Internship at PESU-IoT CENTRE

"Wireless Distance-Based Relay Control Using Raspberry Pi Pico W"

Submitted by:

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Under the guidance of

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Internship Duration - 3 Months

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DECLARATION

We hereby declare that the project entitled “Wireless Distance-Based Relay Control Using Raspberry Pi Pico W” has been carried out by Rakesh D, under the guidance of Mr. Vadiraja. A, Associate Professor at PES-IoT Centre, as a part of the requirements for the completion of the Bachelor of Technology (B. Tech) degree in Computer Science and Engineering at PES University, Bengaluru. This project has been conducted during the academic semester of 3 months (12 weeks).

This report, and the associated work, is a result of my own efforts and has not been submitted previously to any other university or institution for the award of any degree. It reflects the original research and practical application undertaken as part of my academic curriculum at PES University.

I take full responsibility for the contents of this report and affirm that all references and resources used have been properly acknowledged.

PES2UGCS2816
RAKESH D

ACKNOWLEDGEMENT

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Finally, this internship could not have been completed without the continual support and encouragement I have received from my parents and my friends.

ABSTRACT

I. Introduction

I interned at the **PESU IoT Centre**, located at PES University's RR Campus. The centre focuses on research and development in the field of the Internet of Things (IoT). Its mission is to foster innovation and hands-on learning in smart technologies. The centre operates within the **education and R&D sector**, supporting student-led projects and industry collaborations. It is a mid-sized lab-based organization comprising faculty mentors, research scholars, and student interns.
The internship spanned **12 weeks**, aimed at applying IoT concepts to solve real-world problems. It was open to CSE and ECE students with foundational knowledge in electronics and programming. I worked with the **Embedded Systems and Automation** team, contributing to hardware-software integration. My role involved developing and testing the project titled **"Wireless Distance-Based Relay Control Using Raspberry Pi Pico W."** This project contributed to the lab's ongoing efforts in smart automation systems.

II. Job Responsibilities and Duties

During my internship, I was responsible for designing and developing a wireless distance-based relay control system using Raspberry Pi Pico W. My tasks included interfacing the HC-SR04 ultrasonic sensor, configuring Wi-Fi communication, and programming relay control logic. I implemented HTTP-based communication between two Pico boards to toggle a relay based on measured distance. Weekly deadlines ensured steady progress through design, development, and testing phases.
My work directly supported the IoT Centre's goal of creating practical automation solutions. I successfully built a working prototype that demonstrated reliable wireless control over short-range distances. I collaborated closely with peers for circuit design and debugging. Regular reviews with supervisors helped refine the system and solve connectivity issues. This hands-on project enhanced team communication and problem-solving in an embedded IoT setting.

III. Accomplishments and Achievements

One of my key accomplishments was successfully completing the “Wireless Distance-Based Relay Control” project within the given 8-week timeline. I developed a fully functional system that reliably toggled a relay based on distance data transmitted wirelessly between two Raspberry Pi Pico W boards. I overcame Wi-Fi connectivity issues by optimizing HTTP request handling and reducing response delays.
To ensure accurate readings, I calibrated the HC-SR04 sensor and implemented filtering logic in Micro Python. My work received positive feedback during the final project demonstration from both mentors and peers. I also documented the entire project flow, which is now being used as a reference for future interns. Collaborating effectively and debugging hardware in real-time were crucial to this success. This experience improved my skills in embedded systems and wireless communication.

IV. Lessons Learned

The internship at PESU IoT Centre provided valuable insights into real-world applications of IoT and embedded systems. I gained hands-on experience with Raspberry Pi Pico W, sensor integration, and Wi-Fi communication. I learned how to troubleshoot and optimize systems in real-time, enhancing my problem-solving skills.
This experience also deepened my understanding of wireless communication protocols, which I plan to apply in future projects involving smart devices and automation. Additionally, I improved my ability to work in teams and communicate technical concepts effectively.

One area I identified for improvement is my knowledge of low-level networking protocols. I plan to address this by studying network communication standards and exploring advanced IoT architectures. This will further enhance my ability to develop scalable and efficient systems.

V. Conclusion

In conclusion, my internship at the PESU IoT Centre was a highly enriching experience, where I successfully developed the “Wireless Distance-Based Relay Control” system. I faced challenges such as Wi-Fi connectivity issues and sensor calibration, but through problem-solving and optimization, I was able to overcome them. The experience significantly enhanced my practical skills in embedded systems, wireless communication, and real-time troubleshooting.

I am deeply grateful to the mentors and colleagues at the IoT Centre for their continuous support and valuable guidance. Special thanks to [Supervisor's Name] for providing insightful feedback throughout the project.
For future internship programs, I recommend incorporating more opportunities for cross-functional learning, particularly in advanced IoT protocols and network architecture. Additionally, providing more time for deeper project exploration would allow interns to develop a comprehensive understanding of complex systems.

VI. Appendices

Appendix A: Raspberry Pi Pico W Setup and Configuration
Steps and instructions for setting up the Raspberry Pi Pico W for Wi-Fi communication, including configuring it as an access point and ensuring it can communicate with other devices.
Details configuration of Wi-Fi, Pico W settings, and code for initialization.
Appendix B: HC-SR04 Sensor Integration
Code and explanation on how the HC-SR04 ultrasonic sensor is interfaced with the Raspberry Pi Pico W, including setup for distance measurement and sensor calibration.
Includes the wiring diagram and setup for accurate distance readings.
Appendix C: Relay Control Code
Code for interfacing and controlling the relay using Raspberry Pi Pico W. This section explains how the relay is activated or deactivated based on the distance measured by the sensor.
Details relay GPIO pin configuration and control logic.
Appendix D: HTTP GET Request for Distance Data
Sample code for sending HTTP GET requests from the Raspberry Pi Pico W to control the relay based on the distance measurement.
Explains the process of sending distance data and triggering relay actions via Wi-Fi.
Appendix E: Circuit Diagram for Sensor and Relay Setup
Schematic diagram illustrating the wiring connections between the Raspberry Pi Pico W, HC-SR04 sensor, and relay.

Includes pin assignments for the ultrasonic sensor, relay control, and Raspberry Pi Pico W.

Appendix F: Wi-Fi Communication and Network Setup

Step-by-step guide to configuring the Wi-Fi network for the Raspberry Pi Pico W and ensuring smooth communication between the sensor and relay control system.

Details setting up the Pico W as a Wi-Fi access point or client and managing HTTP requests.

Appendix G: System Testing and Calibration Data

Logs and data from system testing, including distance measurements from the HC-SR04 sensor and corresponding relay actions.

Includes example outputs and troubleshooting results during testing.

Appendix H: Performance Evaluation and Feedback

Feedback from mentors and peers evaluating the project, including technical achievements, problem-solving skills, and overall contribution.

Includes performance reviews and key highlights of project milestones.

Appendix I: Final Project Demonstration Video

A link to or description of the final demonstration of the system, showing the Raspberry Pi Pico W controlling the relay based on sensor data.

Provides visual evidence of the working system, showcasing real-time relay control based on measured distances.