such as JSON Web Tokens further enhance system security and access control.

Experimental evaluation of the facial recognition module demonstrates an accuracy of approximately 95–97% under standard conditions, confirming its reliability for real-world deployment. Overall, the proposed system improves operational efficiency, enhances data accessibility, and enables real-time monitoring and analysis of trainee performance. The Shourya Prashikshan Simulator provides a scalable

	and intelligent solution for modernizing defence training systems and supporting data-driven decision-making.

Introduction

Defence training institutions has a crucial role in preparing individuals for physically demanding, mentally challenging, and technically complex responsibilities. Organizations such as army training academies, National Cadet Corps (NCC) units, and paramilitary training centers are responsible for developing discipline, resilience, and operational skills among trainees. Traditionally, these institutions rely on manual processes for managing attendance, monitoring trainee performance, and delivering training content. These conventional approaches have been effective to some extent but still they suffer from limitations such as inefficiency, lack of transparency, and difficulty in handling large- scale data.

One of the primary challenges in traditional training systems is the reliance on manual attendance methods, which are prone to human error and proxy attendance. Additionally, the absence of centralized digital systems makes it difficult for administrators to track individual trainee progress and generate comprehensive performance reports. Training data is often distributed across multiple registers or systems, leading to poor data accessibility and limited analytical capabilities. Furthermore, important aspects such as trainee mental health and stress levels are frequently overlooked since they lack structured monitoring mechanisms.

Rapid advancement of artificial intelligence, machine learning, and web-based technologies, has significant potential to modernize defence training systems. Digital platforms can automate daily regular tasks, improve accuracy, and provide real- time insights into trainee performance. Technologies like facial recognition enable secure and automated attendance tracking, while data analytics can support informed decision-making for training authorities. Similarly, virtual simulation-based training modules offers safer and cost-effective alternative to traditional physical training, reducing risks while enhancing learning outcomes.

Literature Review

The application of digital technologies in management and training sectors has been widely studied, particularly with the uses of artificial intelligence and web-based platforms. Researchers went through various approaches to improve efficiency, accuracy, and accessibility in attendance tracking, learning systems, and performance monitoring.

Facial recognition has emerged as an effective way of automating attendance systems. Traditional methods such as manual registers are immune to errors and proxy attendance, whereas AI-based models use image processing techniques to identify individuals accurately. Techniques like OpenCV and deep learning models shows high accuracy in recognizing faces by converting images into feature representations and comparing stored data. However, factors such as lighting conditions and image quality can influence system performance.

Learning Management Systems (LMS) has been been widely adopted to digitize training and educational processes. The system provide functionalities like content delivery, assessment management, and progress tracking. Studies indicate that LMS platforms improve accessibility and enable better monitoring of learner performance. However, most existing LMS solutions are designed for academic environments and do not incorporate advanced features such as real-time analytics or AI- based decision support tailored for specialized training domains.

In addition, research in mental health monitoring has introduced techniques for assessing stress levels using questionnaires and machine learning models. These systems help in identifying psychological risks at an early stage, allowing timely intervention. Despite their benefits, such solutions are often implemented independently and ain't usually integrated into training management platforms.

Overall, existing research primarily focuses on individual components such as attendance systems, learning platforms, or stress analysis tools. There is limited work on unified systems that combine these functionalities into a **single platform. This gap highlights the need for an solution to be integrated which leverages artificial intelligence and modern web** technologies to enhance training efficiency and monitoring, which is addressed by the proposed system.

Methodology

The proposed system, *Shourya Prashikshan Simulator*, is developed using a systematic and modular approach for ensuring wide scalability, accuracy, and efficient management of training activities. The methodology focuses on using artificial intelligence approaches with modern

web technologies for building a centralized and intelligent training platform. This system has been designed to automate key processes such as attendance tracking, performance monitoring, and training delivery while ensuring data security and reliability.

Whole architecture of the system follows a **client– server model**, which separates the user interface from the backend processing layer. The frontend is developed using React.js, providing a dynamic and responsive interface for trainees and administrators. The backend is implemented using FastAPI, which handles API requests, business logic, and communication with the database. A MySQL database is being used to store structured data such as user details, attendance records, training progress, and assessment results. Communication between components is achieved through RESTful APIs, ensuring efficient and secure data exchange.

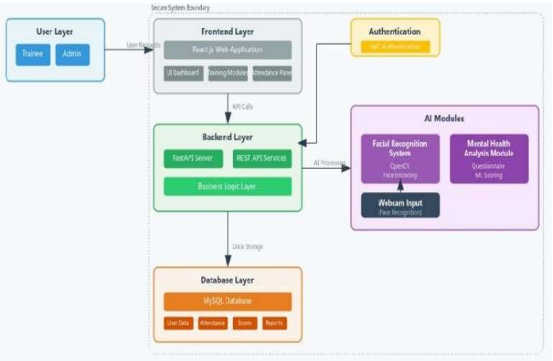

Figure 1: System Architecture Diagram

1. Facial Recognition-Based Attendance System

The attendance module is designed for automating the process of marking attendance using computer vision techniques. During the registration phase, multiple facial images of each trainee are captured through a webcam. Such images are being preprocessed by using OpenCV for face detection, alignment, and normalization. The processed images are then converted into numerical feature representations, commonly known as facial encodings, which uniquely represent each individual.

During attendance marking, a real-time image is captured and processed with the help of same pipeline. The system do extracting facial features and comparing those with stored encodings using similarity measurement algorithms. If the score for similarity exceeds a predefined threshold, the identity of the trainee is verified, and attendance is recorded automatically in database along with a timestamp. This approach minimizes manual intervention, reduces errors, and effectively eliminates proxy attendance.

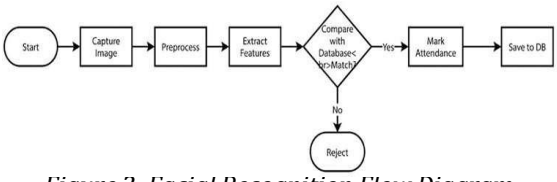

Figure 2: Facial Recognition Flow Diagram

2. Mental Health Monitoring Module

The system incorporates a mental health monitoring component to evaluate the psychological well-being of trainees. This module uses a structured questionnaire consisting of multiple parameters related to stress, motivation, and emotional stability.

Each response is assigned a weighted score, and the cumulative score is used to classify the trainee into predefined categories such as low, moderate, or high stress levels.

The results are stored in the database and visualized through dashboards, allowing administrators to monitor trends over time. This continuous assessment enables early identification of potential mental health issues and supports timely intervention. The module ensures confidentiality to encourage honest responses from trainees.

3. Virtual Training and Learning Modules

The platform integrates interactive training modules designed to simulate real-world scenarios.

These include weapon training and first aid modules, which provide instructional content through videos, animations, and scenario-based learning. After completing the learning material, trainees are required to take assessments to evaluate their understanding.

The system records scores and progress for each module, enabling performance tracking at an individual level.

This digital approach allows trainees to repeat sessions multiple times, improving skill development without any risk connected with physical training environments.

Figure 3: Training Module Interface Screenshot

4. Data Management and Security

Efficient data management and security are

essential components of the system. All data of user, includes personal information, attendance records, and performance metrics, are being stored in a MySQL database. The implementation of authentication is done using JSON Web Tokens (JWT), ensuring secure access to system resources. Passwords are protected using hashing algorithms, preventing unauthorized access.

Role-based access control is applied to differentiate between trainee and administrator functionalities. Administrators have access to monitoring tools and reports, while trainees can only view their individual data. This ensures both security and proper system control.

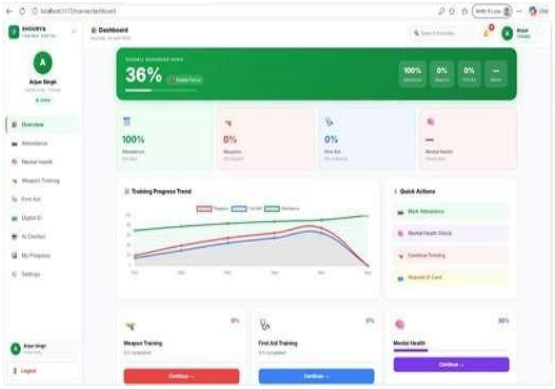

Figure 4: Dashboard and Analytics Screenshot

Results and Analysis

The performance of the *Shourya Prashikshan Simulator* was evaluated based on the effectiveness of its core modules, including facial recognition- based attendance, training modules, and system usability. The evaluation focused on accuracy, efficiency, and the overall improvement in training management compared to traditional methods.

1. Facial Recognition Performance

The module of facial recognition was tested using multiple facial image samples collected during the registration phase. The system utilized OpenCV- based algorithms to detect and recognize faces by comparing real-time captured images facial encodings.

Experimental observations indicate that it achieved an accuracy of approximately **95–97%** under normal lighting conditions. The model was able to correctly identify registered trainees and successfully reject unregistered individuals. The implementation significantly reduced the chances of proxy attendance, is a major limitation in manual systems.

However, it was observed that performance may slightly decrease under poor lighting conditions or when there is significant variation in facial appearance. Despite these limitations, the module demonstrated reliable performance for real-world deployment.

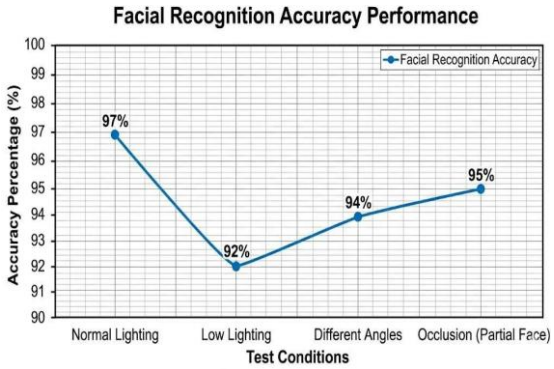

Figure 5: Facial Recognition Accuracy Graph

2. System Efficiency and Automation

The Digital platform implementation resulted in a considerable improvement in operational efficiency. The automated attendance system reduced the time required for attendance marking compared to manual methods. Additionally, the centralized database allowed quick retrieval and management of trainee information, eliminating the necessity of maintaining multiple records.

The uses of RESTful APIs enabled smooth communication between frontend and backend components, ensuring faster data processing and response times. The system also minimized human errors, improving the overall reliability of training management.

3. Training Module Evaluation

The virtual training modules, including weapon training and first aid simulations, were evaluated based on user interaction and performance tracking. Trainees were able to access learning materials,

complete assessments, and monitor their progress through the platform.

The result shows the digital modules provided a flexible and safe learning environment, allowing trainees to repeat sessions and improve their understanding. Performance scores were recorded and analyzed, enabling administrators to identify plus points and drawbacks of each trainee.

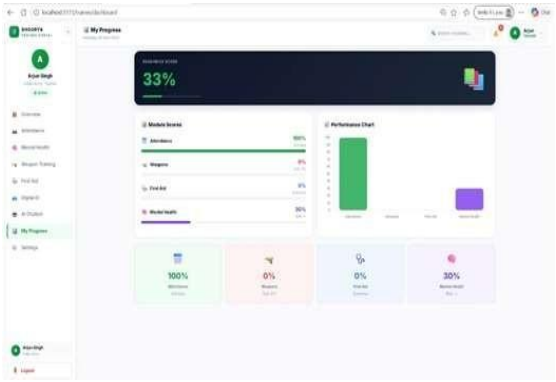

Figure 6: Training Progress Dashboard

4. Mental Health Monitoring Analysis

The mental health monitoring module successfully categorized trainees based on their stress levels using questionnaire-based analysis. The system generated meaningful insights by storing and visualizing data over time, helping administrators identify patterns and trends in trainee well-being.

This feature contributed to proactive decision-making by enabling early identification of individuals who may require attention or support. The integration of this module added an important dimension to training management that is often overlooked in traditional systems.

5. Overall System Impact

The overall implementation of the system demonstrated significant improvements in training efficiency, transparency, and data management. The integration of multiple modules into a single platform enabled real-time monitoring and centralized control. Compared to traditional methods, the proposed system reduced manual workload, improved accuracy, and enhanced the quality of training processes.

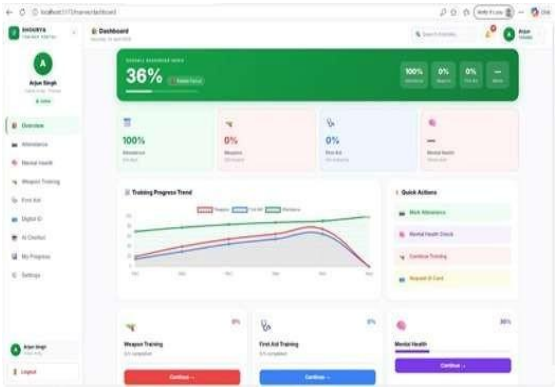

Figure 7: Overall System Dashboard

Conclusion

The *Shourya Prashikshan Simulator* presents an intelligent solution for modernizing defence training systems through the uses of artificial intelligence and web-based technologies. Traditional training methods, which rely heavily on manual processes and fragmented data management, often face obstacles related to inefficiency, lack of transparency, and limited scalability. This proposed system addresses the limitations by providing a centralized digital platform that automates key training operations and enhances overall system effectiveness.

One of the bigger contributions of the work is the integration of a facial recognition-based attendance system, which significantly improves accuracy and eliminates proxy attendance. By leveraging computer vision techniques, the system ensures reliable identity verification and reduces the dependency on manual intervention. In addition, the inclusion of virtual training modules enables trainees to engage in safe and repeatable learning experiences, thereby minimizing the risks came with physical training environments while improving skill development.

The integration of a mental health monitoring module further strengthens the system by addressing an often overlooked aspect of training. Through structured assessments and data analysis, the system enables continuous evaluation of trainee well-being and supports timely identification of potential issues. Moreover, the centralized dashboard provides administrators with real-time insights into attendance, performance, and overall progress, facilitating better decision-making and efficient management.

From a technical perspective, the use of a client–server architecture with React.js, FastAPI, and MySQL ensures scalability, flexibility, and secure data handling. The implementation of authentication and role-based access control enhances system security and ensures controlled access to sensitive information.

Overall, the proposed system demonstrates how the integration of artificial intelligence, machine learning, and modern web technologies can transform traditional training environments into efficient, data-driven, and intelligent systems. The *Shourya Prashikshan Simulator* not only improves operational efficiency and its accuray but also provides a scalable framework which can be extended to various training institutions beyond the defence domain.

Future Work

While the *Shourya Prashikshan Simulator* provides a robust and integrated solution for digital training management, there are several opportunities for further enhancement and

expansion. Future developments can focus on improving system capabilities, increasing scalability, and incorporating more advanced technologies to enhance user experience and system effectiveness.

One potential area of improvement is the making of an **mobile application** for the platform. A dedicated mobile app would allow trainees and administrators to access the system more conveniently, enabling features such as attendance marking, progress tracking, and notifications directly from smartphones. This would increase accessibility and usability, especially in environments where desktop access is limited.

Another important enhancement is the integration of **advanced biometric systems**. While the current system uses facial recognition for attendance, combining it with additional biometric methods such as fingerprint or iris recognition could further improve accuracy and reliability. Additionally, incorporating **GPS-based attendance tracking** can ensure location verification, making the system more robust for field training scenarios.

This system can also be extended by incorporating **advanced analytics and machine learning models** for performance prediction. By analyzing historical data, the platform can provide insights into trainee progress, identify potential risks, and recommend personalized training plans. Predictive analytics can assist administrators in making proactive decisions to improve training outcomes.

Furthermore, the uses of **Virtual Reality (VR) and Augmented Reality (AR)** technologies can significantly enhance the training experience. These technologies can provide immersive simulations for weapon handling, emergency response, and other critical scenarios, offering a more realistic and engaging learning environment compared to traditional methods.

Another area for future work is the implementation of **cloud-based deployment**. Migrating the system to a cloud infrastructure would improve scalability, data availability, and system performance. It would also allow deployment across multiple training centers, enabling centralized management at a larger scale.

Finally, the system can be enhanced by improving the **AI chatbot module** to provide more intelligent and context-aware assistance. Incorporating natural language processing (NLP) techniques can enable better interaction with users, allowing the chatbot to handle complex queries and provide personalized guidance.

In summary, future enhancements aim to make the system more scalable, intelligent, and user-friendly by integrating advanced technologies and expanding its capabilities to meet evolving training requirements.

References

W. Zhao, R. Chellappa, P. Phillips and A. Rosenfeld, "Face Recognition: A Literature Survey," *ACM Computing Surveys*, 2003.

N. Panwar et al., "Facial Recognition Attendance System Using OpenCV," *ResearchGate*, 2024.

H. K. Ekenel and R. Stiefelhagen, "Local Appearance-Based Face Recognition Using Discrete Cosine Transform," *IEEE Transactions on Image Processing*, 2009.

M. Turk and A. Pentland, "Eigenfaces for Recognition," *Journal of Cognitive Neuroscience*, 1991.

M. Coates, D. James and G. Baldwin, "A Critical Examination of the Effects of Learning Management Systems on University Teaching and Learning," *Tertiary Education and Management*, 2005.

R. Ellis, "A Field Guide to Learning Management Systems," *American Society for Training and Development*, 2009.

A. Al-Fraihat et al., "Evaluating E-Learning Systems Success: An Empirical Study," *Computers in Human Behavior*, 2020.

S. Graf and B. List, "An Evaluation of Open Source E-Learning Platforms," *International Journal of Learning Technology*, 2005.

M. Watson and S. Watson, "An Argument for Clarity: What are Learning Management Systems?" *TechTrends Journal*, 2007.

A. Shawar and E. Atwell, "Chatbots: Are They Really Useful?" *LDV Forum – Journal for Computational Linguistics*, 2007.

T. Bickmore and R. Picard, "Establishing and Maintaining Long-Term Human-Computer Relationships," *ACM Transactions on Computer-Human Interaction*, 2005.

J. Hill, W. Randolph Ford and I. Farreras, "Real Conversations with Artificial Intelligence: A Comparison of Human–Human and Human–Chatbot Conversations," *Computers in Human Behavior*, 2015. M. Nuruzzaman and O. K. Hussain, "A Survey on Chatbot Implementation in Customer Service Industry," *IEEE Access*,

2018.

P. Rajpurkar et al., "Building Intelligent Conversational Agents," *ResearchGate*, 2020.

B. Liu and I. Lane, "End-to-End Learning of Task-Oriented Dialogue Systems," *IEEE Spoken Language Technology Workshop*, 2017.

S. Cohen, T. Kamarck and R. Mermelstein, "A Global Measure of Perceived Stress," *Journal of Health and Social Behavior*, 1983.

M. Gjoreski et al., "Continuous Stress Detection Using Machine Learning," *IEEE Journal of Biomedical and Health Informatics*, 2017.

J. Healey and R. Picard, "Detecting Stress During Real-World Driving Tasks Using Physiological Sensors," *IEEE Transactions on Intelligent Transportation Systems*, 2005.

P. T. Tadesse et al., "Stress Detection Using Machine Learning Techniques," *IEEE Access*, 2020.

S. Sano and R. Picard, "Stress Recognition Using Wearable Sensors," *IEEE Conference on Affective Computing*, 2013.

A. Shatte, D. Hutchinson and S. Teague, "Machine Learning in Mental Health: A Review," *Journal of Medical Internet Research*, 2019.

J. Cook et al., "Technology-Enhanced Simulation for Health Professions Education," *JAMA Journal*, 2011.

R. Issenberg et al., "Simulation Technology for Health Care Professional Skills Training," *Medical Teacher*, 2005.

D. Gaba, "The Future Vision of Simulation in Healthcare," *Quality and Safety in Health Care*, 2004.

B. McGaghie et al., "Simulation-Based Medical Education," *Academic Medicine*, 2010.

S. Lateef, "Simulation-Based Learning: Just Like the Real Thing," *Journal of Emergencies, Trauma and Shock*, 2010.

J. Kneebone, "Simulation in Surgical Training," *British Medical Journal*, 2003.

R. Fielding, "Architectural Styles and the Design of Network-Based Software Architectures," *Doctoral Dissertation, University of California*, 2000.

M. Fowler, *Patterns of Enterprise Application Architecture*, Addison-Wesley, 2002.

S. Tilkov and S. Vinoski, "Node.js: Using JavaScript to Build High-Performance Network Programs," *IEEE Internet Computing*, 2010.

J. Bradley, M. Jones and N. Sakimura, "JSON Web Token (JWT)," *IETF RFC 7519*, 2015.

L. Richardson and S. Ruby, *RESTful Web Services*, O'Reilly Media, 2007.