CHAPTER 1. INTRODUCTION

1.1 Background and Importance of the Topic

The Internet of Things (IoT) and Intelligent Environment (IE) services are gaining popularity due to their ease of plug and play connectivity. Smart homes are considered "killer applications" due to their consumer appeal, reachability, and marketability. These IEs have real-life applications in industries like agriculture, trading, retail, financing, legal, transportation, government, and healthcare. Smart homes offer security, peace of mind, and convenience through various devices. However, choosing the right combination of sensors is crucial for better results. Quality properties of these systems add complexity, as there are more variables to cater for. To achieve efficiency and comfort, compromises must be made in terms of user friendliness, security, and reliability. Budgeting, product quality, and resources are some constraints that must be considered. The development of RaspiMonitor aims to address these gaps by creating a smart home monitoring system that ensures security and safety, integrates sensors, and enables users to monitor their usage patterns[1].

The implementation of smart technology in this monitoring system includes features such as human presence detection, motion recognition, and temperature monitoring, all of which aim to improve home security and comfort. Remote monitoring and management facilities also allow users to access the system at any time and from anywhere, providing a timely understanding of conditions at home. In addition, data security and privacy protection are important concerns in this research, focusing on secure data transmission and storage to protect user privacy[2].

Overall, the research of the Raspberry Pi-based smart home monitoring system not only has the potential to accelerate the development of smart home technology, but also provides users with a more intelligent, convenient and secure monitoring solution. This research direction promises broad applications and can support further innovation and development in the smart home sector.

1.2 Raspberry Pi for Smart Homes

A Raspberry Pi is a popular and affordable home automation platform that can control smart home devices and sensors. It is cost-effective, versatile, customizable, and offers privacy as it is a local device. However, setting up a Raspberry Pi for smart home use requires some technical knowledge, as it requires familiarity with software installation and device configuration. Raspberry Pis may not be powerful enough for complex applications and may not be as user-friendly as commercial systems.

There are several Raspberry Pi models available, with the most popular being the Raspberry Pi 4 Model B. This model is more powerful and has all the features needed for creating a smart home system. However, additional hardware, such as a microSD card, power supply, and case, is required. Home automation software, such as Home Assistant, is also available as an open-source option. Additionally, smart home devices must be configured to work with the Raspberry Pi.

In conclusion, a Raspberry Pi can be a cost-effective and customizable solution for creating a smart home system. However, it is crucial to be aware of its limitations before starting.

1.3 Researcher Summary

Raspberry Pi, a Linux-based mini computer, was developed by the Raspberry Pi Foundation in the UK with the aim of providing an accessible platform for learning computer programming. Along with the advancement of Internet of Things (IoT) technology, the concept of smart homes is increasingly becoming a public concern. The smart home concept first appeared in 1984 in the United States with the construction of the first smart building. Since then, various smart home solutions have been developed in developed countries such as the United States, Canada, Europe, Australia, and Southeast Asia[3].

In this context, a smart home system design based on Raspberry Pi emerged. This system utilises the powerful performance and diverse interfaces of Raspberry Pi, combined with high-level programming languages such as Python to develop a comprehensive intelligent system architecture. Functions such as intelligent lighting control, temperature adjustment, security monitoring, and home entertainment are integrated to provide users with a comfortable and intelligent living experience.

From an academic perspective, the development of Raspberry Pi-based smart home systems has attracted the attention and conducted research by many academics and engineers. Their focus includes system performance optimisation, stability improvement, and new function development. Some studies also explore the integration of smart home systems with advanced technologies such as artificial intelligence, big data, and cloud computing, opening up more possibilities for the development of smart home systems in the future.

All in all, the design of Raspberry Pi-based smart home systems has great research significance and broad application prospects in the field of smart home technology. This initiative not only promotes the development of smart home technology, but also contributes to the creation of a more comfortable, safe and intelligent living environment for people.

1.4 Technical Characteristics

Raspberry Pi is a cost-effective solution for home users looking to implement smart home technology without spending a lot. It offers high flexibility, as it can connect to various sensors, cameras, and peripherals easily. The open-source Linux-based operating system allows developers to customize and optimize the system according to their needs. Raspberry Pi supports programming languages like Python and C, allowing users to develop personalized monitoring functions. Its monitoring systems can be accessed and controlled remotely via the internet, allowing users to monitor their home conditions from anywhere. Raspberry Pi also supports security measures like data encryption and user authentication, enhancing the security of smart home systems and preventing unauthorised access. This makes it an affordable, adaptive, and secure solution for today's smart home needs.

1.5 Research Purpose Design and Implementation of Smart Home

The research aims to design and implement a smart home monitoring system using a Raspberry Pi, which would utilize various sensors to collect data about the home environment and potentially control certain aspects for improved comfort, security, and efficiency. Key areas of focus include security monitoring, environmental monitoring, energy monitoring, and power management.

The design phase involves outlining the technical specifications and functionalities of the system, including hardware selection, software selection, system architecture, and testing

and refinement. Key aspects to consider include selecting a Raspberry Pi model suitable for processing sensor data and running the monitoring software, selecting appropriate sensors based on monitoring goals, and choosing a home automation software compatible with the Raspberry Pi and the chosen sensors.

The implementation phase involves setting up the hardware and software components to build the smart home monitoring system, such as installing the Raspberry Pi OS, connecting sensors and peripherals, installing the chosen home automation software, and setting up a user interface (web app or mobile app) to visualize sensor data and potentially control connected devices.

Additional considerations include security, scalability, and power management. Secure communication protocols for data transmission between sensors and the Raspberry Pi, user authentication for accessing the monitoring system and controlling devices, and designing the system to be expandable for future integration of additional sensors and functionalities.

By following these steps and considering additional aspects, your research can contribute to the development of a customized and effective smart home monitoring system using a Raspberry Pi.

1.6 Research Topic Content

This research topic focuses on designing and implementing a smart home monitoring system using the Raspberry Pi, a small and affordable computer. The research aims to address specific aspects of home monitoring, such as security and environment. The system design includes hardware components like Raspberry Pi models, sensors for monitoring, optional cameras, and power supply. Software aspects include the Raspberry Pi operating system, programming languages for sensor data acquisition and processing, and communication protocols for sensors.

The system implementation process includes hardware setup, sensor connection, camera setup, software development, data visualization and alerts, and user interface design. Testing and evaluation involve sensor data accuracy verification, system response time for alerts, and user interface usability testing. Potential limitations and areas for improvement are discussed.

In conclusion, the research project aims to summarize the achievements, discuss real-world applications, and propose future work or enhancements for the system. Additional considerations include security, scalability, and user-friendliness. By exploring these aspects, a comprehensive research paper or project can be created on designing and implementing a smart home monitoring system with a Raspberry Pi, tailoring the specific functionalities and features to the specific area of interest within home monitoring.