Smart Peephole camera

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Introduction

As more concern is being felt for home safety, especially in city areas, it is important to monitor who approaches or rings one's door. A peephole has narrow field of vision and no mechanism to record activity. The project is aimed at turning the conventional peephole into a modern device by developing a Smart Door Peephole Camera system using a Raspberry Pi and an appropriate camera module. The system provides real-time video recording and door front activity storage, enabling users to access footage, send it to the email and enhance home security. Easy, cheap, and web-connected, this setup converts an everyday door into an intelligent watch point with no heavy hardware required.

Components Used

Following is a list of parts that were used to construct the Smart Door Peephole Camera system. The intention was to maintain the design simple and concise, yet ensure that it would provide consistent performance for around-the-clock home security surveillance.

Component	Description
Raspberry Pi (Model 3)	The central microcomputer used for processing camera input, storing video data, and managing internet connectivity.
Raspberry Pi Camera Module v2	An 8MP camera connected via CSI interface, mounted through a traditional door peephole for discreet video capture.
MicroSD Card	Used to store the Raspberry Pi OS, application software, and captured video footage.
Power Supply	Reliable power source to ensure continuous operation of the Raspberry Pi

and connected peripherals.

Wi-Fi Module / Built-in Wi-Fi	Provides internet connectivity for the system, enabling remote access to live streams or stored video.
USB Keyboard & Mouse (Setup)	Temporarily used for initial system setup, SSH configuration, and testing.

Circuit diagram and system Architecture

The system is software-based and has minimal wiring. The camera module of Raspberry Pi is plugged into the Raspberry Pi through the CSI (Camera Serial Interface) port, and the system is powered by adapter.

Important Connections:

Camera Module:

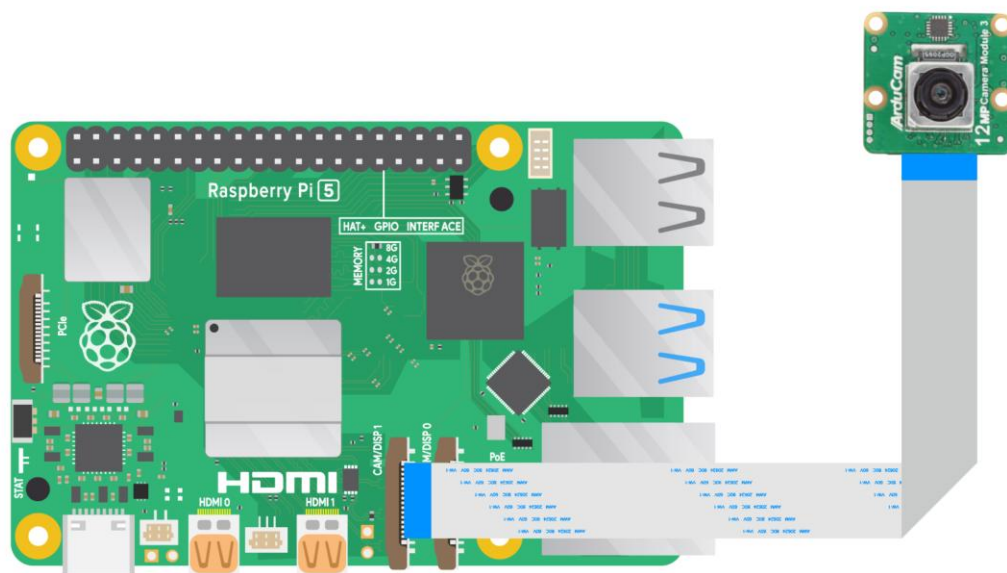Attached to CSI port on Raspberry Pi through ribbon cable.

Power Supply:

Plugged through USB power port (micro-USB or USB-C depending on the Pi model).

Network:

Linked to Wi-Fi network through built-in wireless interface or USB Wi-Fi dongle.

Challenges Encountered

One of the challenges our first challenge was to install the raspberry pi setup and come up with a web interface for it. We faced this challenge by reading through the research papers and gaining more information about

it since it was suggested to us by our TA Malya Mam.

Another problem we encountered was video storage management. Because constant recording rapidly consumed the microSD card, we needed to have a system to manage storage space efficiently. We solved this by implementing a motion-based recording system with basic frame differencing methods. This ensured that the system recorded only when there was motion, thus conserving storage space. We also created scripts that automatically erase old recordings after a specified period, further optimizing storage utilization.

Since the system was based on remote access over the internet, we had security issues regarding unauthorized access to the video stream. To make sure that the video was secure, we used secure remote access mechanisms such as SSH tunneling and password-protected HTTPS through a Flask server. This ensured that unauthorized users could not access the video stream, and the system became more secure to use.

Lastly, another challenge we encountered was how to send message that some unauthorised person has entered in real time, for this, we used e-mail setup, we complied it with mail id so it sends message as soon as someone unauthorised has entered.

Conclusion

The Smart Door Peephole Camera system effectively proves that a small, affordable solution can provide home security through readily available components such as the Raspberry Pi and a camera module. The system allows homeowners to view visitors in real-time and record video locally, all while providing remote access via the internet. Through thoughtful hardware-software integration and overcoming position, storage, security, and night time vision-related challenges, the project fulfills its mission of retrofitting a conventional peephole with an intelligent surveillance system. Enhancements in the future can include AI-based facial recognition, integration with the cloud, and motion detection hardware to further enhance the efficiency and autonomy of the system.

References

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