IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.414 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 7, July 2025

DOI: 10.17148/IJIREEICE.2025.13707

HOME AUTOMATION USING RASBERRY PI

Sneha Karre[1], Komal Kudal [2], Amruta Sutar[3], Satyawa Dindure[4], Shweta Vhankamble[5], Prof. S. A. Malvekar[6]

Students, Electrical Engineering Department, SSWCOE, Solapur, India[1,2,3,4,5]

Assistant Professor, Electrical Engineering Department, SSWCOE, Solapur, India[6]

Abstract: A home automation system using a Raspberry Pi enables users to control and monitor various devices within their homes remotely via the internet. This system typically involves integrating sensors, actuators, and a user interface (often web-based) with the Raspberry Pi, which acts as the central control unit. Users can manage lighting, appliances, and other systems from anywhere, enhancing convenience, comfort, and potentially energy efficiency. This paper proposes the design of Inter of Things (IoT) based home automation system using Raspberry pi. This project presents the design and implementation of an IoT-based home automation system using the Raspberry Pi as the central control unit. The system enables users to monitor and control household appliances such as lights, fans, and security systems remotely through a web or mobile interface, ensuring convenience, energy efficiency, and enhanced security. Using the Raspberry Pi's built-in Wi-Fi and GPIO capabilities, various sensors (e.g., temperature, motion, light) and actuators are integrated to create a smart environment. Communication protocols like MQTT or HTTP are employed to facilitate real-time data exchange between the devices and the user interface. The system supports both manual and automated control modes, making it adaptable to user preferences. This IoT-based solution offers a scalable, cost-effective, and user-friendly alternative to traditional automation systems, and it demonstrates the potential of Raspberry Pi in developing smart home technologies. User required to use different mobile devices like smart phones, Laptops, Tablets to operate the home appliances with the help of UI created on web page. Home automation plays an important role in establishing a smart home and is an ever exciting field that have grown largely over the last few years. New innovations has made the homes progressively appropriate, efficient and much increasingly secured. The low-cost devices used for joining the various electronic equipments and different sensors over an internet connection are supported and connected with the help of the Raspberry pi. Creating a smart home which can be effectively controlled and observed by the Raspberry pi by the means of Internet of Things is the principle target of present work.

Keywords: Home Automation, Internet of Things, Raspberry pi, Server, Mobile Devices

I. INTRODUCTION

Internet of things is a technology of the future that has already started to touch our homes. Controlling the devices manually is totally outdated in today's world. In today's busy scheduled life each time human is not available to control devices manually so automation is batter option. Now-a-days everything is advanced. The technology is at its peak. Now days mostly everything in our surrounding is being automated. In this project we have designed a software in which multiple home appliances are connected and controlled by the mobile by means of internet. In which if a particular appliance is left in looking state we can access and switch off it from anywhere in the world. And by use of camera connected to software we can see what is being done in our house from anywhere which give a proper security. The concept of a smart home has transformed from a futuristic idea into a practical reality, thanks to the rapid development of the Internet of Things (IoT). IoT enables everyday devices to communicate, collect, and exchange data, making automation and remote control possible. Home automation is a key application of IoT, aimed at improving comfort, security, and energy efficiency by automating the operation of household appliances. The Raspberry Pi, a compact and affordable single-board computer, is widely used in IoT projects due to its flexibility, low power consumption, and ease of interfacing with various sensors and actuators. In an IoT-based home automation system, the Raspberry Pi serves as the central controller that connects to the internet and manages all the smart devices in the home. This project focuses on developing a home automation system using Raspberry Pi that allows users to monitor and control home appliances remotely via a smartphone or web application. The system supports real-time data access and decision-making based on sensor inputs such as temperature, motion, and light intensity. Communication protocols such as MQTT or HTTP are used to ensure efficient data transfer between devices and the user interface. By integrating IoT with home automation through Raspberry Pi, this system provides an innovative, cost-effective, and scalable solution for making homes smarter, safer, and more energy-efficient. Using this, we can control home appliances connected through a monitor-based internet [1-14].

IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.414 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 7, July 2025

DOI: 10.17148/IJIREEICE.2025.13707

II. LITERATURE REVIEW

The integration of the Internet of Things (IoT) with home automation has been a rapidly growing area of research, focusing on enhancing the comfort, security, and energy efficiency of residential environments. The Raspberry Pi has emerged as a preferred platform due to its affordability, low power consumption, and ability to interface with a wide range of sensors and actuators. This literature review summarizes key studies and developments related to IoT-based home automation using Raspberry Pi.

A. Robot Control and Monitoring

Many researchers have developed systems that allow users to control home appliances via smartphones or web applications. For instance, implemented a home automation system using Raspberry Pi and the Blynk IoT platform, enabling real-time control of appliances over Wi-Fi. Their system demonstrated the feasibility of remote operation with a user-friendly interface. Raspberry Pi is a small, affordable single-board computer that runs on Linux-based operating systems. It is widely used in home automation for controlling and monitoring devices. The GPIO (General Purpose Input/Output) pins make it easy to interface with various sensors (temperature, motion, gas), actuators (relays, motors), and communication modules (Wi-Fi, Bluetooth, Zigbee).

B. Voice-Controlled Automation

Explored voice-controlled automation using Google Assistant, IFTTT, and Raspberry Pi. The system allowed users to give voice commands to control appliances like lights and fans, enhancing accessibility and convenience, particularly for elderly or differently abled users. Voice-controlled home automation using Raspberry Pi is a smart home system where appliances like lights, fans, and other electrical devices are operated using voice commands instead of manual switches or mobile apps. Raspberry Pi serves as the central controller, interpreting the user's speech and executing actions accordingly

C. Sensor Based-Intelligent Control

Several studies, such as that, emphasized automation based on environmental sensor data. Their system used temperature and light sensors (e.g., DHT11, LDR) to automatically adjust devices like fans and lights, making the system responsive to ambient conditions.

D. Security and Surveillance

Developed a home security system using Raspberry Pi, PIR sensors, and Cameras. The system could detect motion and send alerts with images to the user's email. This Work illustrated how home automation systems can enhance safety through smart surveillance. Literature suggests that while Raspberry Pi offers significant cost-effective advantages, security is a concern. Proper authentication, encryption, and network security protocols must be implemented. Research also emphasizes scalable design, using multiple Raspberry Pi units for large-scale homes or integration with cloud platforms like AWS or Firebase.

E. Cloud Integration and Data Management

Cloud-based systems are becoming increasingly popular due to their scalability and real-time Data access. Designed a system using Raspberry Pi with Firebase, enabling real-time database interaction for controlling and monitoring devices, and logging historical data for analysis. Recent works have explored integrating Raspberry Pi with voice assistants like Amazon Alexa and Google Assistant using IFTTT protocols. Mobile apps created using platforms such as Blynk, MIT App Inventor, or custom Android applications can control appliances, receive alerts, or check real-time sensor data.

F. Protocol Efficiency and System Performance

Emphasized the importance of using lightweight Communication protocols like MQTT for efficient and scalable IoT systems. Their work Highlighted performance improvements and reduced network load in multi-device environment

III. METHEDOLOGY

What is the Raspberry Pi?

The Raspberry Pi is a fully functional credit card-sized computer. It was developed by the Raspberry Pi Foundation with the intention of promoting the teaching of computer science and programming in schools. The device is designed to be easy to use and as affordable as possible. The Raspberry Pi comes as a printed circuit board, but you can buy all the extra stuff needed to make it fully functional. The Raspberry Pi size is 85.60mm x 56mm x 21mm (or 3.37" x 2.21" x 0.83") and weighs 45g.

IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.414 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 7, July 2025

DOI: 10.17148/IJIREEICE.2025.13707

As of December 2015, five models are available: Raspberry Pi Model A – it has 256MB RAM, only one USB port and no network connection. Raspberry Pi Model B – it has 512MB RAM, 2 USB ports and a network connection. Raspberry Pi Model B+ – it has the similar specifications as the Model B, but comes with 4 USB ports, more GPIO pins, and uses less power than the Model B. This model costs$35. Raspberry Pi 2 Model B – the latest version of the device, with 900 MHz quad-core ARM Cortex-A7 CPU and 1 GB of RAM. Raspberry Pi Zero - a stripped-down (but still powerful) version of the Raspberry Pi. This model is equipped with 1GHz ARM11 core and 512 MB of RAM, but comes without an Ethernet port.

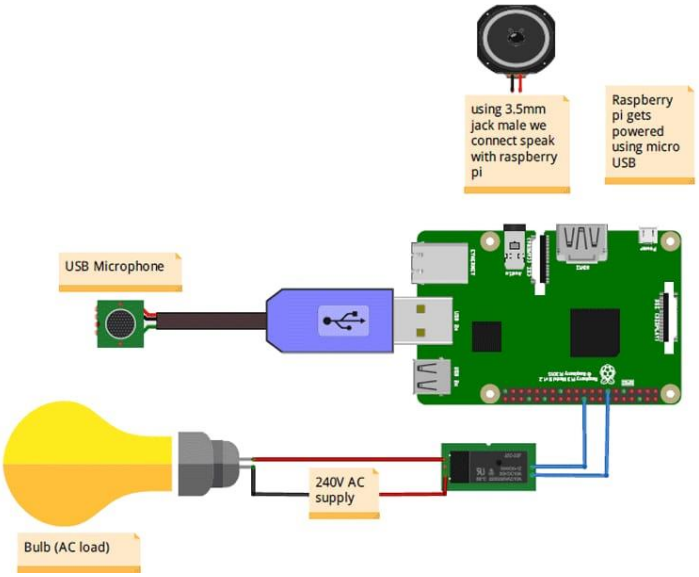

Fig. 1 Block diagram of proposed system

Home automation is the smart management of all aspects related to security, well-being, and comfort of a home or building. Through a set of technologies, different systems are automated, controlled, administered, and optimized.

Raspberry Pi:

- The "brain" of the system, running the automation software and handling communication.
- Can be programmed to receive commands over a network (like WiFi) or directly from sensors.
- Often uses Python as the programming language.

2. Sensors:

- Devices that collect data about the environment, such as temperature, light, motion, etc.
- Examples include temperature sensors (DHT11, DHT22), motion detectors (PIR sensors), and light sensors (photoresistors).
- The sensor data is fed into the Raspberry Pi for processing.

3. Actuators:

- Devices that perform actions based on the Raspberry Pi's instructions, like turning lights on/off or controlling a fan.
- Often involve relays to switch higher voltage/current devices, as the Raspberry Pi's GPIO pins can only handle low voltages and currents.

4. Communication:

- The Raspberry Pi connects to the network via WiFi or Ethernet.
- This allows remote control of the system via a smartphone app or web interface.
- The Raspberry Pi can also communicate with other devices (e.g., an Arduino) using protocols like I2C or SPI.

5. Software:

- Python scripts on the Raspberry Pi handle:
  - Reading sensor data.
  - Processing the data and making decisions (e.g., turning on a light when it's dark).
  - Sending commands to actuators.
  - Communicating with other devices or a user interface.
- Home Assistant is a popular open-source platform specifically designed for home automation on Raspberry Pi.

In essence, a home automation system using a Raspberry Pi works by:

1. **Sensing:** Gathering data from the environment.

IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.414 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 7, July 2025

DOI: 10.17148/IJIREEICE.2025.13707

2. **Processing:** The Raspberry Pi analyzes the data and determines what actions to take.
3. **Actuating:** The Raspberry Pi sends commands to the actuators to perform the necessary actions.
4. **Controlling:** The system can be controlled remotely via a network connection.

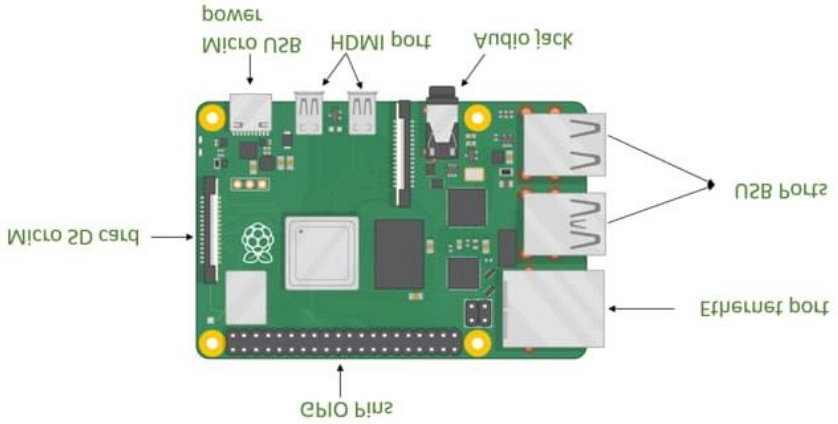

Fig. 2 Circuit diagram

A Raspberry Pi can be used to automate various home functions by controlling devices like lights and fans remotely via the internet. The system typically involves a Raspberry Pi acting as the central controller, connected to sensors and actuators via GPIO pins and an interface like a web server. Commands from a user interface (e.g., a webpage or mobile app) are processed by the Pi, which then activates the appropriate devices through relays or other control mechanisms.
Raspberry pi is the name of the "credit card-sized computer board" developed by the Raspberry pi foundation, based in the U.K. It gets plugged in a TV or monitor and provides a fully functional computer capability. It is aimed at imparting knowledge about computing to even younger students at the cheapest possible price. Although it is aimed at teaching computing to kids, but can be used by everyone willing to learn programming, the basics of computing, and building different projects by utilizing its versatility. Raspberry Pi is developed by Raspberry Pi Foundation in the United Kingdom. The Raspberry Pi is a series of powerful, small single-board computers. Raspberry Pi is launched in 2012 and there have been several iterations and variations released since then.

Key Components and Circuit Explanation:
1. Raspberry Pi: The core of the system, responsible for processing commands and controlling devices.
2. Relays: These act as electronic switches, controlled by the Raspberry Pi's GPIO pins, to turn appliances on or off.
3. Relay Driver Circuit: Provides the necessary current to energize the relay coil when a logic signal from the Pi is received.
4. Sensors (Optional): Devices like temperature sensors, motion detectors, or light sensors can be integrated to provide input for automated actions.
5. Actuators (Optional): Devices like motors or LED lights can be controlled directly by the Raspberry Pi or through relays.
6. User Interface: A web interface (e.g., created with WebIOPi) or mobile app allows users to send commands to the Pi.
7. Power Supply: A stable power supply to power the Raspberry Pi and other components.

IV. RESULT AND DISCUSSION

This document introduces an IoT-based smart home system developed by a group of students. The system uses a Raspberry Pi as the central controller connected to various sensors and appliances via relays. It allows remote monitoring and control of lights, fans and security through a web interface or mobile app.

Internet of things is a technology of the future that has already started to touch our homes. Here we propose an IOT based home automation system using raspberry pi that automates home appliances and allows user to control them easily through internet from anywhere over the world. Our proposed system consists of a microcontroller-based circuit that has lights and fan connected to it along with LCD display and Wifi connector interfaced with raspberry pi. Our system interacts with out online IOT system that IOT Gecko free web interface for controlling our home appliances with ease.

IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.414 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 7, July 2025

DOI: 10.17148/IJIREEICE.2025.13707

Fig. 3 Proposed System

After linking with IOT Gecko, the user is allowed to send load switching commands over IOT to our circuit. The circuit receives the commands over IOT by connecting to internet using wifi connector and then the raspberry processor processes these commands. After this the processor now processes these instructions to get user commands. It then displays these on an LCD display. Also it operates the loads (lights and fan) for switch them on/off according to desired user commands. Thus we automate home appliances over internet using raspberry pi.

V. CONCLUSION

Raspberry Pi offers a cost-effective and versatile platform for home automation, enabling users to control various devices and systems remotely via internet-connected interfaces. It allows for increased convenience, security, and energy efficiency within the home. While offering flexibility, integrating different components and ensuring smooth operation requires careful planning and setup.

Home automation using Raspberry Pi demonstrates how affordable, accessible technology can be leveraged to create intelligent and efficient living spaces. By integrating sensors, actuators, and software tools, the system enables users to control and monitor home appliances remotely, improving convenience, security, and energy efficiency. Raspberry Pi's versatility, low cost, and support for various programming languages make it an ideal platform for building customizable and scalable smart home solutions. As technology continues to evolve, such systems can be further enhanced with features like voice control, machine learning, and IoT integration, paving the way for more advanced and responsive home environments.

REFERENCES

[1]. Maragatham, T., P. Balasubramanie, and M. Vivekanandhan. "IoT based home automation system using raspberry Pi 4." In *IOP Conference Series: Materials Science and Engineering*, vol. 1055, no. 1, p. 012081. IOP Publishing, 2021.

[2]. Dennis, Andrew K. *Raspberry Pi home automation with Arduino*. Birmingham, UK: Packt Publishing, 2013.

[3]. Ashraf, Imran, Muhammad Umer, Rizwan Majeed, Arif Mehmood, Waqar Aslam, Muhammad Naveed Yasir, and Gyu Sang Choi. "Home automation using general purpose household electric appliances with Raspberry Pi and commercial smartphone." *Plos one* 15, no. 9 (2020): e0238480.

[4]. Malvekar, Sachin A., C. L. Bhattar, and Viraj B. Savakhande. "Non-Isolated High Voltage Gain DC DC Converters using Inductors for DC Microgrid." In 2018 International Conference on Control, Power, Communication and Computing Technologies (ICCPCCT), pp. 455-459. IEEE, 2018.

[5]. Malvekar, Sachin A., and C. L. Bhattar. "Non-isolated High Voltage Gain Dcâ€“dc Converters Using Inductors For Pv Application." JournalNX (2018): 158-161.

DOI: 10.17148/IJIREEICE.2025.13707

[6]. Bhosale, Swaroopa S., Y. N. Bhosale, Uma M. Chavan, and Sachin A. Malvekar. "Power quality improvement by using UPQC: A review." In 2018 International conference on control, power, communication and computing technologies (ICCPCCT), pp. 375-380. IEEE, 2018.

[7]. Kapse, Mrunal M., Nilofar R. Patel, Shruti K. Narayankar, Sachin A. Malvekar, and Kazi Kutubuddin Sayyad Liyakat. "Smart grid technology." International Journal of Information Technology and Computer Engineering 2, no. 6 (2022): 10-17.

[8]. Mahananda N. Pukale, Manisha K. Raichurkar, Shivani S. Aousekar, Nikita S. Rapelli, Prof. Sachin A. Malvekar, "IoT Based Smart Energy Meter", International Journal of Advanced Research in Science, Communication and Technology, pp.350, 2024.

[9]. Parshetti, Miss. Rutuja., Burbure, Miss. Shruti, Chavan, Miss. Shrutika, Tamshetti, Miss. Vijayalaxmi, Jagzap, Miss. Pradnya and Malvekar S. A. “Firefighting Robot: A Review.” International Journal for Research in Applied Science and Engineering Technology 12, no. 12 (December 31, 2024): 2055–62.

[10]. Kasturi Ramesh Parbalkar, Rajlaxmi Vishwanath Yeldi, Ishwari Shakesh Jadhav, Krushanaveni Laxminarayan Sidral, Sachin A. Malvekar, "innovation to Industry: Roadblocks in Perovskite Solar Cell Commercialization", JNRID - JOURNAL OF NOVEL RESEARCH AND INNOVATIVE DEVELOPMENT (www.JNRID.org), ISSN:2984 8687, Vol.3, Issue 3, page no. a96-a101, March-2025.

[11]. Dindure, Dhanashri, Vaishnavi Mithapalli, Shivranjani Battul, S. A. Malvekar, and S. P. Patil. "Self-Operating Rain Detection System." International Journal of Innovative Science and Research Technology 10, no. 3 (2025): 2799-2803.

[12]. Priyanka Malyal, Bhargavi Konda, Maheshwari Kota, S. A. Malvekar “A photovoltaic solar system with multiple tasks,” IJIREEICE, vol. 13, no. 4, Apr. 2025: 229-234.

[13]. Bepery, Chinmay, Sudipto Baral, Animesh Khashkel, and Farhad Hossain. "Advanced home automation system using Raspberry-Pi and Arduino." *International journal of computer science and engineering* 8, no. 2 (2019): 1-10.

[14]. Roy, Trideep Singha, Soumalya Ghosh, Rimpi Datta, and Arpita Santra. "IoT based home automation using raspberry PI." *International Journal of Computer Engineering and Technology* 10, no. 3 (2019): 70-74.