SMART BIOMETRIC DOOR LOCK SYSTEM WITH HYGIENIC CONTACTLESS EXIT

Mr. S. R. Pandit[1], Mr. Aniket Gangurde[2] and Mr. Abhijit Gangurde[3]

[1]*Assistant Professor, Department of Instrumentation and Control, MVP's KBTCOE, Nashik, Maharashtra, India*

[2]*Student, Department of Instrumentation and Control, MVP's KBTCOE, Nashik, Maharashtra, India*

[3] *Student, Department of Instrumentation and Control, MVP's KBTCOE, Nashik, Maharashtra, India*

***Abstract*— This paper presents a secure and efficient access control door lock system based on biometric authentication and contactless sensing. It verifies users through fingerprint recognition and unlocks the door for authorized individuals. A no-touch mechanism allows for hygienic, hands-free exit. The system operates on a low-voltage power supply and is suitable for residential, commercial, and industrial applications, offering a reliable and keyless security solution.**

***Keywords*— Access control, biometric authentication, biometric fingerprint recognition, contactless sensing, electronic door lock, security system, keyless entry, automation, no-touch sensor, smart access.**

1. INTRODUCTION

In today's rapidly advancing world, ensuring the security of physical spaces has become more critical than ever. Traditional key-based access systems often pose risks such as key duplication, loss, or unauthorized access. To address these challenges, biometric-based access control systems have emerged as a reliable and efficient solution. This project focuses on the development of an Access Control Door Lock System using the Biomax K30 access control device, a 12V DC power adapter, and a Biomax electromagnetic (EM) lock.

The system operates on fingerprint recognition technology, allowing only authorized individuals to gain entry. The Biomax K-30 device captures and verifies biometric data, sending authentication signals to the electromagnetic lock, which activates upon successful verification. This eliminates the need for traditional keys while enhancing security and ease of access. Designed to provide continuous and dependable operation, the system is powered by a 12V DC adapter, ensuring reliability even during extended use. This project aims to demonstrate a practical, scalable, and secure access control solution suitable for residential, commercial, and industrial environments. The integration of biometric authentication with electronic locking mechanisms provides a modern approach to access management, promoting safety, convenience, and operational efficiency.

2.METHODOLOGY

1: Hardware Required

Name of Components	Specification
Biomax K30 Pro	Access Control System
EM Lock	Magnetic Lock
ZKTeco Switch	No Touch Switch
Power Adapter (12V DC)	Supply For System

2: Software Required

"SmartOffice Suite" is advance level Time & Attendance Software with features of Desktop, Web & Employee Self Service, which helps you to manage your employees Time & Attendance data including Overtime, Leave, multi-shift, Comp-off etc. through browser & mobile.

3. FIGURES

Fig. 1 Biomax k30 pro Access Control System.

- Model: Biomax K30 pro
- Communication: TCP/IP, USB-host
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- Supply: 12V DC, 1.5 Amps Memory:
- Fingerprints Capacity: 2000
- 2)Card Capacity: 2000
- 3)User Capacity:2000

Fig. 2 EM Lock

- Type: Biomax EM Lock.
- Operating Voltage: 12V DC.
- Holding Force: 600 lbs (~272 kgs)

Fig. 3 No Touch Switch

- Model: ZKTeco No Touch Switch
  - Power Supply: 12VDC
  - Detecting Range: 0.1~10 cm
  - Function: Blue LED-Standby; Green Led- Visitor detected

Fig. 4 Circuit Diagram

3. IMPLEMENTATION

- Biomax K30 Pro: A fingerprint and card-based terminal that authenticates users and controls door access. It includes a biometric sensor, RFID reader, and keypad.
- Electromagnetic Lock (EM Lock): A fail-safe lock that uses magnetic force to hold the door closed when energized.
- No-Touch Exit Switch: An infrared sensor that detects hand motion to trigger door unlocking without physical contact.
- 12V Power Supply: Powers the EM lock and K30 device.

2: Entry Process(Authorized Access)

- The EM lock is normally energized, keeping the door securely closed using magnetic force.

- When a user wants to enter, they must authenticate using the K30 Pro by:
  - Scanning their fingerprint
  - Swiping an RFID card
  - Entering a PIN code

- If the credentials match the authorized list stored in the K30 Pro, the device sends a trigger signal (through its NO/COM relay output) to the relay or access control power box.
- The relay cuts power to the EM lock for a set time (usually 5–10 seconds), causing the magnet to release and the door to unlock.
- After the time delay, power is restored, and the door automatically locks again.

2: Exit Process (No-Touch Switch)

- On the inside of the secured area, a No-Touch Exit Switch is installed near the door.
- When a person waves their hand in front of the sensor, it detects motion via infrared signals.
- The sensor sends a signal to the relay or access controller **to** de-energize the EM lock, just like an authenticated entry.

CONCLUSION

The integration of an Access Control System, Electromagnetic (EM) Lock, and No-Touch Exit Switch offers a secure, efficient, and hygienic solution for managing entry and exit in controlled environments. The access control system ensures only authorized individuals can gain access, while the EM lock provides strong and reliable locking based on electrical control. The no-touch switch enhances user convenience and hygiene by enabling hands-free exit, which is especially beneficial in high-traffic or sterile areas.

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