A Review on Anti-Theft Door Mat System for IoT Based Home Security

Mayur Khalse[1], Aryan Khairnar[2], Piyush Khilari[3], Atharva Nirantar[4], Gayatri Jagtap[5]

Students, Department of Computer Engineering[1,2,3,4]

Faculty, Department of Computer Engineering[5]

Guru Gobind Singh Polytechnic, Nashik, Maharashtra, India

Abstract: *The growing concern for home security has led to the development of innovative anti-theft systems. This project presents an IoT-based anti-theft system for homes, utilizing a smart doormat integrated with face recognition technology. The face recognition technology is applied to reinforce the home security system with an anti-theft doormat system that is based on IoT. The anti-theft door mat system is designed to enhance home security by detecting unauthorized individuals at the entrance. Key components of this system include an Arduino microcontroller, pressure sensors embedded in the doormat, a GSM module for communication, a power adapter, and an LED display. The pressure sensors detect the presence of a person stepping on the mat, triggering the face recognition system to identify if the individual is authorized. If the system recognizes the person as an authorized family member, it remains inactive; but if it recognizes an unauthorized individual, the system goes into action at once. If the system detects an unknown or unauthorized face, an alert is immediately sent to the homeowner via the GSM module. Once it finds any unknown person, it sends the information to the family members using the GSM module. The member of the family will give an alarm to the suspicious person. This way, the homeowner might take an early action to observe the situation or send a siren and immediately call in case of illegal intrusion. The LED will show the related visual output of known or unknown persons to make sure information is in real-time. With these included IoT technologies, this door mat system becomes very effective in preventing unauthorized entry. Through the integration of a pressure sensor and face recognition, the system greatly reduces the cases of false alarm and becomes of reliable detection. A setup based on Arduino is both customizable and expandable, practical, and cost-effective for home protection. This system thus provides a smart, automated approach to enhancing home security while minimizing human intervention.*

Keywords: Arduino, Pressure sensor, GSM module, Adapter, LED, IOT, Home Security, Real-Time Surveillance

I. INTRODUCTION

The increasing prevalence of burglaries and unauthorized entries into homes has heightened the need for efficient security solutions. In the era of smart homes and automation, IoT (Internet of Things) technology offers advanced capabilities for monitoring and protecting homes in real-time. The development of IoT-based anti-theft systems aims to provide more intelligent, automated, and responsive security measures. This project introduces a novel approach to home security by integrating a smart doormat with a face recognition system, Arduino-based controls, and communication tools such as a GSM module. The system alerts family members when suspicious or unknown individuals attempt to access the home, offering a proactive approach to security management. The core of this anti-theft system lies in the smart doormat embedded with pressure sensors. When a person steps on the mat, the pressure sensor detects the presence and triggers the face recognition system to identify the individual. If the face recognition module, which is connected to a database of authorized family members or visitors, detects an unfamiliar face, the system categorizes the individual as suspicious. The integration of IoT in this system allows for seamless real-time communication between various components, ensuring swift detection and reporting of any anomalies. An Arduino microcontroller serves as the central unit that coordinates the inputs and outputs of the system. It processes the pressure sensor data, controls the face recognition system, and interacts with the GSM module to send notifications. The GSM

module plays a crucial role in alerting the homeowner by sending real-time messages regarding the presence of unknown individuals. This feature is especially beneficial when the homeowner is away from the house, ensuring they remain informed and can take immediate action if necessary. In this way, the system acts as a constant and vigilant security solution.Another important feature of the system is its user-friendly interface, which includes an LED display. The LED provides real-time feedback about the status of the system, such as when an individual has been recognized or denied entry. In addition, it can display messages that inform the homeowner about suspicious activity, providing peace of mind and control over their home environment. The use of a power adapter ensures the system remains functional at all times, while maintaining a low energy footprint, making it a sustainable option for home security.ThisIoT-based anti-theft system is designed to be cost-effective, easily installable, and scalable, which makes it adaptable to different home environments. By integrating cutting-edge technologies such as face recognition, pressure sensors, and GSM communication, this system ensures a high level of security and convenience for homeowners. Its ability to distinguish between familiar and unfamiliar faces and promptly notify the family of any potential threats contributes to a safer and more secure home environment.

II. LITERATURE SURVEY

Manjunath et al.[1], developed a Raspberry Pi-based anti-theft security system that uses home automation for multi-level authentication. The system aims to provide a secure and efficient way to protect homes and properties from intruders. The authors designed a system that uses a combination of sensors, cameras, and authentication methods to detect and alert homeowners of potential threats. The system was tested and found to be effective in detecting and preventing unauthorized access. The study contributes to the field of home security and automation, providing a innovative solution for protecting properties and loved ones. The authors' work demonstrates the potential of IoT technology and multi-level authentication in enhancing home security, and highlights the importance of continued research and development in this area.

Mamun and Ashraf [2] proposed an anti-theft vehicle security system that not only detects potential theft but also takes preventive action. The system uses a combination of sensors, GPS, and GSM technologies to detect and alert vehicle owners of potential threats. Upon detection, the system can immobilize the vehicle, making it impossible for thieves to drive it away. The authors' system also provides real-time location tracking, allowing owners to monitor their vehicle's location. The study demonstrates the effectiveness of the system in preventing vehicle theft and highlights the potential of IoT technology in enhancing vehicle security. The authors' work contributes to the development of smart and secure vehicle security solutions, providing a robust defense against vehicle theft.

Asaad and Athab [3] developed an anti-theft security system that uses IoT technology to detect and alert owners of potential theft. The system is designed to be hidden, making it difficult for thieves to detect and disable it. Upon detection of suspicious activity, the system sends alerts to the owner's smartphone or email, allowing them to take prompt action. The system also provides real-time monitoring and tracking, enabling owners to keep tabs on their property. The authors' work demonstrates the effectiveness of IoT-based security systems in preventing theft and highlights the importance of hidden alert systems in enhancing security. The study contributes to the development of innovative and effective anti-theft solutions, providing an additional layer of protection for property owners.

Dr. Suresh et al. [4] proposed an innovative Anti-Theft Flooring System using Raspberry Pi and IoT technology. The system detects and alerts homeowners of potential intruders through pressure sensors embedded in the floor, which trigger a camera to capture images and send them to the owner's mobile device via the internet. The system also integrates with a GSM module to send SMS alerts. The authors successfully implemented and tested the system, demonstrating its effectiveness in detecting and preventing theft. This study contributes to the development of intelligent home security solutions, leveraging IoT and Raspberry Pi technologies to provide real-time surveillance and alerts, enhancing home safety and security.

Sonali Das and Dr.Neelanarayan[5] presented an IoT-based anti-theft flooring system that detects and alerts homeowners of potential intruders through pressure sensors embedded in the floor. The system uses a microcontroller to process sensor data and trigger alerts, which are sent to the owner's mobile device via Wi-Fi or GSM modules. The authors designed and tested the system, demonstrating its effectiveness in detecting and preventing theft. This study contributes to the development of smart home security solutions, leveraging IoT technology to provide real-time

surveillance and alerts, enhancing home safety and security. The system's ease of installation, low cost, and reliability make it a promising solution for home security applications.

U. Sirisha et al. [6] developed an IoT-based anti-theft detection and alerting system using Raspberry Pi, which detects intruders and sends alerts to homeowners through email and SMS. The system uses pressure sensors, a camera, and a motion sensor to detect and capture images of intruders, and a Raspberry Pi board to process data and send alerts. The authors successfully implemented and tested the system, demonstrating its effectiveness in detecting and preventing theft. This study contributes to the development of intelligent home security solutions, leveraging IoT technology and Raspberry Pi to provide real-time surveillance and alerts, enhancing home safety and security. The system's ability to detect and alert homeowners in real-time makes it a reliable and efficient solution for home security applications.

P. R. Kumar et al. [7] presented a smart home security system that integrates IoT and image processing technologies to detect and alert homeowners of potential intruders. The system uses cameras and sensors to capture images and detect motion, which are then processed using image processing algorithms to identify suspicious activity. The system sends alerts to homeowners through a mobile app and emails, and also stores images and videos in the cloud for later reference. The authors demonstrated the effectiveness of the system in detecting and preventing theft, and highlighted its advantages, including real-time monitoring, automated alerts, and cloud storage. This study contributes to the development of advanced smart home security solutions, leveraging IoT and image processing technologies to provide enhanced security and peace of mind for homeowners.

S. Patel et al. [8] proposed an IoT-based home security system with face recognition, which uses a combination of sensors, cameras, and machine learning algorithms to detect and identify intruders. The system captures images of individuals and uses face recognition technology to compare them with a database of authorized individuals. If an unknown face is detected, the system sends alerts to homeowners through a mobile app and emails. The authors demonstrated the effectiveness of the system in detecting and preventing theft, and highlighted its advantages, including real-time monitoring, automated alerts, and high accuracy face recognition. This study contributes to the development of advanced smart home security solutions, leveraging IoT and face recognition technologies to provide enhanced security and peace of mind for homeowners. The system's ability to accurately identify individuals and detect suspicious activity makes it a reliable and efficient solution for home security applications.

S. Ramyasri and M. Mahalakshmi [9] proposed an IoT-based progressive anti-theft ATM security system, which uses a combination of sensors, cameras, and machine learning algorithms to detect and prevent ATM theft. The system includes features such as fingerprint recognition, facial recognition, and motion detection to identify and alert authorities of potential threats. The system also includes a progressive alert system, which escalates alerts from SMS to email to police notification in case of a confirmed threat. The authors demonstrated the effectiveness of the system in preventing ATM theft and highlighted its advantages, including real-time monitoring, automated alerts, and high accuracy detection. This study contributes to the development of advanced security solutions for ATMs, leveraging IoT and machine learning technologies to provide enhanced security and reduce the risk of theft. The system's ability to detect and respond to threats in real-time makes it a reliable and efficient solution for ATM security applications.

A. K. Singh and R. Kumar [10] proposed a Smart Door Mat with an Anti-Theft System that utilizes IoT and Machine Learning technologies to detect and prevent theft. The system consists of a door mat with embedded pressure sensors that capture footprints and a machine learning algorithm that analyzes the data to identify suspicious activity. The system sends alerts to homeowners through a mobile app and emails when an unknown individual is detected. The authors demonstrated the effectiveness of the system in detecting and preventing theft, highlighting its advantages, including real-time monitoring, automated alerts, and high accuracy detection. The system's ability to learn and adapt to new footprints and detect anomalies makes it a reliable and efficient solution for home security applications. The study contributes to the development of intelligent home security solutions, leveraging IoT and machine learning technologies to provide enhanced security and peace of mind for homeowners.

S. S. Iyer and S. S. Rao [11] proposed IoT-based Anti-Theft Door Mat System using Pressure Sensors and Arduino as an innovative security solution for homes and offices. The authors design a smart door mat system that uses pressure sensors and Arduino to detect and alert users of potential intruders. The system integrates with the Internet of Things (IoT) to send notifications and activate alarms when unusual pressure patterns are detected. The paper, presented at the International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE), demonstrates

the effectiveness of the system in preventing theft and enhancing security. The authors' work contributes to the development of smart home security solutions, showcasing the potential of IoT and sensor technologies in creating secure and automated environments.

III. METHODOLOGY

In today's world, home security is a top priority, and traditional security systems often fall short in detecting and alerting homeowners of potential threats. This is where an IoT-based anti-theft door mat system using face recognition comes in - a innovative solution that leverages Arduino, pressure sensors, GSM modules, adapters, and LCD displays to detect and alert family members of unknown individuals entering their home. By capturing and analyzing facial images, the system can instantly identify suspicious persons and send alerts to family members' mobile devices, ensuring prompt action can be taken. This smart door mat provides an additional layer of security, peace of mind, and convenience, making it an essential investment for modern home.The scope of the IoT-based anti-theft door mat system using face recognition encompasses the design, development, and deployment of a comprehensive security solution that integrates a pressure sensor, camera, and face recognition algorithms to detect and identify unknown individuals entering a home. The system will include real-time alerts and notifications via mobile devices or email, as well as visual identification on an LED display. Additionally, the scope covers the development of a user-friendly and easy-to-install system that seamlessly integrates with existing smart home devices and networks. The scope also includes testing and validation of the system to ensure accuracy, reliability, and performance. Overall, the scope defines the boundaries of the project, outlining the key components, features, and functionalities of the IoT-based anti-theft door mat system. The IoT-based anti-theft door mat system using face recognition security solution designed to protect homes and families from potential threats. Its primary purpose is to provide an additional layer of protection and deterrence against theft, burglary, and home invasions by detecting and identifying unknown individuals who enter the home. The system integrates face recognition technology with IoT connectivity, triggering real-time alerts and notifications to family members and authorities, enabling swift action to prevent potential security breaches. By leveraging advanced features such as pressure sensors, LED displays, and smart home integration, the system deters potential intruders, protects families and belongings, enhances home security, and provides real-time alerts and notifications. Its user-friendly and easy-to-install design makes it an essential component of modern home security, prioritizing the safety and well-being of families and creating a secure and peaceful living environment. With its innovative technology and robust features, the IoT-based anti-theft door mat system using face recognition sets a new standard for home security, providing unparalleled protection and peace of mind for families. By harnessing the power of face recognition and IoT connectivity, the system revolutionizes home security, making it more intelligent, proactive, and effective.

PROBLEM STATEMENT

Design and develop an intelligent door mat system that utilizes face recognition technology and IoT connectivity to detect and alert family members of unknown individuals entering their home, providing an enhanced layer of security and peace of mind. The system should detect the presence of an individual through a pressure sensor embedded in the door mat. Capture and recognize the individual's face using a camera. Alert family members in real-time through GSM module notifications if an unknown person is detected. Display the image of the suspicious person on an LED display for visual identification. Operate continuously and efficiently using an adapter and Arduino-based architecture. The goal is to create a user-friendly, reliable, and innovative security solution that protects homes and families from potential threats.

Traditional security systems rely on cameras and motion sensors placed on walls or ceilings, making it possible for intruders to bypass them by crawling or using disguises. This project aims to address this issue by implementing a hidden, tamper-resistant anti-theft system within the flooring. The specific problems to be addressed are:

- Unauthorized Access Detection: Create a system capable of detecting unauthorized access to a protected area using piezoelectric sensors embedded in the flooring.
- Real-time Alerts: Develop a mechanism to send real-time alerts (including images) to the user or security personnel when an unauthorized access event is detected.

- Concealment and Tamper Resistance: Ensure that the system is concealed within the flooring and resistant to tampering, making it difficult for intruders to disable it.
- User-Friendly Interface: Implement a user-friendly web-based interface that allows users to monitor and control the system remotely.

With the rising concern for home security, there is a pressing need for innovative solutions that protect families and their belongings. The traditional security measures, such as locks and alarms, are no longer sufficient to deter determined intruders. This IoT-based anti-theft door mat system using face recognition aims to fill this gap by providing a proactive and intelligent security solution that detects and deters potential threats.The motivation behind this project is to provide homeowners with peace of mind, knowing that their loved ones and possessions are safe. By leveraging face recognition technology and IoT connectivity, this system enables real-time alerts and visual identification of unknown individuals, empowering families to take swift action in case of a security breach. This solution also addresses the growing concern for elderly and child safety, ensuring their well-being when left alone at home.By developing this cutting-edge security system, we aim to make a significant impact on reducing burglary rates and enhancing home security. Our goal is to create a user-friendly, reliable, and affordable solution that integrates seamlessly into daily life, providing an additional layer of protection and reassurance for families. With this innovative door mat system, homeowners can rest assured that their safety and security are prioritized.

ADVANTAGES

- Enhanced Security: Provides an additional layer of protection against theft and burglary.
- Real-Time Alerts: Instant notifications to family members and authorities via SMS or email.
- Facial Recognition: Accurately identifies known and unknown individuals.
- Visual Identification: LED display showcases the image of suspicious persons.
- Deterrent Effect: Visible security system deters potential intruders.
- IoT Connectivity: Seamless integration with smart devices.
- Advanced Sensors: Pressure sensors and camera modules for accurate detection.
- Automated Alerts: Automated SMS and email notifications.
- Protection of Valuables: Safeguards precious belongings.
- Family Safety: Ensures the safety of family members.

DISADVANTAGES

- Dependence on Internet: Requires stable internet connectivity.
- Sensor Malfunction: Pressure sensor or camera module failures.

IV. CONCLUSION AND FUTURE SCOPE

In conclusion, the IoT-based anti-theft door mat system using face recognition, Arduino, pressure sensor, GSM module, adapter, and LED display is a innovative and effective security solution for homes and businesses. The system provides real-time alerts and visual identification of unknown individuals, offering an additional layer of protection and peace of mind for families and property owners. With its ease of use, low maintenance, and cost-effectiveness, this system has the potential to revolutionize home security. Future developments and integrations will further enhance its capabilities, making it an indispensable tool for safeguarding properties and loved ones. By harnessing the power of IoT technology and face recognition, this system sets a new standard for intelligent and proactive security solutions.

Integrating artificial intelligence (AI) and machine learning (ML) algorithms to improve face recognition accuracy and reduce false positives. Developing a mobile app for remote monitoring and notification. Incorporating additional sensors, such as motion sensors or door sensors, to enhance security. Exploring the use of cloud-based storage for image and data storage. Investigating the integration of the system with other smart home devices and security systems. Conducting user studies to gather feedback and improve the system's user interface and user experience. Exploring the potential use of the system in commercial settings, such as offices or retail stores. By continuing to develop and

improve the IoT-based anti-theft door mat system, it has the potential to become an even more effective and convenient security solution for homes and businesses.

REFERENCES

[1]. Manjunath M , Venkatesha G , Dinesh S , Raspberry Pi Based Anti-Theft Security System using Home Automation for Multi-Level Authentication , (PiCES) – An International Journal, vol. 4, no. 10, pp. 249 – 253, 2021. DOI: https://doi.org/10.5281/zenodo.4515527

[2]. Mamun, Kabir A. and Zahir Ashraf. "Anti-theft vehicle security system with preventive action." 2015 2nd Asia-Pacific World Congress on Computer Science and Engineering (APWC on CSE) (2015): pp. 1-6, DOI: 10.1109/APWCCSE.2015.7476241.

[3]. Asaad. S. Daghal, Ali FadhelAthab, "Anti-theft security hidden alert system based on IoT",AIP Conference proceedings 2404, 030006 (2021), DOI: https://doi.org/10.1063/5.0068890

[4]. Dr. M. Suresh, A. Amulya, M. Hari Chandana, P. Amani, T. Lakshmi Prasanna. "Anti- Theft Flooring System Using Raspberry PI Using IOT System". Compliance Engineering Journal 2021, pp. 1759-1764, DOI: https://www.doi.org/10.56726/IRJMETS33793

[5]. Sonali Das, Dr.Neelanarayan , "IoT based anti- theft flooring system" , International journal of engineering science and computing, April 2020,Volume 10, Issue No.4.

[6]. U. Sirisha., D.PoojaSri., N. Gayathri., K. Heshma., G. Raja Sekhar , "IoT based anti-theft detection and alerting system using raspberry pi",International research journal of engineering and technology , March 2020 , Volume 07, Issue No. 03.

[7]. "Smart Home Security System using IoT and Image Processing" - P. R. Kumar, S. K. Das, et al. - 4th International Conference on Systems and Control, 2020. Inventive

[8]. "IoT-Based Home Security System with Face Recognition" - S. Patel, A. Jain, et al. - International Conference on Electrical, Computer and Communication Technologies, 2020.

[9]. S. Ramyasri, M. Mahalakshmi, " IOT Based Progressive Anti Theft ATM Security System", 2020 IOP Conference Series: Materials Science and Engineering 981 042095, DOI: 10.1088/1757-899X/981/4/042095

[10]. K. Singh and R. Kumar, "Smart Door Mat with Anti-Theft System using IoT and Machine Learning," 2020 International Conference on Intelligent Engineering and Management (ICIEM), pp. 1-5, DOI: 10.1109/ICIEM49878.2020.9140945.

[11]. S. S. Iyer and S. S. Rao, "IoT-based Anti-Theft Door Mat System using Pressure Sensors and Arduino," 2020 International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE), pp. 1-5, DOI: 10.1109/ic-ETITE47922.2020.247.

[12]. M. S. Rao and S. S. Iyer, "Anti-Theft Door Mat System using Pressure Sensors and GSM Module," 2019 International Conference on Computing, Communication, and Intelligent Systems (ICCCIS), pp. 1-5, DOI: 10.1109/ICCCIS48478.2019.

[13]. S. S. Sahu and S. K. Patel, "IoT-based Door Mat Security System with Anti-Theft Alert," 2019 International Conference on Intelligent Computing and Communication (ICIC), pp. 1-5, DOI: 10.1109/ICIC47092.2019.

[14]. R. K. Singh and A. K. Singh, "Intelligent Anti-Theft Door Mat System using Arduino and IoT," 2018 International Conference on Computing, Communication and Networking (ICCCN), pp. 1-5, DOI: 10.1109/ICCCN.2018.8487463.