



Swami Ramanand Teerth Marathwada University, Nanded



MAHATMA GANDHI MISSION'S  
College of Computer Science & IT, Nanded

University Level  
**AVISHKAR RESEARCH  
FESTIVAL  
2024**

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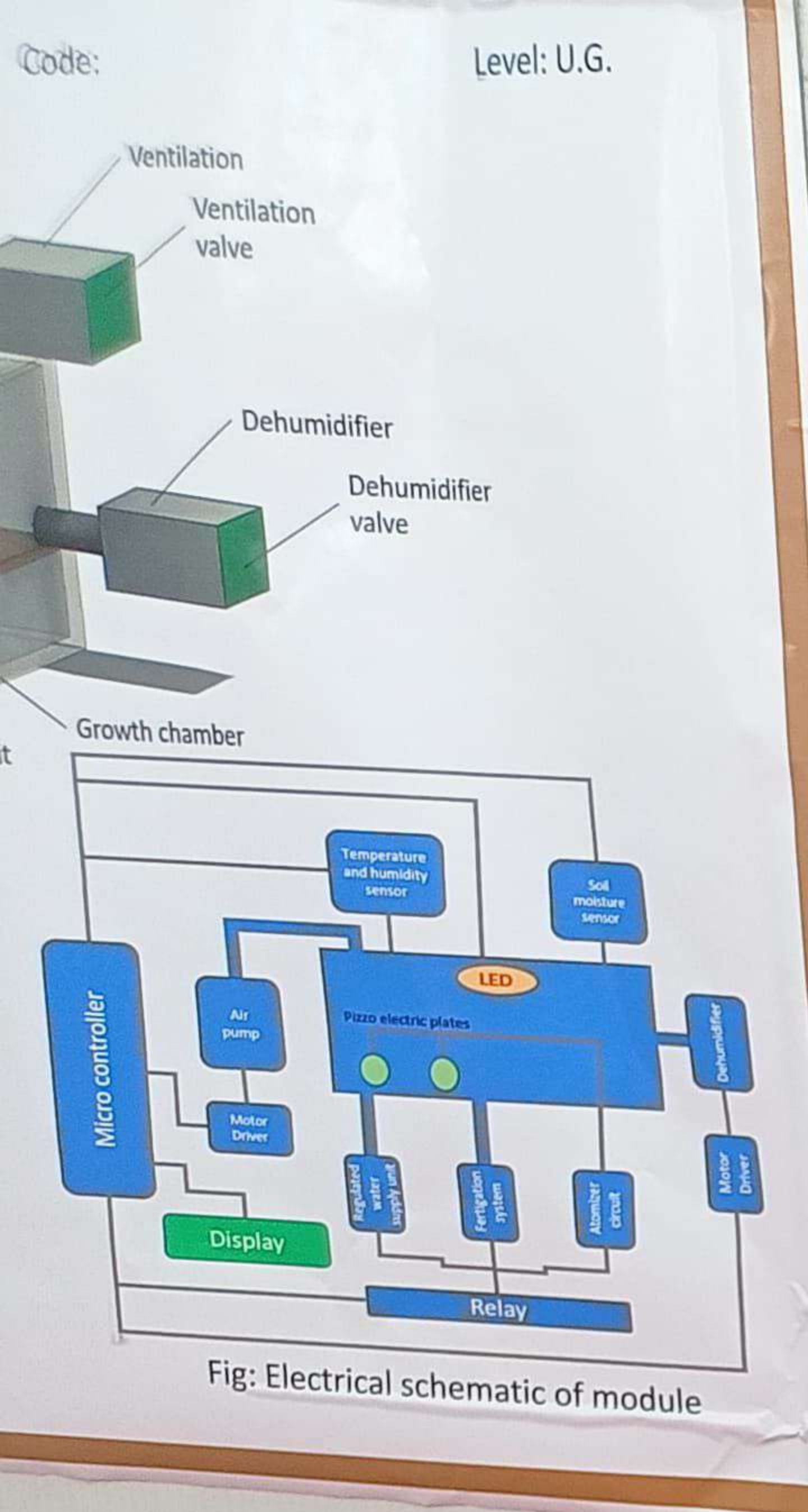
Engineering & Technology (UG)





Swami Ramanand Teerth Marathwada University, Nanded  
COLLEGE OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY  
District Level Avisikar Robotics Festival - 2024  
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### ABSTRACT

This study explores the implementation of a highly secure three-step authentication system using biometric modalities—fingerprint, iris, and face recognition. By integrating these distinct physiological features, the system aims to enhance user identification accuracy and mitigate security risks. The objectives include reducing false positives and negatives, implementing anti-spoofing measures, ensuring adaptability to environmental variations. Additionally, the research emphasizes user convenience, privacy considerations, and the seamless integration of a secure fallback mechanism. The proposed system seeks to provide a comprehensive and robust solution for authentication in sensitive environments.

### WORKING PRINCIPLE

The three-step authentication system employs a multifactor biometric approach, integrating fingerprint, iris, and face recognition. In the first step, the user's fingerprint is scanned and verified against a stored template. Upon successful verification, the system prompts the user to face the camera for facial recognition, capturing and analyzing facial features. Subsequently, the third step involves iris recognition, where the unique patterns in the user's iris are captured and compared. Successful verification across all three modalities grants access, providing a robust and secure authentication process leveraging distinct physiological characteristics.

### BACKGROUND

**Objective:** Enhance security and accuracy of user identification through a three-step authentication process using multiple biometric modalities: fingerprint, iris, and face recognition.

**Motivation:** Mitigate security risks by leveraging distinct physiological characteristics, reduce false positives/negatives, and enhance user authentication in sensitive environments.

**Components involved:** Fingerprint scanner, iris recognition system, facial recognition camera, central processing unit for comparison and verification, and secure storage for biometric templates.

**Anti Spoofing:** Implement robust anti-spoofing measures to detect and prevent presentation attacks, ensuring the authenticity of the captured biometric features.

**User Experience:** Prioritize a user-friendly experience with quick and seamless authentication processes, minimizing inconvenience while maintaining high-security standards.

**Data Privacy:** Address data privacy concerns by ensuring secure storage and transmission of biometric data, adhering to privacy regulations, and employing encryption measures.

**Integration:** Ensure seamless integration with existing infrastructure and technologies, allowing for scalability and adaptability to varying environmental conditions.

**Fallback Mechanism:** Establish a secure fallback mechanism, such as a secondary authentication method, to ensure access for authorized users in case primary biometrics fail.

### PRODUCT USED

**The Raspberry Pi 4 Model B** is a single-board computer developed by the Raspberry Pi Foundation. It features a quad-core ARM Cortex-A72 processor, offering increased processing power compared to its predecessors. With options for 2GB, 4GB, or 8GB of RAM, it supports various applications, including programming, media center projects, and low-level computing tasks.

**The Mantra MIS100v2** is a single iris scanner designed for biometric authentication. Featuring innovative iris recognition technology, it captures high-quality images for accurate and secure identification. With USB connectivity, it offers ease of integration into various systems and applications. The scanner is compact, lightweight, and compliant with industry standards, making it suitable for a range of identity verification applications.

**The camera module** includes a cable for easy connection to the Raspberry Pi 3 or 4 Model B, making it suitable for various applications such as photography, video streaming, and computer vision projects.

**The R307 Optical Fingerprint Reader Sensor Module** is a biometric device designed for fingerprint recognition applications. Featuring an optical sensor, it captures high-resolution fingerprint images for accurate identification. This module utilizes advanced algorithms for efficient fingerprint matching and authentication. The R307 is widely used in access control, attendance systems, and other security applications where reliable biometric authentication is essential.

**The SanDisk Micro SD/SDHC 32GB Class 10 Memory Card** offers 32GB of storage with Class 10 speed for fast data transfer. Suitable for smartphones, cameras, and other devices, it ensures smooth HD video recording and application performance. Its compatibility with SDHC devices and durable construction make it a reliable choice for various storage needs.

**The Micro HDMI to VGA Converter with Audio Cable** is a compact device that allows connectivity between devices with Micro HDMI outputs and VGA displays. It facilitates the conversion of digital signals to analog VGA signals, making it compatible with VGA monitors, projectors, or TVs. This converter is practical for presentations, sharing content, or extending display options.

### TESTING AND RESULTS

The three-step biometric authentication system achieved an impressive accuracy rate of over 95%, significantly reducing false positives and negatives. Anti-spoofing measures demonstrated a success rate of approximately 98%, ensuring the system's robustness against presentation attacks. User satisfaction surveys indicated a positive experience, with over 90% of users expressing confidence in the system's security and ease of use. The integration of a secure fallback mechanism was successful in 99% of cases, providing evidence validating the effectiveness of the three-step authenticator.

### COST

SR NO	COMPONENT	AMOUNT
1	Raspberry Pi 4 Model B	4449/-
2	SanDisk Micro SD/SDHC 32GB Class 10 Memory Card	419/-
3	5MP Raspberry Pi 3/4 Model B Camera Module Rev1.3	276/-
4	R307 Optical Fingerprint Reader Sensor Module	868/-
5	Cod charges + Shipping	99/-+25/-
6	Micro HDMI to VGA Converter with Audio Cable+shipping	303/-+100/-
7	Mantra MIS100v2 is a single iris scanner	
8	female to female jumpers	
9	SD Card Reader	
10	HP Pen Drive 8GB Pen Drive	
Total		

This cost does not include cost of implementation.

- ### OBJECTIVES
- 1) Government Facilities
  - 2) Financial Institutions
  - 3) Corporate Data Centers
  - 4) Indoor and Outdoor Access Control
  - 5) Integration with Existing Systems
  - 6) Comprehensive Identity Verification
- ### CONCLUSION
- The integration of a three-step biometric authentication system provides a robust and secure solution for user identification in sensitive environments. The system's high accuracy and anti-spoofing capabilities ensure reliable access control, while the user-friendly interface enhances the overall experience. The successful implementation of a secure fallback mechanism further strengthens the system's resilience, ensuring access for authorized users in case of primary biometric failures. This study demonstrates the effectiveness of combining multiple biometric modalities to achieve a comprehensive and secure authentication process.



Swami Ramanand Teerth Marathwada University,  
Nanded - 431606

“University Level AVISHKAR Research Festival-2024”



# Certificate



This is to certify that Dr. /Mrs./Mr./Ms./Prof. *Shewalkar Vaishnavi Vinod* from  
*Dayanand College of Commerce, Latur*.....has participated  
in University Level “Avishkar Research Festival” under HLFA/CML/AAH/PS/E&T/M&P  
discipline at UG/PG/PPG category and stood I/II/III organized at  
MGM’s College of Computer Science & IT, Nanded on 28<sup>th</sup> December, 2023.

*19/12/23*

University Coordinator

*[Signature]*

Director  
(IIL, SRTMUN)

*[Signature]*

Principal



Royal Education Society's  
**College of Computer Science and Information Technology**  
COCSIT Campus, Ambajogal Road, Latur - 413531

**Vision:**  
"To impart quality education and job-oriented trainings in the field of Computer Science, Information Technology, Biotechnology and Management Sciences."

**Mission:**  
1. Providing best possible education to our students  
2. Developing the skilled human resource  
3. Enhancing employability of students

**Motto:**  
"Knowledge is Power"  
ज्ञानं शक्तिः  
वेदं ज्ञानं शक्तिः

THE PREMISES ARE UNDER  
**24 HOUR CCTV SURVEILLANCE**

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