ATM THEFT DETECTION, AUTO ARRESTING AND INTIMATION SYSTEM

S Asha Kiranmai*[1] | B Vishali[2] | B Tanvika[3] | A Poojitha[4]

1 Associate Professor, EEE Department, Bhoj Reddy Engineering College for Women,Hyderabad, Telangana, India.

2, 3&4 Undergraduate Students, Bhoj Reddy Engineering College for Women, Hyderabad, Telangana, India.

Abstract:

ATM thefts have become a growing concern in today's financial landscape, requiring advanced security systems to combat the rising threat. This proposed work is developed to safeguard ATMs against theft attempts and auto arrest the intruder from escape. This system aims to build a real-time theft detection through integrated sensors and upon detecting any suspicious activity, such as unauthorized tampering, the system instantly triggers an action and once a theft is detected, the LED and buzzer are automatically activates. The door of ATM Booth silently close and get automatically locked, securing the ATM forming an unbreakable wall that prevents any attempt by thief to exit. Additionally, an SMS alert is sent to the authorities enabling law enforcement to respond promptly and a password is provided to unlock the door of ATM Booth. To further enhance security, the system is equipped with an unconscious gas mechanism. The system releases a safe, non-lethal gas that renders the thief unconscious.

Keywords: *ATM, Vibration Sensor, Unconscious gas, password, SMS Alert, LED, Buzzer*

1. INTRODUCTION

The increasing number of ATM theft incidents has raised significant concerns about the security of financial institutions and their customers. Criminals often use various sophisticated techniques to breach ATM security, leading to financial losses and operational disruptions. In light of these challenges, ensuring robust and real-time ATM security has become essential to prevent theft and enable prompt action by authorities.

S. Karthikeyan (2015) introduced an "Automated Anti-Theft and Misuse Alerting System for ATMs" that focused on detecting unauthorized access or tampering with ATMs. The system utilized sensors to monitor abnormal activities and sent real-time alerts to the concerned authorities via GSM communication. This work laid the foundation for automated theft detection systems by emphasizing quick notification as a primary measure to combat ATM theft [1].

Sudipta Miaiti (2016) presented a study titled “ATM Robbery Prevention Using Advanced Security”, which incorporated biometric authentication to restrict unauthorized users and a tamper-proof locking mechanism to safeguard the ATM. The system emphasized preventive measures by employing advanced locking systems and introduced an alert system to notify the authorities in case of a breach [2].

Ramesh Kumar (2019) proposed a system in his work, “ATM Theft Detection and Location Tracking Using GSM and GPS Module”. This approach integrated GSM and GPS technology to enhance location-based tracking in case of theft or unauthorized ATM movement. The system also triggered a live alert to authorities and bank officials, ensuring that the ATM's real-time location was monitored and tracked effectively [3].

R. Sathya, C. Pavithra, T. Santhiya, and L. Revathi (2019) in their work titled “Design and Implementation of ATM Theft Monitoring System using K-Band Doppler Radar”, published in the International Journal of Advanced Research in Computer and Communication Engineering, Vol. 8, No. 2, proposed a system that utilized K-Band Doppler Radar for monitoring ATM theft. The system was designed to detect suspicious movements or activities inside ATM premises and alert authorities instantly to prevent theft [4].

T. Ravindra (2022) developed an “Advanced Anti-Theft ATM Security System Using Raspberry Pi”, which combined sensor-based monitoring, real-time video surveillance, and artificial intelligence. The system leveraged motion and vibration sensors to detect unauthorized actions, while the Raspberry Pi controller processed data to trigger automated responses, including locking mechanisms, alert notifications, and video recording for evidence collection. This research highlighted a shift towards comprehensive solutions that integrate hardware, software, and networking technologies to ensure robust security [5].

The main limitation of the above research papers is that they focus solely on theft detection and sending SMS alerts to authorities using various technologies. They do not explore how the thief can be apprehended at the scene after the theft is detected. To address this issue, an ATM Theft Detection, Auto-Arresting and Intimation System is proposed as a hardware-based solution that leverages technology to ensure both early detection and enhanced security. The system is designed to monitor ATM premises, detect unauthorized activities, and take automated actions to contain the threat and alert the authorities.

In the proposed system, sensors integrated with a microcontroller are used to detect suspicious activities in the ATM. Upon detecting a potential theft, the system sends an SMS alert to nearby police stations or bank authorities for immediate action. Simultaneously, the system locks the door automatically, effectively preventing the thief’s escape. This layered security approach

ensures containment of the situation within the premises while authorities are on their way to intervene.

By analysing the above literature survey our project introduces an advanced ATM security system that, upon detecting unauthorized access, automatically releases a safe, non-lethal gas to incapacitate the intruder. Simultaneously, it transmits a secure password to authorized personnel, enabling them to unlock the ATM door and apprehend the suspect. This approach enhances traditional ATM security measures by integrating immediate physical deterrents with controlled access protocols.

2. BLOCK DIAGRAM

The block diagram for ATM theft detection auto arresting and intimation as shown in Fig.1.

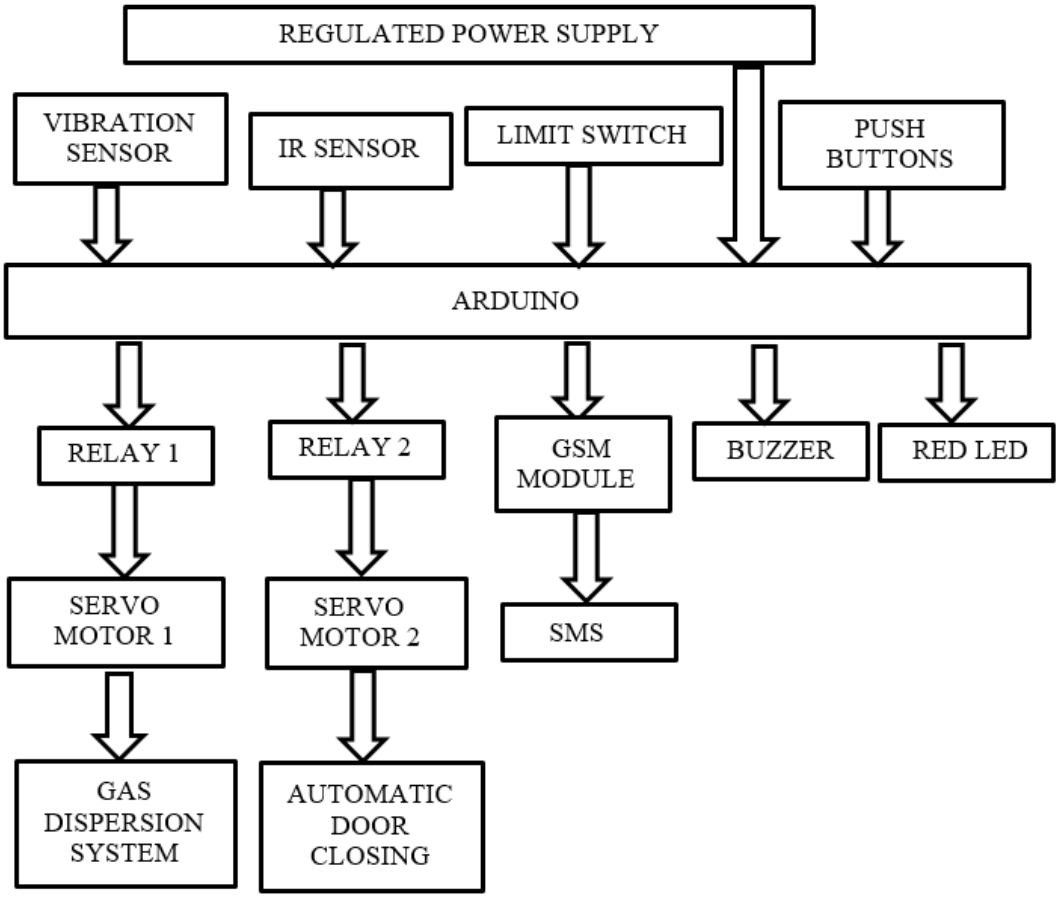

Fig.1. Block Diagram

Regulated Power Supply: Supplies consistent voltage and current to all components of the system, ensuring stable operation.

Vibration Sensor: Detects any physical tampering, such as vibrations caused by breaking or drilling the ATM.

IR Sensor: Detects the presence of a person near the ATM.

Limit Switch: Monitors ATM cash box door status (open/closed). It helps trigger alarms or lock mechanisms when the door is forcefully opened.

Arduino: Acts as the central controller that processes inputs from sensors, executes logic, and sends signals to other components.

Relay 1 & 2: Acts as switches to control high-power devices (like servo motors) using low-power Arduino signals.

GSM Module: Sends SMS alerts to authorized personnel or law enforcement in case of unauthorized access or tampering.

Buzzer: Emits a loud sound as an audible alarm to detect the thief and alert nearby individuals.

Red LED: Acts as a visual indicator of a theft attempt or unauthorized access.

When a person enters the ATM booth, the IR sensor detects their presence and automatically opens the ATM door. If someone attempts to tamper with the ATM, the vibration sensor attached to the machine is activated and sends a signal to the Arduino. The Arduino then triggers an output signal that is sent to a servo motor via a relay, which automatically locks the ATM door. At the same time, a gas dispersion system releases a non-lethal gas to render the intruder unconscious. Similarly, if a person tries to open the ATM cash box, a limit switch is activated, initiating the same sequence of actions. Once any theft attempt is detected, both an LED and a buzzer are activated as alarms. Additionally, an SMS alert is sent to the authorities via the GSM module. A password system is provided to unlock the ATM booth door upon the arrival of the authorities. The entire setup operates efficiently due to the Regulated Power Supply, which ensures all components work without interruption. This cohesive system enhances ATM protection through early detection and immediate response.

3. HARDWARE MODULE

The hardware module is shown in the Fig.2.

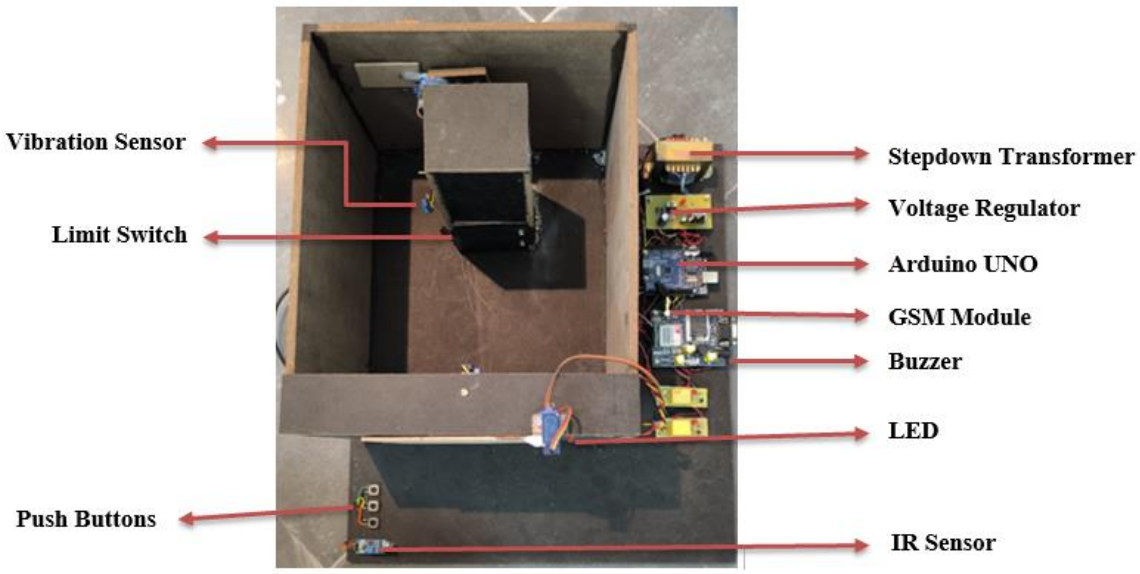

Fig.2. Hardware Module

A single-phase 230V, 50Hz power supply powers an Arduino Uno through a transformer and a voltage regulator that converts the output to a stable 5V DC. This regulated voltage supplies power to various connected components, including an IR sensor, vibration sensors, LEDs, a buzzer, a GSM module and a servo motor. The system is designed to automate door access and detect theft. When a person is detected by the IR sensor, the servo motor automatically opens the door, allowing entry. If theft is detected by the vibration sensors or a limit switch, the GSM module sends an SMS alert to the authorities, ensuring immediate notification. Simultaneously, the buzzer activates and the LED lights up as a visual and audible indication of the theft. And also a password is provided to unlock the door the of ATM Booth door after the arrival of authorities. This integrated system ensures efficient access control, theft detection and real-time alerts for enhanced security and monitoring in various applications.

4. TESTING AND RESULTS

The hardware was tested for different cases to observe its operation

4.1 Automatic Door Operating System

When a person approaches to the door, the IR sensor detects their presence and sends a signal to the microcontroller, which processes the input and activates the servo motor via a relay, causing the door to open automatically as shown in Fig. 4.1. Later the door closes within 5 seconds after the operation.

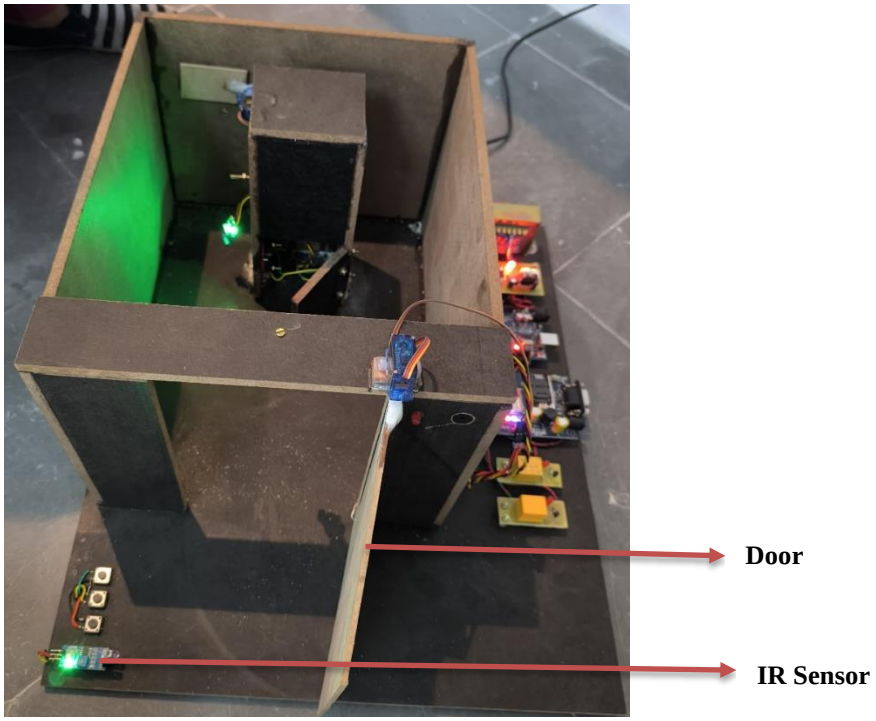

Fig.4.1. Automated Door Mechanism

4.2 Theft Detection while Tampering

When someone try to attempt the theft by hammering or drilling the ATM machine, the vibration sensor on the ATM box detects the tampering as shown in Fig.4.2 and sends a signal to the microcontroller, which activates the GSM module to send the message "ALERT!! ATM THEFT DETECTED, ATM BLOCKED" to the registered mobile number as shown in Fig.4.3 and once a theft is detected, the LED, Buzzer are triggered and also the door of ATM Booth locks automatically.

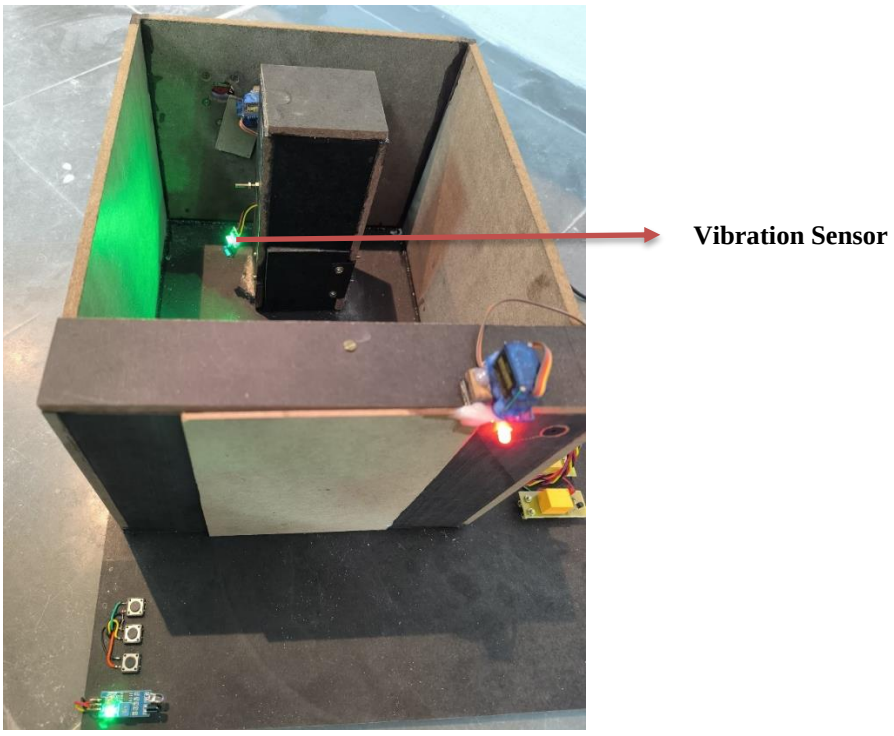

Fig.4.2. Theft Detection while tampering

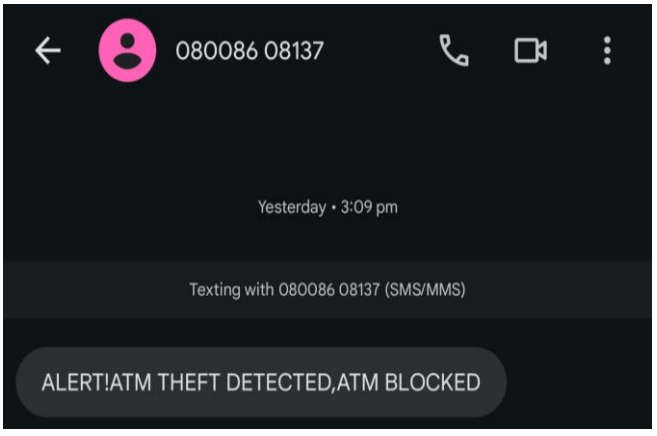

Fig.4.3 Alert Message to Authorities (while tampering)

4.3 Theft Detection while Removal of Cash Box

When someone attempts to open the ATM cash box, the limit switch on the door is triggered as shown in Fig.4.4 and sends a signal to the microcontroller, which activates the GSM module to send a message "ALERT!! ATM THEFT DETECTED, ATM BLOCKED." to the registered mobile number as shown in Fig.4.5 and once a theft is detected, the LED, Buzzer are triggered and also the door of ATM Booth locks automatically.

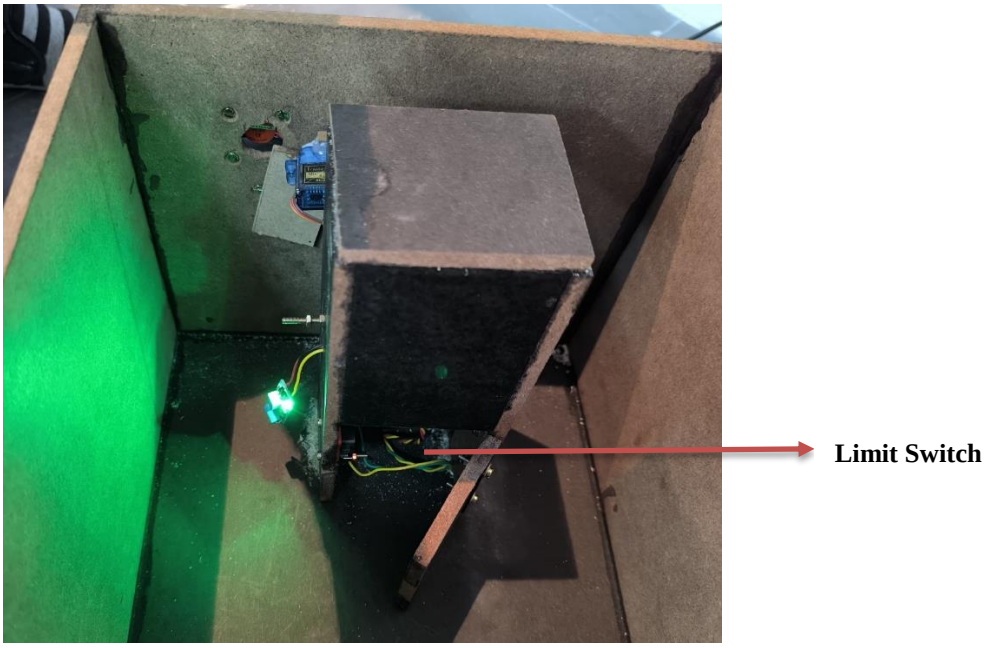

Fig.4.4. Theft Detection while removal of cash box

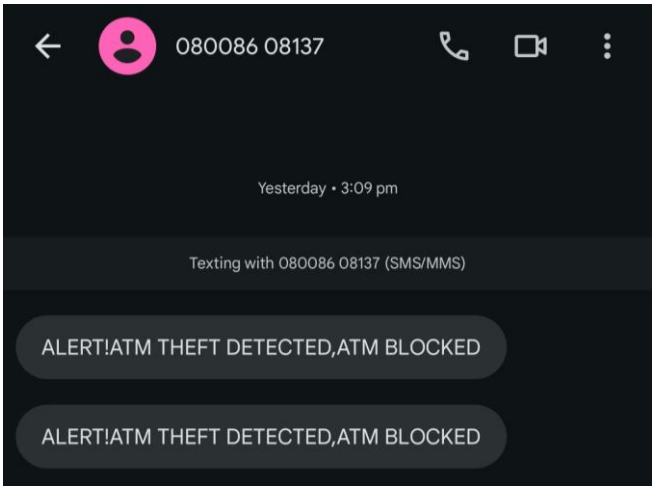

Fig.4.5 Alert Message to Authorities (while removal of cash box).

4.4 Deploying Non-Lethal Unconscious Gas

When an intruder is detected inside an ATM Booth, the system automatically activates a gas dispersion mechanism using a servo motor, releasing an unconscious gas like Halothane, Isoflurane, Desflurane and sevoflurane as shown in Fig.4.6 to prevent the thief from escaping.

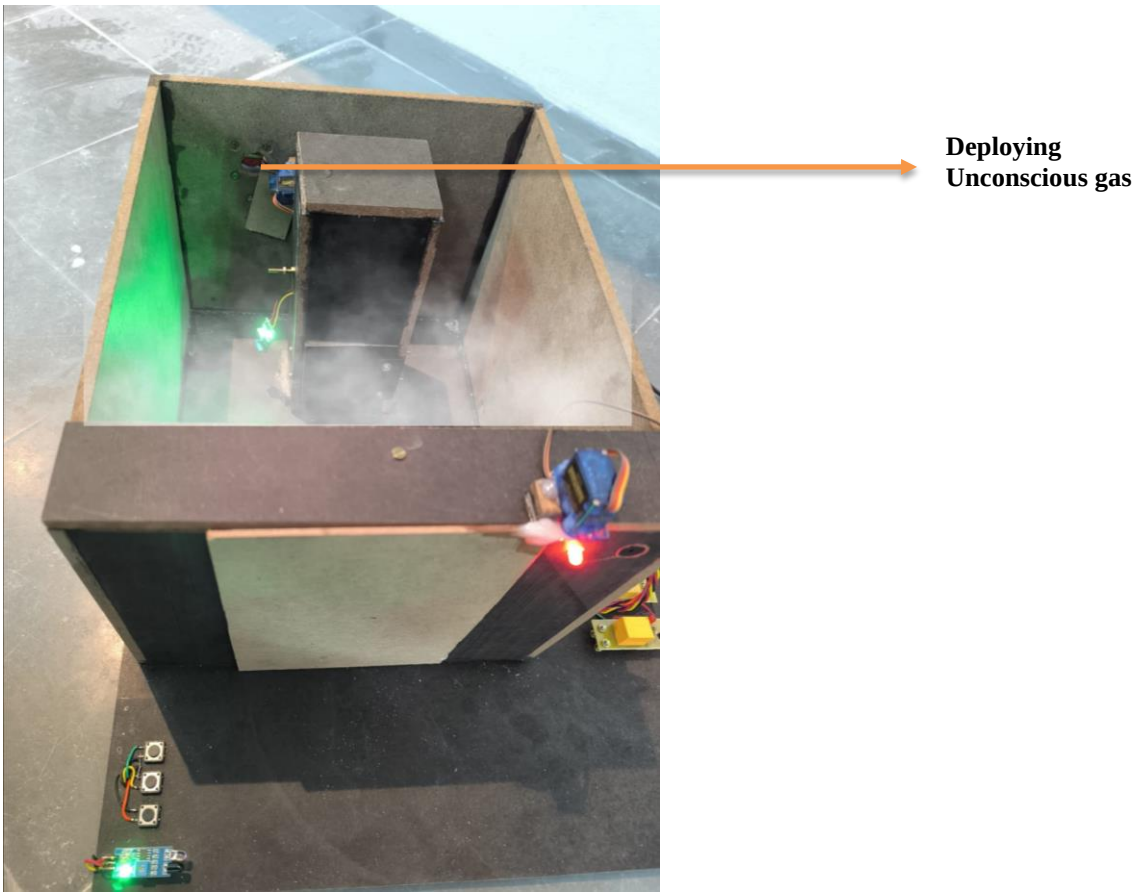

Fig.4.6. Release of unconscious gas

4.5 Automatic Door Opening System with Password

When a thief enters into the ATM Booth and a theft is detected, the ATM door automatically locks. When an authorized person enters the correct 3 digit password with 3 Push buttons as shown in Fig.4.7, the door opens. If anyone tries to unlock the door with the wrong password, an alert is sent to the authorities as shown in Fig.4.8.

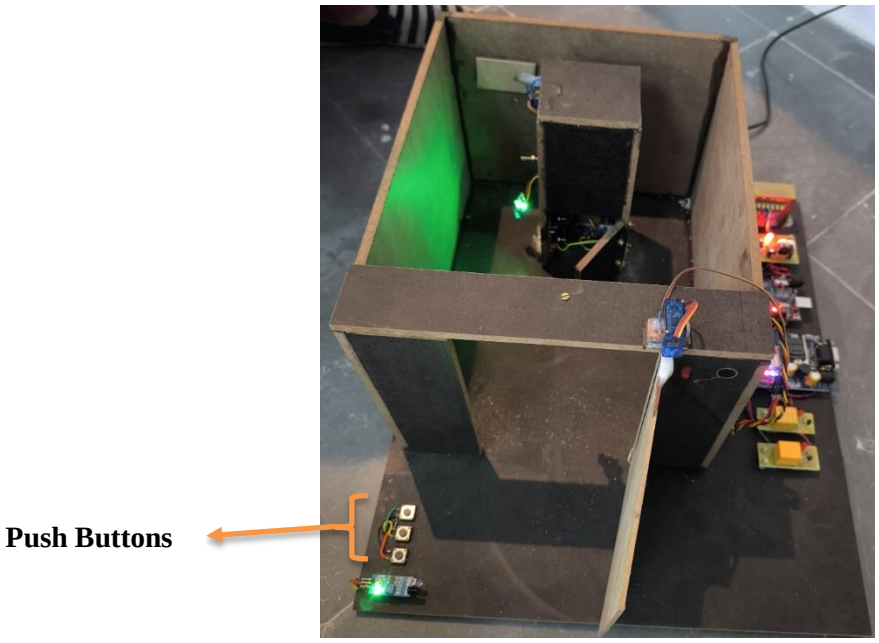

Fig. 4.7 ATM Door Operation during Correct Password

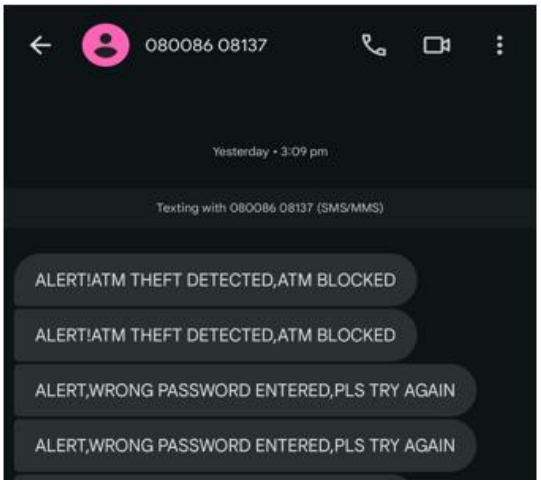

Fig.4.8. Alert for Wrong Passwords

4.6 Results and Discussion

The ATM theft detection and intimation system performed effectively across all tested scenarios i.e., the vibration sensor effectively identified tampering or drilling attempts, while the limit switch reliably detected whether the ATM's cash box was opened or removed, showcasing its ability to monitor and respond to tampering. The vibration sensor and limit switch reliably identified theft attempts, triggering the microcontroller and is programmed to activate the GSM module and embedded in such a way that immediate alerts are send to registered mobile number for prompt action. In the event of a detected theft attempt, the system automatically locks the ATM door and releases an unconscious gas to prevent the intruder's escape. An SMS is sent to the authorized persons to inform them that a theft has occurred. Authorized persons can later access the ATM using a secure password to unlock the door of ATM booth, ensuring controlled and safe re-entry after an incident. Once a theft is detected, the LED, Buzzer are triggered for the alert. This integrated approach significantly strengthens the system’s ability to deter and respond to theft attempts effectively. Additionally, the IR sensor and servo motor ensured smooth and automated door access. All system components worked cohesively, providing real-time theft prevention, alerting and blocking measures. This robust system ensures heightened ATM security through prompt detection and proactive protection mechanisms.

5. CONCLUSION

The development of an advanced and reliable ATM security system addresses critical challenges related to theft and vandalism, significantly enhancing the protection of financial assets. By using sensors, GSM Module, Servo motors, the system ensures real-time detection of unauthorized access or tampering. The integration of vibration sensors, IR sensors and Limit Switch allows for prompt identification of suspicious activities, while features like door-locking and automated alerts provide a swift and effective response to threats. The system notifies relevant authorities via SMS alert through GSM, reducing the risk of financial loss and enabling rapid intervention.

This hardware was rigorously tested in various scenarios i.e. detection of tampering through vibration sensor, removal of cash box through limit switch, SMS to the authorities, activation of LED and Buzzer, Push buttons to unlock the door of ATM Booth and releasing of unconscious gas like halothane, Isoflurane, desflurane and meeting all the defined criteria and performing effectively under tested conditions. It demonstrates a successful application of technology to improve ATM security, providing financial institutions with a practical and robust solution to safeguard their assets while ensuring customer trust. This innovative system represents a significant step forward in combating ATM theft and vandalism.

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