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Envision, Enable, and Empower
Smarter and Resilient Societies

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11th ERDT Conference
on Semiconductor and Electronics, Information and Communications Technology and Energy

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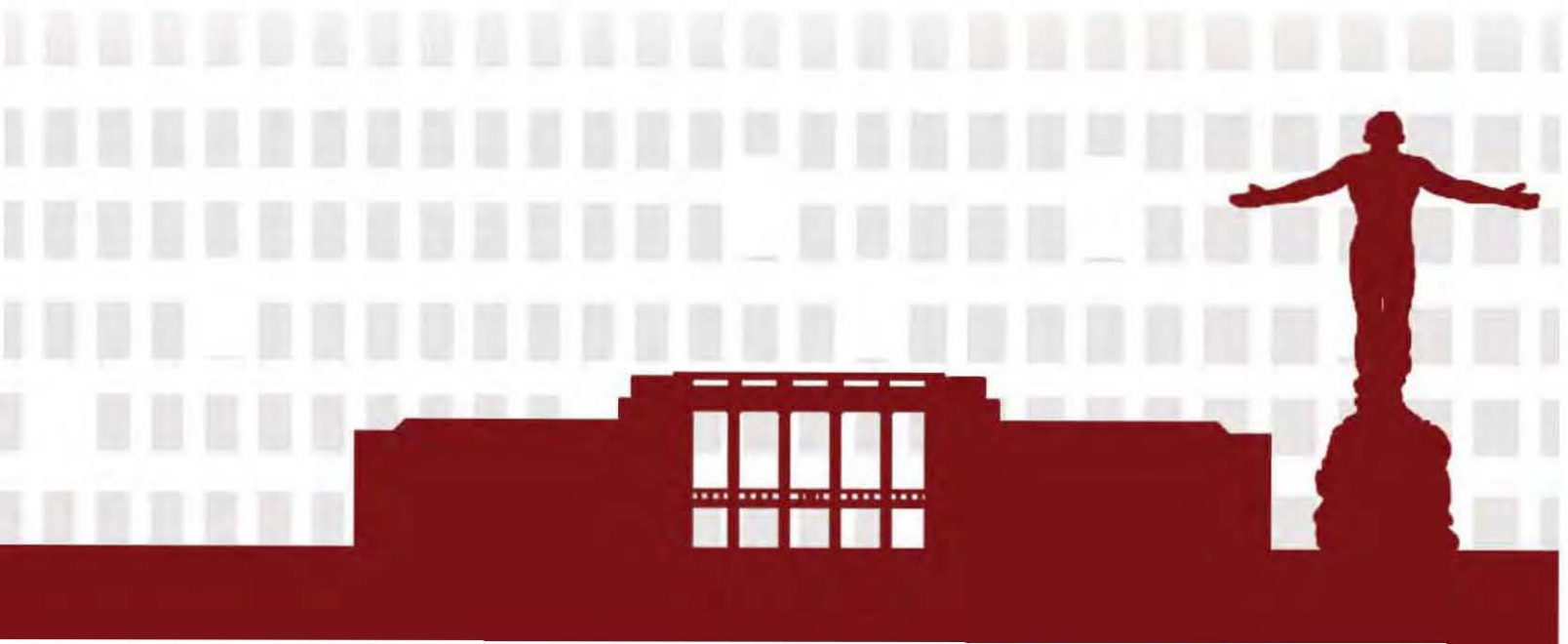
Metro Manila, Philippines



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AN ANDROID-BASED, RASPBERRY PI WIRELESS MESH NETWORK IMPLEMENTATION USING BATMAN-ADV PROTOCOL FOR FIRST-RESPONSE COMMUNICATIONS

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ABSTRACT

The Philippines' geographical location makes it prone to natural calamities, especially typhoons and earthquakes. In event of these disasters, communication is vital in performing rescues and saving lives. It is desired that first-response communications are fast and reliable to be able to perform those tasks. However, the Philippines is greatly lacking in this aspect. The country still relies on telecommunication infrastructures, which perform worse during disaster scenarios. Telecommunication infrastructures are unsuitable for first-response purposes because they are usually centralized; when the connection to the main node is down (usually due to snapped wires), the remaining nodes are rendered useless. Furthermore, when neighboring nodes are down, the remaining node is forced to cater to all the clients connected to it, which could lead to an overloaded and unreliable network. Wireless mesh networks have a potential to solve this problem; they are decentralized and are capable of rerouting and adjusting themselves to fit the situation.

In this study, we devised an alternative low-power, reliable, cheap, and decentralized wireless mesh network. We used messaging with both direct and chatroom methods as our communication platform, and added message caching in order to add to reliability. To handle the messaging and caching, we created an Android application to accompany the network. The scope of the study was limited to four nodes and two Android phone clients.

To create the network, we used four Raspberry Pi nodes connected via ad-hoc connection, with one Raspberry Pi node connected to the internet. [1][2] The network utilized the Better Approach To Mobile Ad-Hoc Networking (BATMAN-adv) [3] protocol to handle the routing of the nodes and their messages. Furthermore, the network nodes acted as Message Queuing Telemetry Transport [4] brokers to handle the tagging the messages and bridging to the other nodes' brokers. Using the MQTT protocol, chat communication was tested and implemented bidirectionally. The Android application was responsible for providing the interface where the clients will interact as well as the caching of the messages. We tested the network to be able to message other clients within the local area network first. Afterwards, we checked if the messages were forwarded to the node with internet and if they arrived at the internet broker.

Using this project, we have proven that a low-powered, reliable, and cheap wireless mesh network using Raspberry Pis can be made. The network was able to perform the sending and caching messages successfully. The messages were successfully cached such that each Raspberry Pi can distribute the messages. We accomplished this by utilizing the topic hierarchy feature of the MQTT protocol to devise a tagging system for the messages. Furthermore, the decentralization of the nodes made the network reliable; broken nodes were ignored and the messages were rerouted to be able to reach their destination successfully.

We were able to create an alternative to infrastructure networks whenever disasters occur. We also addressed issues of reliability, overloading, and power consumption. The wireless mesh network formed was able to perform well when nodes were added and removed. Communication can easily be done using the Android application where messages can be sent and received; caching was implemented so that messages can be seen by clients whenever they are available.

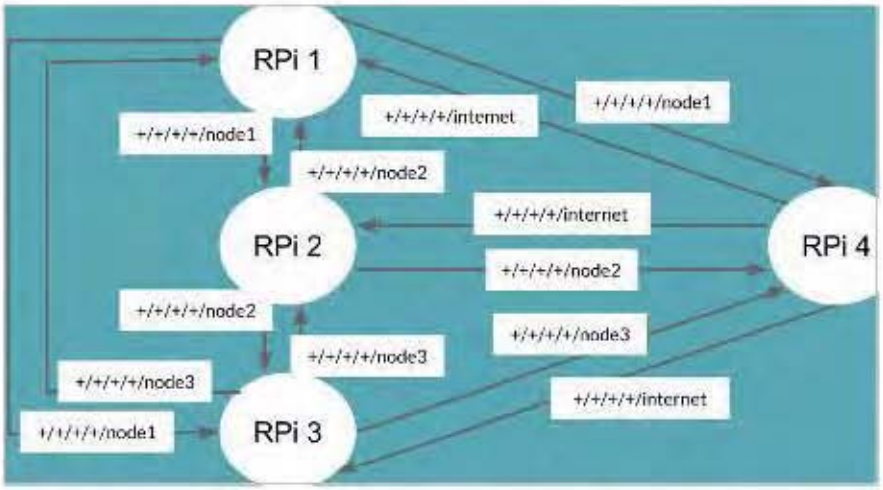

Figure 1. The devised tagging convention for the messages and their corresponding nodes

For future studies, we recommend that the network be deployed in an actual community to test if it can handle the load. We also suggest creating an iOS version to increase reliability and usability. Finally, we recommend that a tagging automation system be developed so that additional nodes' messages can be tagged automatically.

Keywords: Android, BATMAN-adv, MQTT, Wireless Mesh Netwrok

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