UNIVERSITY MALAYSIA TERENGGANU
FACULTY OF OCEAN ENGINEERING TECHNOLOGY & INFORMATICS

[CSM3313]
INTERNET OF THINGS (IOT)

PROJECT REPORT
(Wifi Manager)

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[*MOBILE COMPUTING*]
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Executive Summary: ESP32 WiFi Manager for Seamless Connectivity to Multiple Access Points

Introduction:
The ESP32 WiFi-Manager is a cutting-edge solution designed to enable seamless connectivity between an ESP32 microcontroller and multiple access points on different networks. It provides a hassle-free way to manage WiFi connections, allowing users to easily switch between access points without the need for reconfiguration. With its intuitive interface and robust functionality, the ESP32 WiFi Manager offers a reliable and efficient solution for IoT applications and connected devices.

Key Features and Benefits:
1. Multiple Access Point Support: The ESP32 WiFi Manager empowers ESP32-based devices to connect to different access points on various networks. This versatility allows for smooth transitions between different WiFi environments, ensuring uninterrupted connectivity.

2. Automatic Network Selection: By leveraging advanced algorithms, the WiFi Manager automatically selects the most suitable access point based on predefined criteria such as signal strength, security protocols, and user preferences. This eliminates the need for manual intervention and optimizes the connection process.

3. User-Friendly Configuration: The WiFi Manager simplifies the configuration process by providing an intuitive interface accessible via a web browser or a mobile application. Users can easily scan and select available access points, enter credentials, and manage network settings with minimal effort.

4. Dynamic Reconfiguration: With the ESP32 WiFi Manager, reconfiguration of network settings is a breeze. Users can effortlessly update WiFi credentials or switch to a different access point through the management interface, eliminating the need for hardware modifications or complex programming.

5. Robust Security: The WiFi Manager ensures secure connections by supporting various encryption protocols, including WPA2, WPA3, and enterprise-level security standards. It also incorporates authentication mechanisms to protect against unauthorized access, ensuring the integrity and privacy of data transmissions.

6. IoT Integration: The ESP32 WiFi Manager is specifically tailored for IoT applications, making it an ideal choice for smart home automation, industrial monitoring, and other connected devices. It seamlessly integrates with existing IoT frameworks, enabling easy deployment and interoperability.

7. Extensibility and Customization: The WiFi Manager offers flexibility for developers to extend its capabilities and customize the user interface to suit specific requirements. This empowers

users to tailor the solution to their unique networking needs while maintaining a user-friendly experience.

INTRODUCTION

The ESP32 WiFi Manager is a revolutionary solution designed to address the challenges faced by ESP32 microcontroller users when connecting to multiple access points on different networks. This innovative tool simplifies the process of managing WiFi connections, providing a seamless experience for IoT applications and connected devices. By offering an intuitive interface and advanced functionality, the ESP32 WiFi Manager ensures uninterrupted connectivity and empowers users to effortlessly switch between access points without the need for reconfiguration.

PROBLEM STATEMENT

Connecting an ESP32 microcontroller to multiple access points on different networks can be a cumbersome and time-consuming task. Each time a user wants to switch networks, they must manually reconfigure the WiFi settings, which is inconvenient and may require technical expertise. Moreover, the absence of an efficient mechanism to automatically select the most suitable access point further complicates the process. This results in connectivity disruptions, increased user intervention, and limits the seamless integration of ESP32 devices into various network environments.

OBJECTIVES

1. Simplify WiFi Management: The primary objective of this project is to develop an ESP32 WiFi Manager that simplifies the management of WiFi connections. By providing a user-friendly interface and streamlined configuration process, the WiFi Manager aims to eliminate the need for complex manual intervention, reducing the time and effort required to connect ESP32 devices to different access points.

2. Enable Seamless Network Transitions: The WiFi Manager should facilitate seamless transitions between multiple access points. It should automatically select the most suitable access point based on predefined criteria such as signal strength, security protocols, and user preferences. This objective ensures uninterrupted connectivity and enhances the user experience by eliminating the need for manual reconfiguration.

3. Enhance Security and Authentication: Security is a critical aspect of WiFi connectivity. The WiFi Manager should support robust encryption protocols such as WPA2, WPA3, and enterprise-level security standards to protect against unauthorized access and ensure the integrity and privacy of data transmissions. Additionally, it should incorporate authentication mechanisms to further enhance security measures.

4. Foster IoT Integration: The project aims to develop a WiFi Manager specifically tailored for IoT applications. The WiFi Manager should seamlessly integrate with existing IoT frameworks,

enabling easy deployment and interoperability. This objective allows IoT developers and businesses to leverage the power of the ESP32 microcontroller for their connected devices and applications.

5. Promote Extensibility and Customization: The WiFi Manager should be designed to be extensible and customizable. Developers should have the flexibility to extend its capabilities and customize the user interface to suit specific networking requirements. This objective empowers users to tailor the WiFi Manager to their unique needs while maintaining a user-friendly experience.

By addressing these objectives, the ESP32 WiFi Manager project aims to provide a comprehensive and efficient solution for managing WiFi connections on ESP32 microcontrollers, enabling seamless connectivity to multiple access points on different networks.

PROPOSED SOLUTION

To address the challenges of connecting ESP32 microcontrollers to multiple access points on different networks, we propose the development of an advanced ESP32 WiFi Manager. This solution will provide a seamless and user-friendly experience, simplifying the management of WiFi connections and ensuring uninterrupted connectivity. The proposed solution consists of the following key components and features:

1. Intuitive Web Interface:
The WiFi Manager will feature an intuitive web-based interface accessible through a web browser or a mobile application. Users can easily navigate through the interface to configure and manage their WiFi connections. The interface will provide clear instructions and visual cues to guide users through the process, making it accessible to both technical and non-technical users.

2. Multiple Access Point Support:
The WiFi Manager will support connections to multiple access points on different networks. Users will be able to scan for available access points and select the desired network from a list. The WiFi Manager will remember the configured access points, allowing for quick and seamless switching between networks without the need for reconfiguration.

3. Automatic Network Selection:
To simplify the process of connecting to access points, the WiFi Manager will incorporate intelligent algorithms for automatic network selection. It will evaluate factors such as signal strength, security protocols, and user preferences to automatically choose the most suitable access point. This feature eliminates the need for manual intervention and ensures optimal connectivity.

4. Dynamic Reconfiguration:
The WiFi Manager will provide a dynamic reconfiguration feature, allowing users to easily update WiFi credentials or switch to a different access point. Through the web interface, users can modify network settings on the fly without the need for hardware modifications or complex programming. This flexibility ensures hassle-free connectivity management for ESP32 devices.

5. Robust Security Measures:
Security is a paramount concern for WiFi connections. The WiFi Manager will support industry-standard encryption protocols such as WPA2, WPA3, and enterprise-level security standards. It will also implement authentication mechanisms to protect against unauthorized access. These security measures will ensure the confidentiality and integrity of data transmissions.

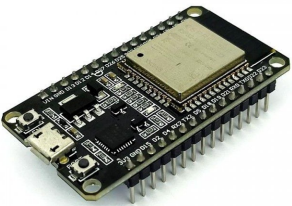6. Integration with IoT Frameworks:
The WiFi Manager will be designed to seamlessly integrate with existing IoT frameworks and platforms. It will provide compatibility with popular IoT protocols, enabling easy deployment and interoperability with other IoT devices and services. This integration will enhance the capabilities of ESP32-based IoT applications and facilitate their integration into larger IoT ecosystems.

7. Extensibility and Customization:
To cater to diverse user requirements, the WiFi Manager will be designed to be extensible and customizable. Developers will have the flexibility to extend its functionality and integrate additional features based on specific project needs. The web interface will also support customization options, allowing users to personalize the WiFi Manager to their preferences.

By implementing these features and functionalities, the proposed ESP32 WiFi Manager provides a comprehensive solution to the challenges faced when connecting ESP32 microcontrollers to different access points on various networks. It offers a user-friendly experience, seamless network transitions, robust security, and integration with IoT frameworks, ultimately enabling efficient WiFi management for ESP32-based devices in diverse IoT applications.

IOT COMPONENT

No	Device Name	Figure
1	ESP32	
2	Wire	
3	Cable	

FLOWCHART
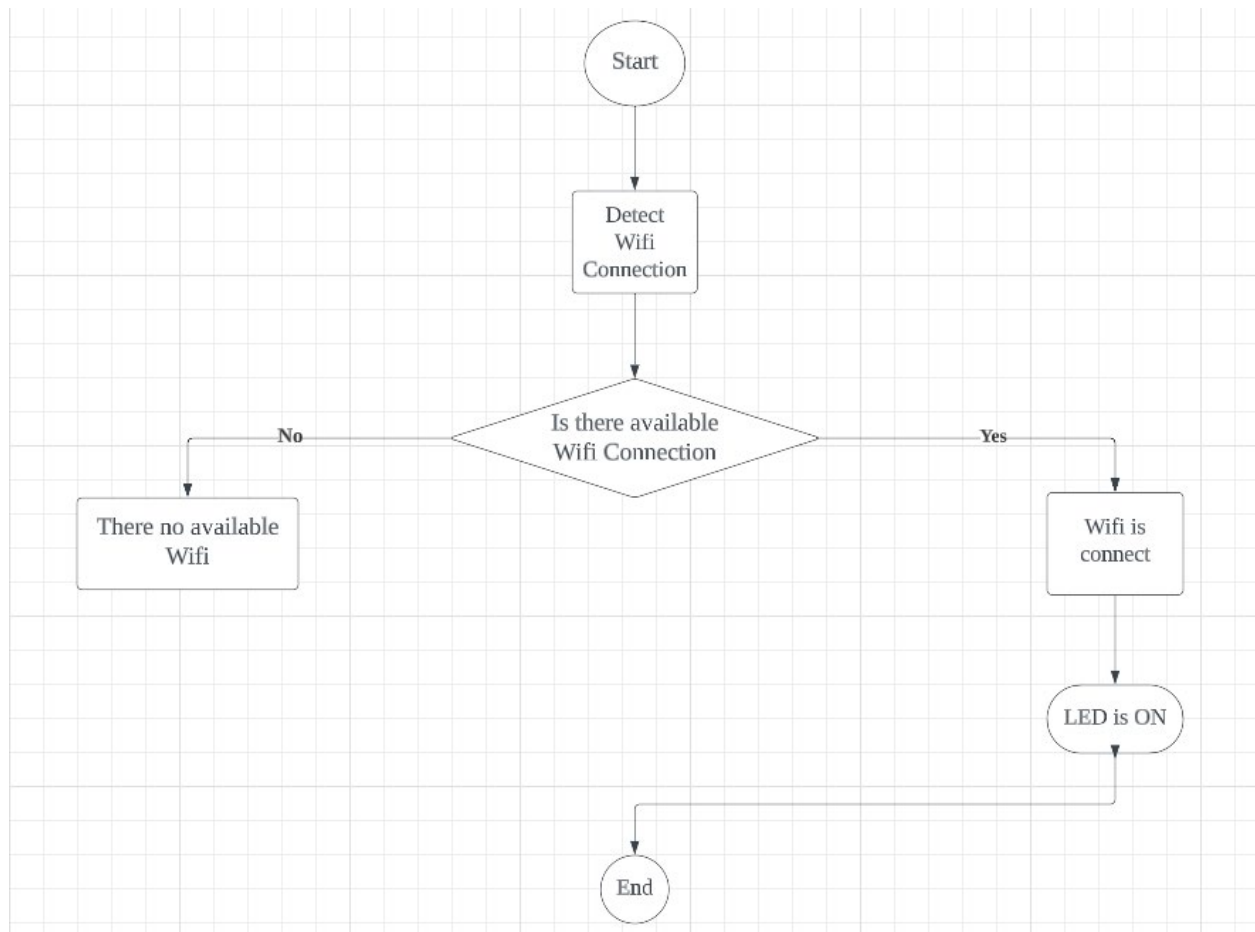
This flowchart shows how the wifi manager works. First, it will detect available Wifi around us then it will show the available wifi. If the wifi is connected LED will turn on to show that the wifi has been connected. If there were no available wifi LED will not turn on.
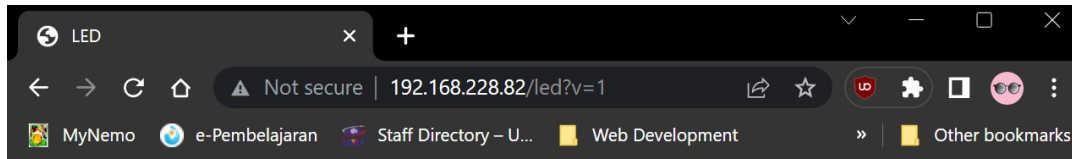
RESULT AND DISCUSSION:

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WIFI

LED

Favoriot

LED

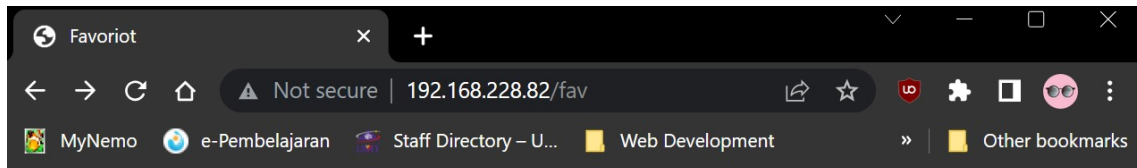## GPIO: OFF

ON OFF

Index

192.168.228.82/led?v=1

WLAN

SSID: None

Galaxy Note20 Ultra 5G4fc9 ⌄
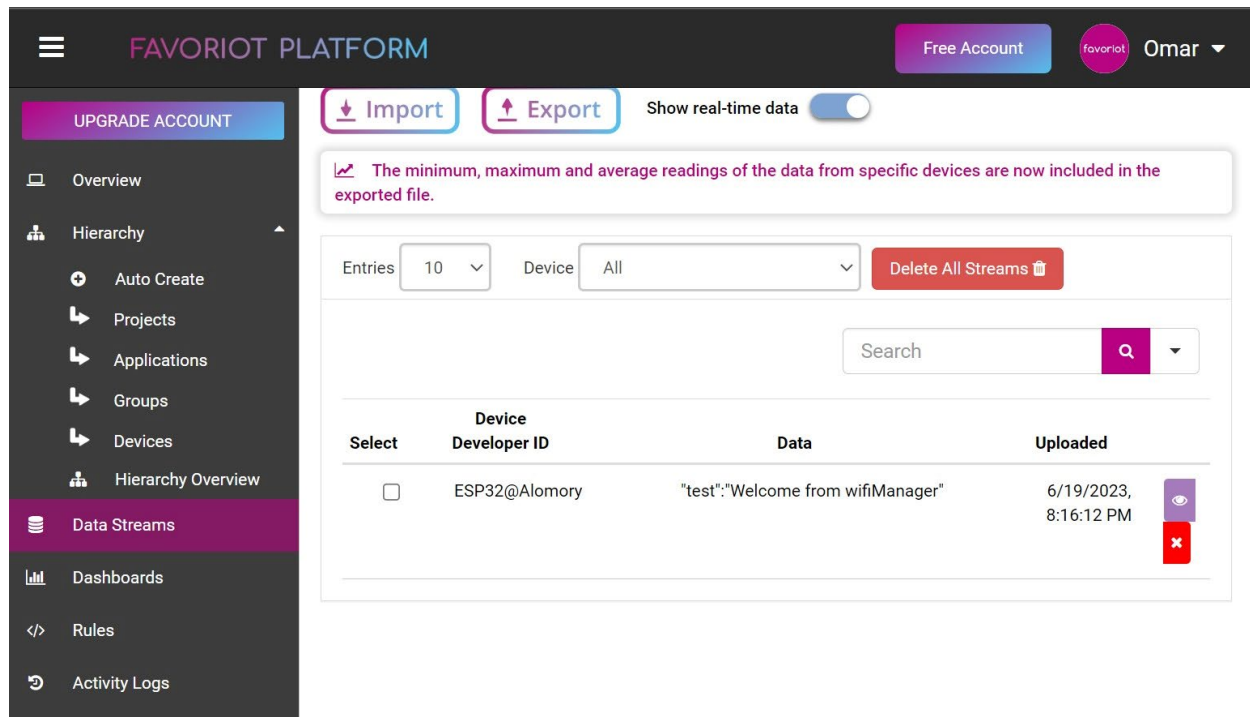
••••••••

Submit

Index

← → C ⌂ ⚠ Not secure | 192.168.228.82/fav

Favoriot

IKv8wVWkBH7G8z2Hxn1Tl

ESP32@Alomory

Welcome from wifiManager

Submit

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Link for Source Code:

https://github.com/citawarisan/fwinism

Link for Presentation Slide:

https://www.canva.com/design/DAFmQEAKuoQ/7gOesaOtASNKee39wGIWmQ/edit?utm_content=DAFmQEAKuoQ&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton

Link for the Video:

https://drive.google.com/file/d/1rfIZ5Wyuw8pfEZAFOiBxPl7NAgy6xMXN/view?usp=sharing

Introduction:
In the era of Internet of Things (IoT), the need for reliable and efficient connectivity solutions has become paramount. For ESP32 microcontroller users, connecting to multiple access points on different networks can be a cumbersome and time-consuming process. However, the development of an advanced ESP32 WiFi Manager offers a promising solution. This essay explores the benefits and considerations surrounding the proposed WiFi Manager, which aims to simplify WiFi management, enhance the user experience, prioritize security, foster IoT integration, and provide flexibility for customization.

Simplifying WiFi Management:
The proposed WiFi Manager revolutionizes the way ESP32 microcontrollers connect to different access points on various networks. Through its intuitive web interface, users can easily configure and switch between access points without the need for manual reconfiguration. This simplification empowers both technical and non-technical users, streamlining the process and eliminating frustration.

Enhancing User Experience:
One of the key features of the WiFi Manager is its automatic network selection capability. By intelligently evaluating factors such as signal strength and security protocols, the WiFi Manager ensures seamless connectivity. This removes the burden of manually choosing access points, providing users with a hassle-free experience and increasing productivity.

Prioritizing Security:
Security is a critical aspect of WiFi connectivity, and the WiFi Manager addresses this concern. It supports industry-standard encryption protocols such as WPA2, WPA3, and enterprise-level security standards. Additionally, the WiFi Manager implements authentication mechanisms, safeguarding against unauthorized access and ensuring the confidentiality and integrity of data transmissions.

Fostering IoT Integration:
In the ever-expanding world of IoT, the WiFi Manager's compatibility with popular IoT frameworks and protocols is a significant advantage. This seamless integration enables easy deployment and scalability within larger IoT ecosystems. Businesses and developers can leverage the power of ESP32-based devices for a wide range of IoT applications, opening doors for smart home automation, industrial monitoring, and more.

Flexibility and Customization:
The WiFi Manager offers extensibility and customization options, catering to specific project requirements. Developers can extend its functionality and integrate additional features, while users can personalize the web interface to suit their preferences. This flexibility ensures a tailored experience, accommodating diverse needs without sacrificing usability.

Maintenance and Updates:
To ensure optimal performance and security, regular maintenance and updates are crucial for the WiFi Manager. This includes addressing bug fixes, implementing new features, and staying up-to-date with evolving WiFi standards. By providing a mechanism for seamless updates and maintaining an active support system, the WiFi Manager can adapt to emerging needs and guarantee long-term success.

Compatibility and Interoperability:
In the interconnected world of IoT, compatibility and interoperability are vital. The WiFi Manager must seamlessly communicate and integrate with different devices, protocols, and

platforms. Collaboration and adherence to industry standards will foster interoperability, enabling users to leverage the full potential of the WiFi Manager within a cohesive ecosystem.

Conclusion:
The proposed ESP32 WiFi Manager represents a significant advancement in simplifying the connectivity of ESP32 microcontrollers to multiple access points on different networks. By streamlining WiFi management, enhancing the user experience, prioritizing security, fostering IoT integration, and providing customization options, the WiFi Manager empowers users to harness the capabilities of ESP32 devices in various IoT applications. With careful attention to security, compatibility, and maintenance, the WiFi Manager holds tremendous potential for revolutionizing the IoT landscape and advancing the way we connect and interact with smart devices.

CONCLUSION

The ESP32 WiFi Manager revolutionizes the way ESP32-based devices connect to multiple access points on different networks. Its comprehensive feature set, including multiple access point support, automatic network selection, user-friendly configuration, and robust security, enables seamless connectivity and enhances the user experience. By simplifying the management of WiFi connections, the WiFi Manager empowers IoT developers, businesses, and end-users to effortlessly harness the power of the ESP32 microcontroller for their connected devices and applications.

APPENDICES
Task Distribution among group members

Table below shows the lists of tasks distributed among team members throughout project.

Tasks	Members
1. Setup devices	Omar, Gary
2. Program code	Omar, Gary
3. Discussion on output obtained	Arun, Danial
4. Executive summary	Danial, Omar
5. Introduction	Danial, Gary
6. Problem statement	Danial, Gary
7. Objectives	Danial, Omar
8. Proposed solutions	Danial
9. Methodology	Danial, Gary
10. Result & discussion	Danial, Omar
11. Conclusion	Danial
12. Appendices	Arun

<u>REFERENCE</u>

1. Staff, C. (2022b, November 26). *Interfacing 16X2 LCD Module with ESP32 with and without I2C*. Circuit Schools. https://www.circuitschools.com/interfacing-16x2-lcd-module-with-esp32-with-and-without-i2c/
2. Instructables. (2017, September 20). *How to Make Arduino-Based Collision Detection Warning System*. https://www.instructables.com/Arduino-Based-Collision-Detection-Warning-System/
3. Thakkar, J., Jariwala, S., & Diwan, S. (2018). Smart Wi-Fi Manager for IoT Devices. In 2018 International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS) (pp. 2042–2046). IEEE. https://doi.org/10.1109/ICECDS.2018.8479442
4. T. D. (2017). Dynamic Web Configuration for ESP32-based IoT Device. In 2017 11th International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS) (pp. 416–421). IEEE. https://doi.org/10.1109/IMIS.2017.105