

DESIGN AND IMPLEMENTATION OF A SMART INTRUDER DETECTION SYSTEM

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ABSTRACT: A municipality's most valuable assets are likely its residents and their possessions. An intruder detection system is a modern idea for cities that is critical for residents' ability to live and work together peacefully. This intruder detection system is designed to detect any unauthorized individuals and report them to appropriate authorities. This allows the incident responder to investigate the issue and take appropriate action immediately. When someone moves, the system's PIR sensor alerts the Pi camera, which records the movement. After the identification process is completed, the extracted face is sent to the Raspberry Pi via an HDMI cable. This system runs efficiently using OpenCV-Python. The picture taken is compared to the picture stored in the database by the authorized user. The system can distinguish between authorized and unauthorized users by comparing their credentials. If it turns out to be someone who isn't supposed to be there, the system sends an email with the identified image to the owner, whose authorized number we've entered into the system, via Wi-Fi.

KEYWORDS: Intruder detection, Image acquisition module, Image recognition, Raspberry pi.

I. INTRODUCTION

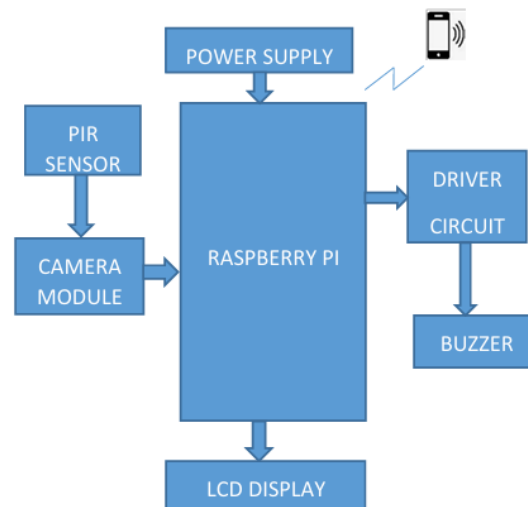
The primary function of a human intrusion detection system is to detect and prevent unauthorized individuals from entering a building, store, or protected area, thereby protecting both people and property. Most military, commercial, residential, and industrial buildings use security systems to protect occupants from intruders while also preventing property damage and break-ins. This system is effective at detecting intruders and ensuring public safety. We can reduce theft by using this intrusion detection system, which will prevent any harm from occurring in our home and allow us to take prompt action. The system's design keeps the camera outside the space while continuously recording video. When a client enters the room, our system is set to begin processing. Each of these features can be activated through software or specialized apps, and the Raspberry Pi can be used to photograph the intruder.

The camera's only functions are to capture, save, and upload images. When the PIR sensor detects movement, it sends a signal to the Raspberry Pi's GPIO. When the Raspberry Pi detects an intruder, Python code tells it what to do. Our primary goal is to develop a system that detects and photographs intruders using a Raspberry Pi camera. Use the Raspberry Pi's facial recognition to quickly capture images of the visitor and any unauthorized individuals in the area. The user's photo was already in the database. The photograph and the datasets saved in the database will be compared. When the Raspberry Pi's image does not match the image in the dataset, it instructs the Pi camera to take a new picture and save it. The Raspberry Pi then composes an email with the recently viewed photos and sends it to the specified email address. The email attachment includes a photograph of the intruder.

II. EXISTING METHOD

Security and surveillance systems can use a wide range of intrusion detection systems. False alarms are possible because these systems detect intruders only with human assistance or after a lengthy installation process. Surveillance systems detect intrusions using built-in cameras that can record video and store it on an external hard drive. Nonetheless, it will cost a significant amount of money to set up, store, and monitor this system. The video will be deleted after an owner review, despite the fact that the activity was extremely rare. Because they must watch the entire video, they lose valuable work time and increase the risk of missing details during the analysis process. Directly viewing the streaming video was not possible. V. K. Bhanse discusses the automatic detection of bank robberies and thefts using intelligent surveillance. To simplify the system, a Raspberry Pi single-board computer was used.

BLOCK DIAGRAM



When someone breaks in, the other system uses radar technology to locate them. Radar detects intruders by emitting microwave or radio wave pulses that reverberate off of the objects in its path. These systems are widely available and reasonably priced; however, when radio signals pass through them, they emit radiation. An additional type of burglar alarm system is an electronic alarm system. Their purpose is to alert the owner in the event of a break-in. Some of these categories include vibration sensor systems, glass break detector systems, ultrasonic motion detector systems, passive infrared (PIR) motion detector systems, and photoelectric beam systems. False alarms can occur even when intruders can be detected without assistance. This may cause the owner to feel undue pressure. We were unable to locate a photo of the intruder, which is why the alarms went off. R.G. Bhavani uses image processing to improve safety. This intruder detection system used the GSM module and Bluetooth to transmit data over mobile networks. These modules allow the system to deliver messages to the appropriate recipients. Visitors were denied entry because they needed to enter an OTP via the keypad. They were thought to be trespassing.

III. PROPOSED SYSTEM

The system is made up of a Raspberry Pi and a Pi camera, which capture real-time images and videos of intruders. The camera is constantly monitoring the area and recording video. Following video acquisition, photographs are taken at regular intervals. The collected images are converted to RGB format. These images are processed once more to see if the intruder is present. When there is no longer an intruder, the process ends. When an intruder is present, the technology distinguishes between people and animals. Regardless, the information is sent to a server. The server shows the current time and images of people who shouldn't be there. The processed image is also compared to databases in the system. Processing is completed when the subject's face matches one of the images stored in the system's database. If not, the developed app notifies the user via text and email, including a photo of the intruder and their current location. Setting an alarm with the app from a distance makes it easier to notify others of something.

IMAGE ACQUISITION MODULE

When someone enters the building, a sensor detects them and activates a hidden Raspberry Pi camera. The intruder will be captured on camera, and the image will be transmitted to the microcomputer via HDMI cable for processing.

FACE RECOGNITION

Face recognition is the process of identifying a person based on a digital photo. The mined face is compared to images from the training set during the recognition phase. As soon as there is no match, the store owner is notified via SMS with a photo of the stolen item. To create harmonious facial features, use a gradient of pixel intensities, as well as the locations and sizes of the eye, mouth, and nose bridge areas.

The Pi camera provides the input image. Unnecessary image elements must be removed in order to distinguish the face from the background. Specific features allow a person to distinguish a human face from other elements in an image. These characteristics are related to features. The fact that the eyes on human faces are usually darker than the rest of the body is an important characteristic. The bridge of your nose is a bright spot on your complexion.



Fig 1. Intruder detection system

DETECTION AND EMAIL ALERT

Sending a JPG file with the intruder's picture and sounding the alarm in response to a verified intrusion.

RASPBERRY PI

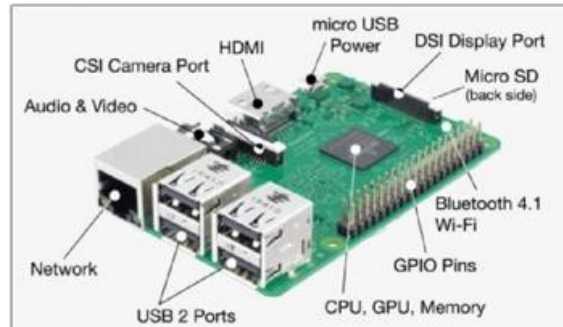


Fig 2. Raspberry pi

It is a tiny computer that looks like a credit card. Using a standard keyboard and mouse and connecting it to a TV or computer monitor instead of the CPU. Students primarily use it to learn programming languages such as Python and Scratch because it is cheap. The Raspberry Pi 3 runs on a Linux-based operating system. The board's fast processor and numerous features make it ideal for advanced applications. It's a single-board computer.

PI CAMERA

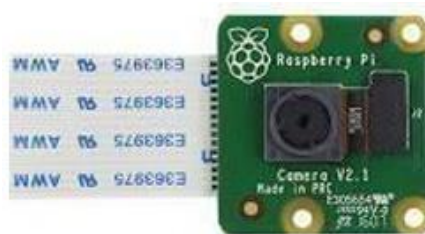


Fig 3. Pi Camera

The Pi camera is portable and compatible with a number of other devices. The MIPI camera's serial interface protocol enables communication with the Raspberry Pi. It is widely used in image processing, machine learning, and surveillance projects. This 5MP camera, which can record video and take high-quality pictures, is ideal for drone or CCTV projects.

PIR SENSOR

When something visible to it emits infrared (IR) light, an electronic sensor called a passive infrared sensor (PIR sensor) responds to it. They are commonly found in PIR-based motion detectors. PIR sensors are used in programmable lighting and security alarm systems for a variety of applications.



Fig 4. PIR Sensor

IV. EXPERIMENTAL RESULTS

The Raspberry Pi, camera, and sensor modules all communicated with each other. The camera finds the person whose face the PIR sensor recognizes and compares it to a pre-configured database. If it detects an intruder, it will send the

owner a call alert and a picture of the intruder via Wi-Fi after the store has closed. The buzzer outside the store will sound off at the same time.



Fig 5. Output of face recognition

V. CONCLUSION

Our system would provide the client with real-time updates on internal developments and live streaming. The framework includes security features for the Internet of Things. When wired or wireless protocols detect intruders, the security module promptly notifies the owner or administrator, allowing them to take appropriate action to improve facilities and security while conserving energy.

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