International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Smart Security Design of Home Automation and Security System Using Raspberry Pi

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Abstract:
The burgeoning global market for intelligent technology is rapidly embracing the interconnected landscape of devices, paving the way for the ubiquitous Internet of Things (IoT). IoT's emergence opens up novel prospects to enhance device connectivity within households, fostering domestic automation. Central to this evolution is the imperative to craft and implement a secure residential automation system. In the present day, home security threats pose one of the most challenging concerns, as security assumes paramount importance in the face of increasing possibilities of intrusion. Addressing this, the primary focus is to establish safeguarding measures and remote monitoring for residences via the internet, countering the perils of home security risks. This system incorporates advanced features like facial recognition for individuals approaching entry points, promising simplicity and adaptability in operation. As the internet's reach expands, leveraging IoT driven home automation is pivotal, envisaging a security mechanism that grants homeowners comprehensive remote control over their abode and autonomously tracks residence access, all without the need for intricate manual interfaces.

Keywords: Internet of Things (IoT), Home Automation, Raspberry Pi, Face Recognition, Motion Sensor, Webcam.

I. INTRODUCTION

An Internet of Things, or IoT network is made up of web-enabled smart devices that employ embedded systems of processors, sensors, and communication gear to acquire, interact with one another, and act on the data they acquire from their surroundings. By connecting to an IoT terminal, which acts as a central hub enabling IoT device data transmission, IoT gadgets can share the sensor information they collect. The data may also be delivered to an edge device for local analysis before being shared. Local data analysis decreases the amount of data transferred to the cloud, reducing bandwidth use. These gadgets occasionally interact with other similar devices and take action based on the data they exchange. Although individuals may engage with the devices to set them up, give them instructions, or retrieve the data, the gadgets conduct the majority of the job without their assistance. The particular IoT apps utilized determine a great deal of the connection, networking, and communication protocols used with these web-enabled devices. IoT can also make data collection methods simpler and more dynamic by using machine learning and artificial intelligence. A new paradigm known as the Internet of Things (IoT) has transformed the conventional way of living into a high-tech lifestyle. As the technology is advancing that has made our life

and work better, IoT has developed quickly. The edge computing is the most important developments in IoT. Without linking to the cloud, devices may analyze data locally and this was possible because of edge computing. It helps IoT devices to handle data more quickly, with better security. Using edge computing IoT devices gets benefit to make choices quickly and lowers latency to improve user experience. The inclusion of ML and AI into IoT devices is another development. IoT devices can assess data and make predictions based on patterns and trends and this is possible because of AI and ML models. This strengthens the precision and effectiveness of IoT devices and assists in the decision-making process for organizations. So this how IoT has advanced greatly in the past couple of decades, and many new gadgets and technology has emerged to open up new opportunities. IoT is anticipated to have an ever more significant role in influencing the direction of technology as the number of connected devices increases.

In IoT there are various Domains based on its Applications such as in Smart cities, where we see the hunt for parking spaces is made simpler and more practical for cars in smart cities with smart parking. To determine if a parking space is used or not, sensors are utilized in smart parking. Local controllers compile this data and transmit it to the database over the Internet. To find available parking spaces, drivers might utilize an application. Whereas in case of Smart Lighting, buildings, parks, and roadways may all benefit from energy saving smart lighting systems. Smart lighting enables dynamic lighting management and ambient-condition adaptive lighting. Remote configuration of lighting schedule and intensity is possible with smart lights that are linked to the Internet. Traffic jams, hazardous driving conditions, and accidents may all be announced to users using smart roads with sensors. Internet-based applications or social media platforms may get information gathered from roadways and forwarded to them. Traffic bottlenecks are lessened as a result. In case of Environment, multiple sensors are used by IoT-based weather monitoring systems to collect data. A cloud-based storage system receives that data. Applications allow for the analysis and visualization of the data collected. Users of such programs have the option of subscribing to weather warnings. In case of air pollution, use of gaseous and meteorological sensors in IoT-based air pollution monitoring systems allows for the monitoring of dangerous gas emissions from automobiles and companies. To make choices on pollution management strategies, the gathered data may be examined. Many sensor nodes are used by IoT based flood monitor systems to track the water level. On the server or in the cloud, data from the sensors is combined. Applications for monitoring send out alarms when they see a quick rise in water level or a high flow velocity. In Energy systems, Integrated with the electrical grid, a smart grid is a data communications network. Utility companies, their suppliers, and customers may all benefit from the predictive information and suggestions that smart grid technology offers. Real-time power usage may be recorded by smart meters, which also enable remote control of power distribution. In Retail, IoT may be used to control the inventory at a warehouse or store. RFID tags can be connected to the goods or things in the store. The RFID reader or software may automatically display the quantity of products in the store or warehouse by using the RFID tags. A notice may be automatically delivered to the store owner when a product runs out of stock. In case of logistics, Different sensors may be installed along delivery routes to different sites, and they can be seen remotely via an application. The delivery service may automatically determine which routes are less crowded by looking at the data given by the sensors, and plan the delivery of items along those routes. In Agriculture, The act of watering plants is referred to as irrigation. Data about the soil and surroundings may be gathered by utilizing various sensors, such as temperature, humidity, soil moisture sensors, etc. This information can then be used to inform when to activate the sprinklers to water the plants. Talking about in Industry, Sensors are a fixable

component of the industrial machinery. Machine diagnosis is possible with the use of the sensor data. If a machine performs as predicted, we can determine whether that is the case. When the machine's life is about to end, the data analysis will also inform the owner of the machine of that fact. In Health and Lifestyle, Because of the Internet of Things, providing healthcare remotely is now a practical alternative. A hospital visit is not necessary for every minor health issue a patient may have. These patients can receive care at a distance by the physician. To monitor the patient's health vitals, several sensors can be mounted nearby. The doctor keeps an eye on the sensor data and takes the proper action. There are also other application domains in IoT that has emerged and lot of advancements have took place over the years. Home Automation is one of the domain in IoT that has advanced few years ago where there were new devices created for home to make it, what we call as smart. These devices can be a surveillance cameras, sensors and actuators like gas sensors and alert systems, automatic light on and off using sensors, switching on and off of fan or all together controlling and monitors all the electronic devices and appliances as a whole system etc., making it easy for an individual to manage, control and monitor their house remotely either inside the house or outside.

A "smart home" constitutes an integral aspect of the IoT paradigm, aiming to seamlessly integrate home automation. By connecting household objects and devices to the Internet, users gain the capability to remotely monitor and manage them, accessing the complete IoT system from any location with Internet connectivity. The primary objective of this project is to address the limitations of conventional home security systems by furnishing real-time information about the household's status when the owner is absent. Given the escalating concerns related to security breaches and intrusions, security has become a paramount consideration. The essence of home automation is particularly evident in its capacity to provide enhanced security features, promptly notifying and alarming users. Home automation frameworks encompass elements like motion detectors, surveillance cameras, and other vital safety mechanisms within the household, facilitating their activation via mobile devices. This study focuses on the development of a cost-effective home security system using Raspberry Pi and IR sensors. Leveraging the IoT platform, this home security system is meticulously crafted. When human intrusion is detected at the home's entrance, the system promptly notifies the homeowner through a photograph sent via Telegram. The central control of the entire home security system is managed using a Raspberry Pi 4, employing Python programming. Positioned at the main entrance, the system delivers Telegram alerts to the user's smartphone from anywhere in the world through internet connectivity. This innovative approach addresses security concerns through a technologically advanced and accessible means, contributing to the safety and protection of homes in the modern age.

II. LITERATURE REVIEW

In recent times, the Internet of Things (IoT) has ushered in transformative innovations that enhance the ease and comfort of our daily lives. An integral facet of IoT is its ability to facilitate remote control of home automation devices via the internet, presenting a significant advantage. A prominent attribute of modern homes is the incorporation of sophisticated high-end security systems. The prevailing trends in home automation encompass various functionalities, including the remote control of appliances, automation of gadgets, and the integration of remote video surveillance sensors, among others.

[1] Kavya N L, Bharath Kumar G, et.al (2020) In their paper they proposed the envisioned system

focuses on enhancing home safety by providing real-time access control through a mobile smartphone and a Raspberry Pi hub. A security device equipped with a webcam is stationed at the entrance of the residence, establishing a connection with the Raspberry Pi. Within this system design, automated door access is achieved using advanced Face Detection and Face Recognition capabilities. This technology also triggers the transmission of a photograph alert to the designated email address.

[2] Vaishnavi S.G and Pratibha S.Y (2016) In their paper they proposed the study which revolves around the analysis of diverse intelligent home automation systems and technologies, examining them from various feature perspectives. The research centers on the fundamental idea of home automation, wherein the oversight and management tasks are executed through intelligent devices embedded within residential structures. The review encompasses a range of heterogeneous home automation systems and technologies, including those based on central controllers (such as Arduino or Raspberry Pi), web interfaces, email integration, Bluetooth connectivity, mobile applications, SMS interaction, ZigBee implementation, Dual Tone Multi Frequency utilization, cloud integration, and Internet connectivity, all while considering their performance characteristics.

[3] Cristina Stolojescu-Crisan, Calin Crisan and Bogdan-Petru Butunoi (2021) In their work they proposed a system to establish connections among sensors, actuators, and various data sources, aiming to facilitate multiple home automation functionalities. This system, named qToggle, operates by harnessing the capabilities of a versatile and potent Application Programming Interface (API), which serves as the core of a straightforward and universal communication framework. The devices employed by qToggle typically encompass sensors or actuators with an upstream network connection that implements the qToggle API. The majority of qToggle's utilized devices are built upon ESP8266/ESP8285 chips and/or Raspberry Pi boards. A mobile application has been created to enable users in managing an array of household appliances and sensors. The qToggle system is designed to be user-friendly, adaptable, and can be extended by integrating diverse devices and supplementary components.

[4] Shradha Somani, Parikshit Solunke, Shaunak Oke, et.al (2018) In this paper, author's objective of this endeavor is to construct a wireless home security system. To ensure network-based security, AES encryption is employed. The safeguarding of the residence involves the transmission of alerts to the user through the Internet in the event of unauthorized entry, and if necessary, triggering an alarm. The integration of home automation is achieved by deploying suitable sensors strategically throughout the premises. For server and control functions, a Raspberry Pi is harnessed. This Raspberry Pi assumes the responsibilities of managing electrical devices, as well as offering user authentication and security measures.

[5] Shivangi Mishra, Siba Prasad Khatua, et.al (2020) In this, the work primarily revolves around achieving the automated management of household appliances such as lights, fans, and more, using Internet connectivity. The core aim of this study was to devise and execute a home automation system utilizing the Internet of Things (IoT) technology, capable of overseeing a wide array of household devices through an intuitive web interface. The proposed system demonstrates remarkable adaptability by utilizing Wi-Fi technology to establish connections between distributed sensors and the central home automation server. The construction of the proposed system relies on a combination of a controller and Raspberry Pi.

The software framework for this endeavor relies on the Python programming language and the Raspbian operating system. The project encompasses comprehensive sections, including the methodology, intricate software design specifications, implementation setup, and circuit connections. Additionally, the project envisions the potential expansion of the system and discusses avenues for scalability. The project's central focus is on creating an economical and expandable solution that maintains a low cost while accommodating a diverse range of devices for control.

This approach ensures the system's viability, efficiency, and compactness.

[6] Pavithra.D and Ranjith Balakrishnan (2015) In their work they introduced a streamlined implementation of the Internet of Things (IoT) concept, designed to monitor and manage household appliances through the global network, the World Wide Web. This home automation system employs portable devices as user interfaces, enabling communication with the home automation network via an Internet gateway, utilizing lowpower communication protocols like Zigbee and Wi-Fi. The primary goal of this endeavor is to enable the control of domestic appliances through smartphones, utilizing Wi-Fi as the communication protocol and

Raspberry Pi as the central server system. Users interact with the system directly through a web-based interface, accessing it remotely through the Internet. This allows the manipulation of home appliances such as lights, fans, and door locks via an easily navigable website. A noteworthy feature that bolsters safety measures against fire incidents involves the system's capability to detect smoke. In the event of a fire, the system triggers an alert message, accompanied by an image, which is sent directly to the user's smartphone. The server interfaces with relay hardware circuits to control the operation of home appliances. Interaction with the server empowers users to choose the desired device for control. Even if the web connection is disrupted or the server experiences downtime, the embedded system board retains the ability to manage and operate the appliances within the home environment. In essence, this project establishes a scalable and cost-effective home automation system, enriching user experience and safety through remote control and proactive fire detection capabilities.

[7] Pratik Banerjee, Arijit Ghosh, Satwik Poddar, et.al (2020) In this work they explain that enabling the remote management of a diverse array of devices through a home automation system can be achieved using several communication options, including LAN, cellular networks, satellite communication, and internet technologies. The central advantage of home automation becomes most apparent in its security capabilities, where users are promptly notified and alerted in the event of any potential privacy breach. Smart home systems truly shine in their ability to seamlessly integrate new devices, appliances, and emerging technologies. As innovations continue to emerge, older devices are being phased out. Within this dynamic landscape, home automation frameworks can incorporate motion detectors, surveillance cameras, automated entryway locks, and other critical safety measures within a residence. These can be conveniently activated and managed from a mobile device, allowing users to maintain a comprehensive security setup. Furthermore, this system can deliver security alerts to various devices based on the time of day, ensuring that the alarm system adapts to the user's schedule. This level of flexibility and adaptability enhances both the efficiency and effectiveness of the overall home automation experience.

[8] Aman Sharma and Anjana Goen (2019) In this paper they presented a solution to mitigate home security threats by leveraging Zigbee network-enabled digital technology, enabling the creation of a

smarter and more secure home environment. This technological approach offers the potential to enhance device connectivity, ultimately leading to a comprehensive security solution. As the realm of the Internet continues to expand, the ability to remotely control and monitor network-enabled devices becomes increasingly feasible. Additionally, these devices can be programmed to send signals to designated recipients, notifying them of potential security risks. The integration of both Zigbee security systems and Wi-Fi networks is facilitated through a shared gateway. This integration ensures that the system is user-friendly, adaptable, and cost-effective. The foundation of this solution relies on Zigbee network infrastructure, necessitating specific hardware components including Zigbee Modules, Micro-Controller (ATMEGA168), Relays, Voltage Regulators, and a variety of sensor devices. The operational process entails the sensors detecting potential threats and transmitting signals through the Zigbee network to the micro-controller. Upon receiving threat signals, the micro-controller executes appropriate actions and subsequently sends signals to a remote location for further notification. Zigbee technology is characterized by its simplicity, flexibility, and reliability, making it an extensively utilized transceiver standard. Notably, Zigbee boasts a low data rate and energy consumption profile, with an operational range typically spanning 10 to 20 meters; this can be expanded up to 150 meters through the use of direct sequence spread spectrum modulation, which aligns well with the requirements of a home security system.

[9] Deepak.S.Kumbhar, H.C. Chaudhari, Shubhangi M.Taur, et.al (2019) In this paper they introduced an IoTenabled system designed to deliver security alerts to homeowners and registered individuals via email whenever human intrusion is detected at the home's entrance. The IoT-based home security system encompasses several components, including a Raspberry Pi 3, a Pi camera, a PIR sensor, a microphone, an ultrasonic sensor, a buzzer, a doorbell button, LED/LCD screen, and an internet connection. The study presents two distinct operational modes for the home security system. In the first mode, upon detecting motion and the pressing of the doorbell button, the system captures an image and employs a stored database to determine if the individual is familiar or unfamiliar. If the person is unfamiliar, the system triggers an alert by sending an email notification to the user and registered members, including the captured image, video, and audio clip of the person. Conversely, if the individual is recognized as familiar, their image is captured and stored within the system. In the second mode, the system identifies any suspicious movement of a person near the door, subsequently activating an email notification alert. Additionally, the system activates a security warning alarm installed at the entrance. This system, developed on the IoT platform, contributes significantly to enhancing security against intruders. It effectively employs advanced technology to provide a comprehensive and robust security solution for homeowners.

[10]Syed Ali Imran Quadri and P Sathish (2017) The objective of their work was to establish a secure and internet-enabled surveillance system for residential premises. The proposed approach involves the utilization of the ARM-11 architecture and a Linux-based Raspberry Pi-3 board, along with a USB camera and a DC motor. The DC motor is connected to the Raspberry Pi-3 board via a driving circuit (L293D) to facilitate door control, while the USB camera is linked to the USB port of the Raspberry Pi-3 board. The system is designed to provide end users with a dedicated webpage furnished with a username and password requirement, thereby granting access solely to authorized individuals. Upon successful login, users gain the capability to control the door's operation through open and close buttons. Additionally, they can access live streaming video from the targeted location, specifically the vicinity surrounding the door.

For added functionality, a capture button is incorporated, enabling users to capture snapshots from the ongoing video feed. This comprehensive setup seamlessly combines security and surveillance aspects for residential protection. The underlying architecture, combining Raspberry Pi technology and a Linux operating system, results in a highly functional and efficient solution that enhances the security and monitoring capabilities of homes through internet connectivity.

III. PROPOSED METHOD

The proposed system consists of the raspberry pi, web camera, IR sensor.

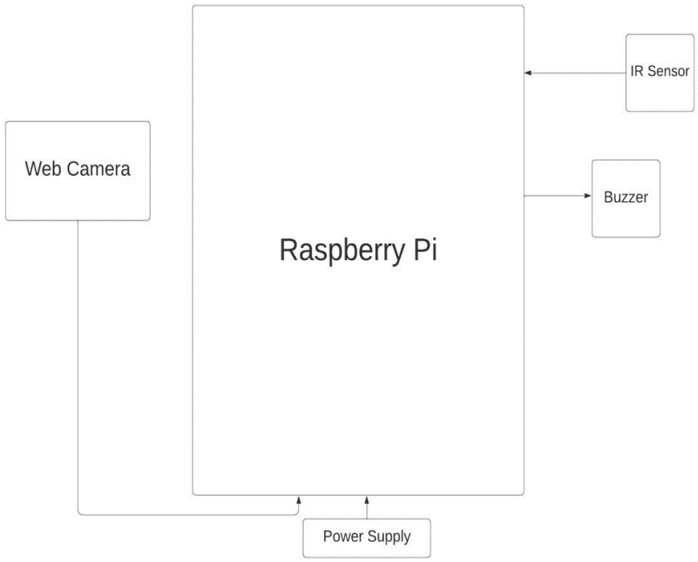

Figure 3.1: Architecture of the proposed system

A. HARDWARE REQUIREMENTS

1. Raspberry Pi

The Raspberry Pi is a series of compact and budget-friendly single-board computers created by the Raspberry Pi Foundation, a charitable organization based in the UK. These computers have been designed with the aim of promoting computer science education, facilitating experimentation, and offering a versatile platform for a diverse array of projects, ranging from basic programming exercises to intricate do-it-yourself (DIY) ventures. The Raspberry Pi boards are approximately the size of a credit card and encompass all the essential components found in a computer, including a Central Processing Unit (CPU), Random Access Memory (RAM), input/output ports, and storage options usually through micro SD cards. These boards can operate on various operating systems, including Linux-based distributions like Raspberry Pi OS (previously known as Raspbian), as well as other specialized software and operating systems.

Figure 3.1.1: Raspberry Pi 4 Model B

2. Web Camera

A web camera connected to a Raspberry Pi can play a crucial role in enabling face detection and recognition capabilities. By combining the Raspberry Pi's processing power with the camera's input, you can capture images that identify and verify individuals based on their facial features. The Web Camera is connected to Raspberry Pi via a USB port, forming an integrated setup. This configuration is complemented by an IR sensor that triggers motion detection functionality. Upon sensing motion, the system initiates the process of capturing images. These images are then stored in the faces folder in Raspberry pi, constituting a repository of recorded data. An integral aspect of this mechanism involves sending these images to a designated Telegram bot, thereby notifying the user.

Figure 3.1.2: Webcam

3. IR sensor

An IR (Infrared) sensor is engineered to identify infrared radiation within its environment. Infrared radiation boasts longer wavelengths compared to visible light, yet it remains shorter than radio wave wavelengths. The applications of IR sensors are diverse, encompassing the detection of object presence, motion, heat, and other occurrences linked to emitted or reflected infrared radiation. Fundamental to an IR sensor is its dualcomponent structure, featuring an IR emitter that emits the radiation and an IR receiver that detects radiation reflecting off surfaces or emitted by objects. The receiver's role involves converting the collected IR signals into electrical signals suitable for subsequent processing. An IR sensor can be used to detect motion within its field of view. When integrated into the system, it serves as a trigger mechanism that signals when there is movement or activity in the monitored area. The IR sensor can detect the presence of a person or an object within its range. This can help in determining whether there is someone

in front of the camera, prompting the system to activate its face capture functionality.

Figure 3.2.4: IR Sensor

B. SOFTWARE REQUIREMENTS

1. Raspberry Pi OS

Raspberry Pi OS, formerly known as Raspbian, is the official operating system designed specifically for the Raspberry Pi series of single-board computers. It's a Linux-based operating system that provides a userfriendly environment for various applications, projects, and educational purposes. Raspberry Pi OS is tailored to the hardware specifications and capabilities of Raspberry Pi devices, ensuring optimal performance and compatibility. Raspberry Pi OS is a versatile platform that caters to a wide range of applications, from basic tasks and web browsing to programming, education, and DIY projects. Its seamless integration with Raspberry Pi hardware, combined with its user-friendly interface and educational features, makes it an accessible and popular choice for users looking to leverage the capabilities of Raspberry Pi devices.

2. OpenCV

OpenCV, or Open Source Computer Vision Library, stands as an open-source software library specifically designed for computer vision and machine learning applications. This comprehensive library offers an array of tools, algorithms, and functions that cater to diverse computer vision tasks. These tasks encompass image and video analysis, object detection, facial recognition, machine learning, and beyond. Primarily coded in C++, OpenCV also extends support to popular programming languages like Python, Java, and others. OpenCV provides an expansive toolkit for processing images and videos. This involves a spectrum of operations ranging from filtering and transformations to color space conversions and blending. OpenCV boasts robust facial recognition capabilities, facilitating the detection and recognition of faces within visual content. It extends its prowess to the analysis of facial attributes like gender and age estimation.

3. Thonny Python IDE

Thonny stands as an integrated development environment (IDE) tailored for Python programming, with a special focus on newcomers and educators. The IDE presents an intuitive interface that simplifies the entire process of writing, testing, and debugging Python code. Thonny's primary aim is to alleviate the learning curve for beginners in both programming and the Python language by offering a range of features designed to support their needs effectively.

4. VNC Viewer

VNC Viewer is a versatile tool designed for both local computers and mobile devices, enabling users to establish remote connections and take control of distant devices such as computers, tablets, or smartphones. With VNC Viewer software installed on your device, you can seamlessly access and manage

another computer located elsewhere. This software functions as a graphical desktop sharing system, granting you the ability to remotely operate the desktop of a remote computer that has VNC Server installed. Once connected, VNC Viewer facilitates the transmission of keyboard, mouse, or touch input to the VNC Server, effectively giving you full control over the accessed computer. VNC Viewer allows you to interact with the remote computer as if you were physically present in front of it, offering a convenient and efficient means of remote desktop access and management. To access and remotely control Raspberry Pi Computer on our Desktop or PC we use VNC Viewer.

The IoT system developed in this project centers around the Raspberry Pi. The Raspberry Pi is integrated with an IR sensor, a USB web camera, and a power supply to constitute the complete system. This device is adaptable for installation in various locations as needed. The IR sensor's connection is established via the GPIO pins of the Raspberry Pi to work it as per the flowchart (Fig: 3.2) and setup the system. Here we use Raspberry pi because it acts as a small computer and can be easy to handle so that we can use it to control the overall system. Some of the benefits of using raspberry pi can be:

- Raspberry Pi supports the creation of a home-based server, allowing anyone connected to this server to operate within its environment.
- The ability to manage numerous devices through its GPIO pins enhances its practicality.
- Integrating new devices is simplified; a minor program needs to be written to manage the device. This attribute underscores the system's flexibility and potential for growth.

To detect the face, the open CV xml “haarcascade_frontalface_default.xml” is utilized.

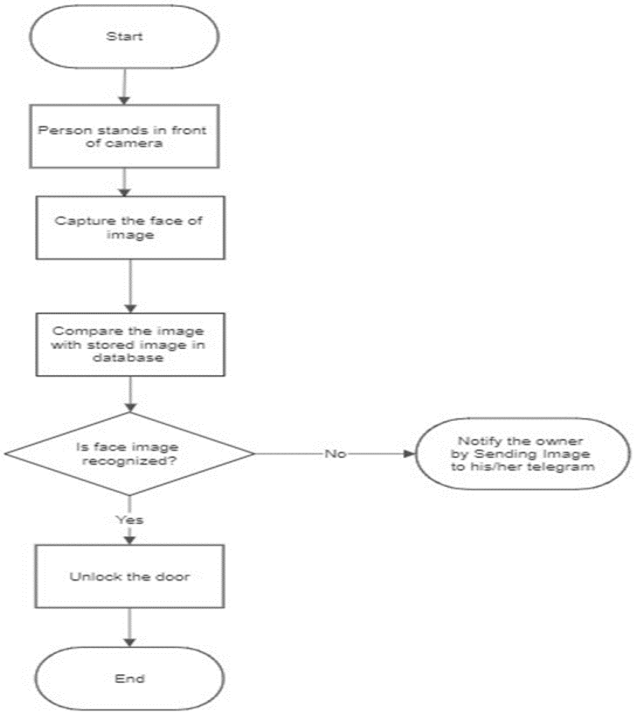

Figure 3.2: Flowchart of the Proposed System

- There are two shell files in raspberry pi, first one to save the image and second to detect and recognize the image, first file captures the face and save it in database, and second file recognizes the face and check if the face is known or unknown. When we run first file it asks to enter the person’s name, upon entering

the name a folder by that name is created and then the camera window opens. As the camera window opens the person whose face has to be saved needs to stand in front of the camera and then we initiate the camera to capture the photo of the person. The web camera captures 13 photos of the person and saves it in the folder. When we initiate the second file, it starts to quantify faces and then starts to process all image in database, then video streaming starts and the camera window is opened.

- The person should stand in front of camera, when the person moves his/her hand towards IR sensor (sensing range approximately 3cm), the camera starts to detect face and checks if the face is saved in database.

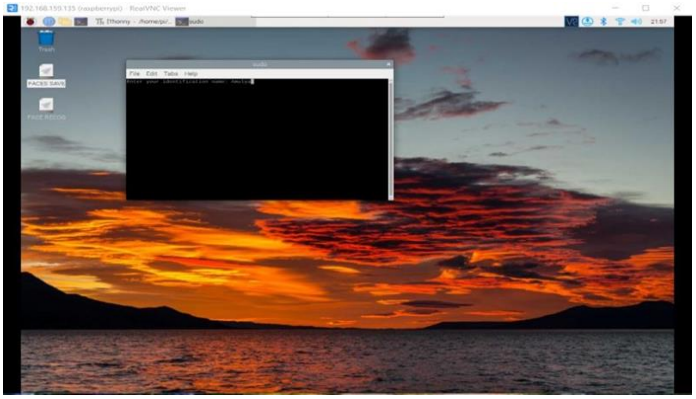

Figure 3.3: Saving Photo in database: Entering name of the Person

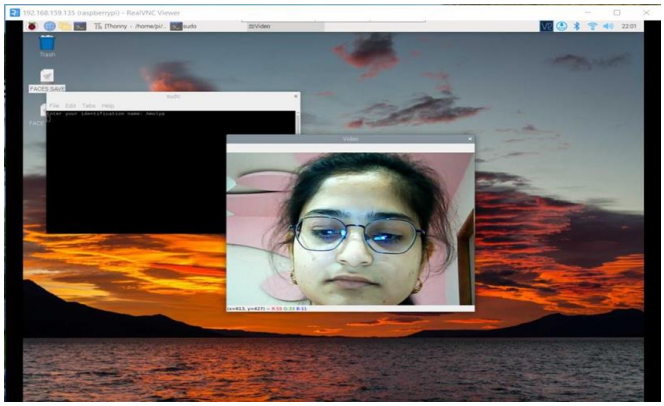

Figure 3.4: Camera taking several photos to save in database

- If the face is saved in database then the green rectangle appears around the face with the name of the person indicating as known.

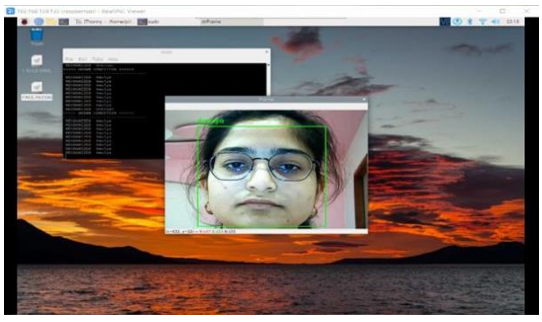

Figure 3.5: Detecting the person as Known

- If the face is not saved in database then the green rectangle appears as unknown and the face is captured and the captured face photo is sent to the owner's telegram Account.

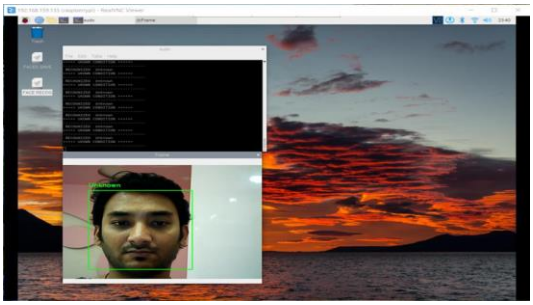

Figure 3.6: Detecting Unknown person

• Telegram notifications are dispatched to the homeowner, promptly delivering images of any visitor directly to their Telegram application on their smartphone. This allows the user to conveniently review these images in real-time. Any unauthorized entry can be swiftly identified through Telegram alerts on the user's smartphone.

IV. RESULTS

• The overall system can be placed towards the entrance door of the house. The system detects any people arriving at the door and recognizes whether the person is known or unknown. This system can be helpful when the owner is not in the house and the owner will be able to know any unknown people arriving at their door.

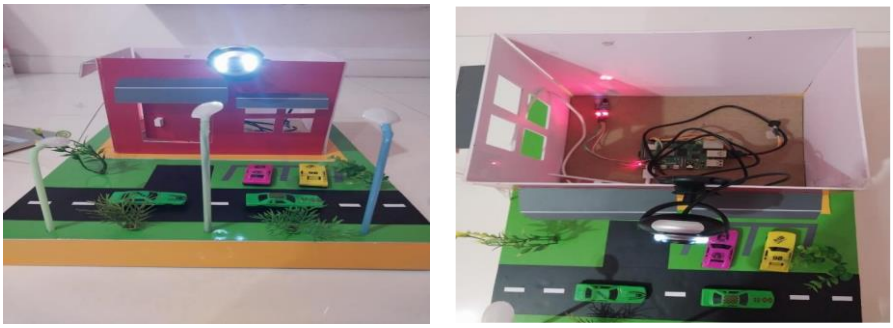

Figure 4.1: Prototype of the System

• Upon detecting the person at the door, if the system recognizes the person as unknown then the captured photo is sent to the owner of the house to their Telegram Account via the Telegram Bot.

Figure 4.2: Telegram Alerts sent to the owner

V. CONCLUSION AND FUTURE SCOPE

A Smart Home Security System has been successfully developed, leveraging the capabilities of Raspberry Pi and the revolutionary Internet of Things (IoT) technology. This innovative system has been meticulously designed to address the paramount concern of safeguarding homes and ensuring the protection of both life and property. In an era where security is of utmost importance, the implementation of such a system presents a sophisticated and effective solution that resonates with the contemporary need for heightened safety measures. The primary objective of this Smart Home Security System is to provide homeowners with a comprehensive and intuitive means of fortifying their living spaces. By harnessing the potential of IoT, the system can seamlessly integrate and control an array of security devices deployed within a home environment. This unified approach ensures a cohesive and streamlined security infrastructure that caters to diverse safety needs. One of the standout features of this system is its real-time monitoring capabilities. Through strategically positioned sensors, cameras, and detectors, the system constantly gathers data and assesses the security status of the home. This real-time monitoring empowers homeowners with immediate insights into any potential threats or breaches, allowing for swift and well-informed responses. In the unfortunate event of a security breach, such as theft or unauthorized access, the system is primed to capture the image as an evidence. This data can serve as a crucial resource for law enforcement and safety departments, aiding in the investigation and resolution of any incidents. The ability to provide tangible proof enhances the overall effectiveness of the system in deterring criminal activities and ensuring accountability. What truly sets this system apart is its user-centric design. Through a user-friendly interface, homeowners can effortlessly manage and customize their security settings, granting them control over various security devices and protocols. This accessibility ensures that users can tailor the system to their specific requirements, fostering a sense of ownership and engagement in the safety of their homes. In conclusion, the integration of Raspberry Pi and IoT technology in the creation of a Smart Home Security System marks a significant milestone in the realm of home security. By addressing the prevalent concerns surrounding safety and protection, this system stands as a prime example of harnessing technology for the greater well-being of individuals and their property. Its ability to coordinate security devices, provide real-time monitoring, and offer evidence in case of security incidents positions it as an indispensable tool in the modern world, where safety and peace of mind are paramount. For future work of Smart Security design, more devices, components can be added for the security features like door lock system, door unlock access by fingerprints etc., to enhance the security system.

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