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INTELLIGENTACCESSCONTROLSYSTEMFOR GRANARYBASEDONFACERECOGNITIONANDOXYGENCONCENTRATION

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Abstract*—The granary plays a crucial role in ensuring food security; however, it is vulnerable to theft and unsafe working environments caused by oxygen deficiency. This paper presents an Intelligent Access Control System that integrates face recognition and oxygen concentration monitoring to enhance both security and worker safety. The system uses image processing techniques for authentication and sensors for real-time oxygen monitoring, automatically restricting access under hazardous conditions. This design ensures only authorized personnel enter while maintaining safe environmental conditions.

Index Terms—Face recognition, oxygen concentration, granary security, IoT, access control system.

INTRODUCTION

Grain storage facilities are vital for maintaining food reserves, but they are often prone to theft and unsafe storage conditions. Traditional lock-and-key systems are inadequate for preventing unauthorized access. Additionally, oxygen deficiency inside granaries can pose serious health hazards to workers. Hence, there is a need for an intelligent system that integrates modern technologies like biometrics and IoT-based monitoring.

To address these challenges, the proposed system integrates face recognition for biometric-based access control and oxygen concentration monitoring for real-time safety assurance. This ensures that only authorized individuals access the granary and that the internal environment remains safe for both workers and stored grains.

LITERATURE SURVEY

Several approaches have been developed for secure access control. Conventional RFID and password-based systems, though widely used, are susceptible to duplication and unauthorized access. Recent research focuses on biometric authentication, with face recognition gaining popularity due to its non-intrusive and reliable nature. In

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parallel, IoT-based environmental monitoring has been applied to granaries to detect temperature and humidity.

However, few systems combine biometric security with oxygen concentration monitoring for holistic safety.Recent works point to the value of integrated systems that combine biometric access control with environmental sensing.

Table I. Comparison of Existing Systems

Solution Type	Features	Limitations
RFID/Key Access	Simple and low-cost	Can be stolen/duplicated
Fingerprint System	Biometric verification	Prone to wear & false rejections
Face Recognition	Contactless, accurate	Needs good lighting
Gas Sensors in Warehouses	Real-time monitoring	Standalone, not integrated

PROPOSED SYSTEM

The proposed Intelligent Access Control System integrates face recognition for authentication and oxygen concentration sensors for safety monitoring. The system comprises the following modules:

• Face Recognition Module – Employs a camera and ML-based facial recognition algorithms for identity verification.
• Oxygen Monitoring Module – Utilizes O2 sensors to measure air quality inside the granary.
• Microcontroller – Controls data processing and decision-making.
• Access Mechanism – Electronic door lock that activates only if both authentication and oxygen safety conditions are met.
• Alert System – Sends real-time notifications to supervisors in case of abnormal oxygen levels or unauthorized access attempts.

The proposed system is IoT-enabled, allowing data (access logs, environmental readings) to be transmitted to a central server or cloud platform. Secure protocols (e.g., MQTT over TLS) ensure the integrity and confidentiality of the transmitted data.

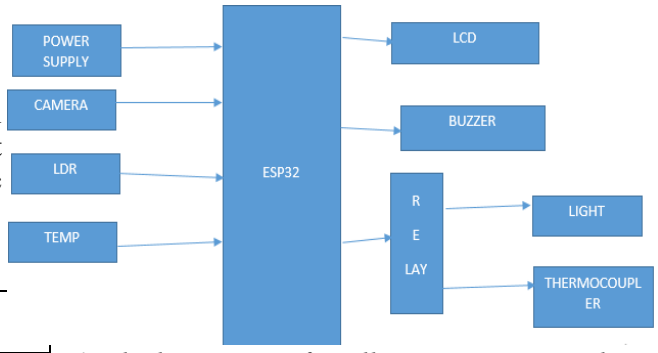

Fig. 1. Block Diagram of Intelligent access control system for granary based on face recognition and oxygen concentration

System is designed to enhance the safety and security of grain storage facilities by integrating biometric access control with environmental monitoring. Unlike traditional systems that rely only on keys, RFID, or standalone biometrics, this framework enforces dual-layer security: (i) verifying the identity of the individual using face recognition, and (ii) ensuring the oxygenconcentration inside the granary is within safe limits before granting access.

RESULTS AND DISCUSSION

The prototype system was tested in a controlled environment. Face recognition achieved an accuracy of approximately 95% under standard lighting conditions. Oxygen sensors successfully detected variations in air quality with response times under 3 seconds. The integration ensured that unauthorized access was denied, and access was restricted during unsafe oxygen levels. This dual-layer approach significantly enhanced both security and worker safety compared to conventional systems.

CONCLUSION AND FUTURE SCOPE

The Intelligent Access Control System for Granaries provides a dual-layer security and safety solution by integrating face recognition and oxygen concentration monitoring. This ensures that only authorized personnel can access the facility and only under safe environmental conditions. Future improvements include cloud-based data analytics, AI-driven predictive maintenance, and integration with smart agriculture frameworks.

This project demonstrates a practical solution for enhancing granary safety and security through intelligent access control. By combining

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face recognition with oxygen concentration monitoring, the system ensures that only authorized personnel gain entry under safe environmental conditions. Future enhancements include: Integration with cloud databases for centralized monitoring. Deployment of AI-based adaptive face recognition for varying lighting conditions.

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