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An IoT Based Multipurpose Frith System: A Review

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Abstract - *Advanced home security systems have been considered to be a necessity to ensure safety in the current rising crimes. It has advanced from simple alarms and surveillance cameras to its extension through additional advanced technologies such as fingerprint recognition and violence detection automatically notifying users about their presence. The present paper highlights the design and implementation of a smart security system that uses an advanced model of Raspberry Pi with two layers of authentication through fingerprint, live camera preview, detection of violence, and authentication via Gmail. This is a cost-effective but efficient and real-time application for any residential or commercial scenario. The system uses IoT and machine learning to support surveillance, detect violence activities, and authenticate users. It provides real-time monitoring by a specific website, giving actual alerts in case of unauthorized access or violent acts. This security system has the feature face recognition technology that can differentiate between authorized and unauthorized users, hence minimizing possibilities of false alarms. Apart from features with face recognition, has other features. Guest management has a time-limited access that allows visitors in according to set conditions. The system complements user protection, having its own mechanisms if an unauthorized person attempts to break into the system. If the intruder tries to disable or bypass, the system sends a message to the owner, sending a video and audio recording of the intrusion event.*

***Key Words*: Raspberry pi advanced model, Violence detection, surveillance, fingerprinting, and authentication.**

1.INTRODUCTION

In light of the increasing risk of criminal activities, security systems have evolved significantly with the passage of time to respond to the escalating demand for security in homes, business, and financial institutions. The system has shifted over time from being mainly physical barrier-based and humans, depending entirely on human monitoring, through progressive development in technology over time.

Security systems have started from face-detection-based equipment to more elaborate systems that implement multiple layers. The new system improves security aspects by integrating violent detection, a real-time alarm, sending information to users via notifications, viewing the house's situation via monitoring, and identification through fingerprints. G-Mail Authentication is integrated within the system. Only people approved by the authentication process are enabled to use this system. Hence, all this makes security become more solid as well as perfect, enabling owners to access remote monitoring of houses from devices used.

Real-time monitoring and access to remote property management greatly enhance security management. Users can look at live feed, get real-time alerts in case of probable threats, and take immediate actions when necessary. The AI-powered violence detection from the system would identify suspicious behaviours, and prompt action could be taken before events escalate. Fingerprint recognition adds another layer of security by eliminating risks associated with stolen credentials or unauthorized access. The use of smart automation guarantees faster response times to any potential breaches, increasing both reliability and efficiency.

These developments are, however, current improvements that pose challenges in the security of a highly connected world. Cyber threats, data privacy concerns, and potential vulnerabilities in the system require constant up-to-date improvements and strong encryption systems. Thus, high-efficiency preservation of security features is required, keeping the system user-friendly for its adoption. The new system is a big step forward concerning modern demands for security characterized by an intelligent.

2. LITERATURE REVIEW

Miss. Ketaki Santosh Raorane et al. developed Real-Time Security System using deep learning from the Raspberry Pi, which spots suspicious activities - like chasing and fighting. The system scans the area being monitored with a Pi camera at intervals of 5 seconds. These images are passed through a piece of work called PyTorch and Natural Language Processing to analyze suspicious behavior, and those results are sent off to Dropbox with real-time alerts. Unlike traditional CCTV systems, which only offer footage for later review, this system provides immediate detection and response. It also stores data securely in the cloud, reducing the risk of tampering.[1]

Kavya N L et al. developed IoT-based home automation and security system working with the use of Raspberry Pi with smartphones for remote control and monitoring. It uses face

recognition in automatic door opening where webcam captures images, and a compromised access by an unauthorized person may throw signals back through an email. MQ-3 detects gas leaks, and flame detectors detect fire, with real-time notifications to the users. The system offers live monitoring without needing massive storage capacity, it is designed to improve home security with remote access to appliances and future developments that include multi-level authentication through biometrics or RFID cards.[2]

This is a low-cost IoT-based home security system developed by Sweatha G.S et al. using the night vision camera with Raspberry Pi, which is efficient and requires minimal storage. Real-time alerts are sent to users through notifications as well as via emails whenever an intrusion is detected. The system can be monitored from any smartphone anywhere in the world. With the help of computer vision, intrusion type-whether it be human or animal-would be differentiated, and object tracking would automatically track the intruder with the help of a camera. The entire system has been designed using Python, offering 24/7 surveillance and can provide future prospects for augmenting security employing newer technologies.[3]

Pallavi Mitra. developed an Intelligent Home Security System using Raspberry Pi, using digital image and speech processing for enhanced security. There are two subsystems in this system: vehicle access through number plate recognition and human access through face and speech recognition. All the facial, speech codes, as well as the number plates of the vehicles, are stored in a database. The Raspberry Pi captures and processes images and compares to a stored database. A person gains access only if both face and speech match. If one subsystem fails, then the other takes over to make the system reliable. Its future work includes addressing limitations such as misrecognition in face and voice detection and number plates written in regional languages.[4]

Yatindra Lohomi et al. developed a smart home system using IoT, where sensors are controlled and monitored by the ESP8266 controller and Raspberry Pi 3. The system consists of smart features such as doorbell, locker security system, and remote control of devices of the home over the internet. The low-cost level connection of electronic devices as well as sensors into a two-way communication for energy as well as data exchange will be served by Raspberry Pi 3.[5]

Vinoth R et al. developed system that ensures security through a fingerprint-based system, integrated with multiple layers of protection. Once authorized, a fingerprint sensor reads and verifies the identity of the person for access. If an unknown person tries for access, then the photo is captured and sent to the admin via email, along with OTP for added security. This increases surveillance further by having a PIR sensor snap anyone near the door. The three-tier security approach taken by the system wipes off hacking concerns and brings safety for home or workspace. Future scope also includes face verification and advanced types of microcontrollers in it for a better result.[6]

Idea of S. Srikanth et al. develops a smart surveillance system on the Raspberry Pi platform to deal with the security issues in homes and offices. A PIR sensor is used to detect movement, while the system uses a Pi camera for photography of the intruders, and such photographs are forwarded to the user via email. Python programs are applied across the processes of the entire system, which is controlled by the Raspberry Pi-3. Live streaming can be accessed through a local server that observes the area. It is low-cost, efficient, and energy-saving because, in this system, it only activates when motion is detected. That helps it consume less power and waste lesser memory and also offers real-time surveillance alerts about security and privacy.[7]

This paper by Deepak.S. Kumbhar et al. deals with the designing of an IoT-based home security system based on Raspberry Pi-3, Pi-camera, PIR sensor, microphone, and other components to facilitate surveillance and alert in a real-time manner. This system operates on two modes of operation. In the first, it captures the image of the visitor when motion is detected and the doorbell has been pressed declaring whether he is known or unknown by comparing the same with a stored database. If there is no knowledge, it sends an email to the user with all captured images, videos, and audioIn suspicious movement, it raises an alarm, sends an email alert with the intruder's picture for remote monitoring.[8]

This paper by Manjunath M. et al. presents an IoT-based anti-theft home automation system based on Raspberry Pi 3B in order to achieve enhanced security and automation. It combines the features of motion and sound sensors, face recognition, and CCTV for real-time monitoring and alarming systems. Once unauthorized motion or sound is detected, it triggers an alarm with the activation of the camera and sends a notification to the owner. The system also contains fire detection in the form of smoke sensors and an automatic water sprinkler system. The design is based on automation and control through remote monitoring through internet-enabled devices to provide multi-level security and energy efficiency through automation.[9]

The paper by I Gusti Made Ngurah Desnanjaya et al. discusses IoT-based home security monitoring, with Raspberry Pi. It has PIR sensors for motion detection, gas, and temperature sensors to observe the home environment. It captures images through Raspberry pi camera when motion is detected. The alerts are received in real time by users through Telegram. Gas density and temperature measurements are recorded by the system and abnormal readings like a gas leak and excessive heat alert the users. The design is user-friendly, and allows remote control via a smartphone, providing real-time home security solution.[10]

The paper by Prof. Mrs. S. S. Sankpal et al. discusses Advanced home automation has drawn a lot of attention in recent times, mainly due to convenience factors, security concerns, and energy efficiency. The modern home automation system with the present-day integration in the IoT era has gained capacities for easier access and remote control of appliances using smartphones and internet connectivity applications. Traditional automation just assumes lighting, heating, and cooling, but nowadays, systems have voice control, cloud-based solutions, and a network of advance security features including PIR sensors and wireless door control. Some technologies included herein are Raspberry Pi, Zigbee, GSM/GPRS, and human tracking that improve home security and automation. Several intelligent home automation systems are discussed here with all of their characteristics, benefits, and limitations in this paper.[11]

This paper by Mohd Azlan Abu et al. discusses the rapid development of the Internet of Things (IoT) revolutionized home security systems with new, smarter, and more efficient ways of monitoring and protecting homes. Instead of using technology to automate homes, many conventional systems that are well priced and uncomplicated maintain a bias toward home automation instead of security. This paper presents an IoT-based home security system. The system uses cost-effective sensors integrated with cloud-based monitoring, providing real-time alerts. In this system, the Passive Infrared (PIR) and Infrared sensors detect unauthorized entry and movement. It sends data to a microcontroller that has an internet module. The FAVORIOT platform, using the Blynk application, allows for remote monitoring of homes and automatic email or SMS alerts. It has enhanced security without compromising the affordability and usability, which have made home security more accessible and efficient for modern households. [12]

The paper by George Vardakis et al. discusses IoT has made smart homes much more secure by integrating various devices that monitor and manage the environment within the house. This review paper discusses and reviews several IoT-based smart home security systems developed so far, including their architectures, communication protocols, and security features. It also talks about integrating sensors, cameras, and smart locks and discusses the different communication protocols that are used in the implementation of such a system, such as Zigbee, Z-Wave, and Wi-Fi, to study their capabilities in ensuring safe and reliable data transfer. The vulnerabilities of an IoT-based security system are considered and methodologies proposed that may be appropriate to give protection against these threats. Based on the current progress and challenges, this review provides insight into developing more robust and efficient IoT-enabled smart home security solutions. [13]

This paper by Sanitha P S discusses IoT has transformed the modern life through its application for smooth communication among any number of interrelated devices, which helps in seamless automation with enhanced security, making homes intelligent to their fullest extent. Moreover, security systems based on IoT are considered to be much more promising regarding the ever-rising demand for smart home solutions by offering effective and remotely controlled surveillance services. This paper discusses some of the IoT-enabled home security systems that employ wireless technologies like Bluetooth and internet-based communication to monitor and control security features through Android devices. The common techniques of facial recognition, mainly applied in access control and surveillance, require massive facial data for optimum functionality. IoT brings these systems into the category of cost-effective, scalable, and energy-efficient security solutions, which reduce human intervention and improve safety and convenience. The paper also evaluates the most recent concepts developed for smart home automation systems with the purpose of enhancing security, low power consumption, and ease of use for people, particularly the elderly and physically handicapped, thus making progress in smart home automation possible. [14]

This paper by Anju P.S et al. discusses rapid development in technology has made automation in security one of the major requirements in living life. It has become the primary role in developing the enhanced security system of homes. In this paper, an IoT-based smart home security system using Raspberry Pi and ATmega 328 microcontroller along with PIR sensor for detecting motion is designed. It will detect an intruder and sound alarms and inform the homeowner who can view live feeds of video captured and control his home appliances through a web interface. The above-designated system proves to be cost-effective user-friendly security automation by authentication-based access control and real-time monitoring and remote management of electrical appliances. This will give a convenient minimum security risk intelligent solution for home automation by using wireless communication and IoT technology. [15].

3. SYSTEM METHODOLOGY: NEW APPROACH

Fig -1 the block diagram representing the ideal architecture of an advanced security system, which makes use of Raspberry Pi as the primary controller. Input comes from a camera and a variety of sensors detecting violence, face recognition. Inputs are processed based on these detected threats in Raspberry Pi, and the alert is sent through email.

For any violent action detected, the alarm sounds to alert the surrounding people and security personnel. Moreover, in cases where an interface connection to a system is established from outside, for example, through a mobile application or dedicated website, the user receives real-time alerts through email. This helps in making the earliest possible responses for security threats.

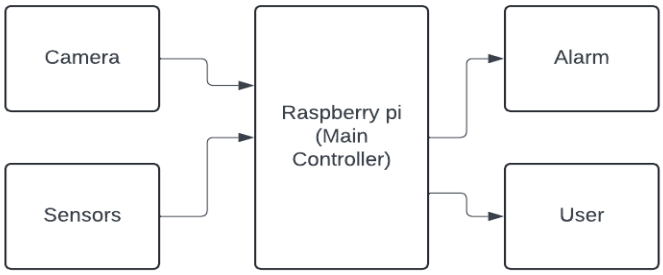

Fig -1: Basic Block Diagram of System

This further increases the level of overall security due to multiple detection technologies being combined into an integrated automated system. All this is provided through facial recognition for authentication purposes, violence detection, which analyses violent behavior. These components combine towards the heightened level of security attained. The whole system is done with Raspberry Pi so that its cost-effectiveness and energy consumption are maintained on high performance.

The security system also has the feature of detecting tamper. If the person is attempting to disable or bypass the system without permission, it at once reports to the user and records the case. Real-time monitoring with automated threat detection gives this system a scalable and adaptable solution proper for residential and commercial applications.

4. FUTURE SCOPE

The setup of the security system based on Raspberry Pi can further be extended in the future using more advanced AI algorithms for face recognition or real-time image surveillance once an event is flagged suspicious. These algorithms improve with every additional data the system accumulates, and thus, the system will identify even more new threats and anomalies with better accuracy. This system will add proactiveness by using machine learning-based models that will enable pattern analysis or probable security breach predication based on previous behavioral habits and environmental factors.

The system can even go towards multi-factor protection where, for example, biometrics, PIN codes, physical keys, and behavioral analysis all work together to authenticate access or set off action. It will enhance the safety level with highly secured authorized accesses for those into sensitive regions or systems. Additionally, real-time backup integration to the cloud can prevent possible cases of data manipulation and enable timely alertness by authorities if major threats exist. Storing it in remote will ensure preservation even in a damage case with regard to hardware material. The other option is where central monitoring becomes possible through services of the cloud that allow a security individual or system administrator to be able to receive, monitor, and respond to incidents from afar.

5. CONCLUSIONS

The proposed Raspberry Pi-based security system is an advancement of the conventional surveillance systems mainly because it encompasses the incorporation of fingerprint recognition, violence detection, and real-time alerts. Such features highly enhance the capability of the system to monitor spaces for visible threats with a much higher level of security. This deep learning empowers the system to improve the skills of detecting over time, thus assimilating new threats with a minimal interference of the human being. Adding this aspect also brings forth fingerprint recognition so that it gives layering addition for authentication, and thus making the system secure and suitable enough for an individual to access.

This system thus enhances the security in homes and offices and solves some of the primary problems such as cheap monitoring, real-time responses and user authentication. By including affordable hardware like Raspberry Pi with open-source software, it provides the facility to a whole user community without losing functionality. The real-time emails alert the security officials or homeowners at once in case something suspicious happens, hence, if the need for intervention arises, such can be easily done. The system is based on deep learning algorithms, advanced sensors, and sends emails, and thus is the base for higher reliability and functionality while making the system scalable. Biometric analyses of data, facial recognition, and multi-factor authentication may add some more security in the near future with AI algorithms being integrated into the future systems. This will make the security solutions smarter and more intuitive, anticipating and preventing security breaches before they occur.

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