ENERGY EFFICIENT WIFI REPEATER

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ENERGY EFFICIENT WIFI REPEATER

NUR ATIKAH BINTI MOHD YUSOF

This report is submitted in partial fulfilment of the requirements for the Bachelor of Computer Science (Computer Networking)

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2015

DECLARATION

I hereby declare that this project report entitled

ENERGY EFFICIENT WIFI REPEATER

is written by me and is my own effort and that no part has been plagiarized without citations.

STUDENT : _____ Date: _____

(NUR ATIKAH BINTI MOHD YUSOF)

SUPERVISOR: _____ Date: _____

(DR NORHARYATI BINTI HARUM)

DEDICATION

To my beloved parents Mohd Yusof Abdullah and Nik Salmah Binti Nik Aziz, to my twin sister Nur Afifah, my brothers Muhammad Izham and Muhamad Ikmal. To my supervisor Dr Norharyati Harum, thank you for the ideas and guidance.

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Alhamdulillah, Thanks to Allah SWT, whom His willing give me the opportunity to complete this Final Year Project. The title of this project is Energy Efficient WiFi Repeater. This final year project report was prepared for Faculty of Information and Communication Technology (FTMK), Universiti Teknikal Malaysia Melaka (UTeM). This report is based on the references format given by the university.

Firstly, I would like to express my thanks to my supervisor, Dr Norharyati Harum for the inspirational and guidance during this project scheduled. My deepest thanks and appreciation to my parents, siblings and friends for their support, constructive suggestion and encouragement from begin until this project completed.

ABSTRACT

A wireless repeater also called wireless range extender takes an existing signal from a wireless router or wireless access point and rebroadcasts it to create a second network. When two or more hosts have to be connected with one another over the IEEE 802.11 protocol and the distance is too long for a direct connection to be established, a wireless repeater is used to bridge the gap. The Raspberry Pi is a credit card sized minicomputer developed by the Raspberry Pi Foundation with the intention of promoting basic computer science in schools. The Raspberry Pi can work to any Linux kernel operating system such as Linux, Raspbian, Debian and vice versa.

The methodology used in this project is System Development Life Cycle (SDLC) because all the process involved in this project is similar to SDLC approach. This project is to develop energy efficient Wifi Repeater using Raspberry Pi. To complete this project it involves 2 processes that catch the original wireless signal to act as a Wifi Repeater such as connecting to existing wireless LAN (WLAN) network and broadcasting a new WLAN network. This project used 2 USB dongle to setup and configured this process. The result from this project consists of a product and the result analysis. The product can performs when a Mobile Station (MS) access the wireless connection out of the Aceess Point (AP) coverage be able to connect to the wireless connection using the WiFi Repeater. The signal strength received by MS of the Wifi Repeater will be compare with the conventional AP.

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LIST OF ABBREVIATIONS

MS	:	Mobile Station
AP	:	Access Point
DHCP	:	Dynamic Host Configuration Protocol
SSID	:	Service Set Identifier
MAC	:	Media Access Control
WLAN	:	Wireless Lan
NAT	:	Network Address Translation
SDLC	:	System Development Life Cycle
SoC	:	System on Chip
VGA	:	Video Graphic Array
HDMI	:	High Definition Multimedia Interface
dBm	:	deciBel milliwatts

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CHAPTER I

INTRODUCTION

1.1 Introduction

A wireless Repeater [1] (also called wireless range extender) takes an existing signal from a wireless router or wireless access point and rebroadcasts it to create a second network. When two or more hosts have to be connected with one another over the IEEE 802.11 protocol and the distance is too long for a direct connection to be established, a wireless Repeater is used to bridge the gap. It can be a specialized standalone computer networking device.

The Raspberry Pi [2] is a credit card sized minicomputer developed by the Raspberry Pi Foundation with the intention of promoting basic computer science in schools. It uses Broadcom SoC, a 700MHz ARM11 processor handles basic computations which is inputs outputs and calculations. The Raspberry Pi was originally designed to teach kids computer and programming skills without the need for expensive computer labs. The Raspberry Pi has a network interface, GPIO's, USB interfaces and a HDMI interface that can support any applications such as media streaming

box, network file storage and game emulator. The Raspberry Pi can work to any Linux kernel operating system such as Linux, Raspbian, Debian and vice versa.

In this project we develop energy efficient Wifi Repeater using Raspberry Pi. To complete this project it involves 2 processes that catch the original wireless signal to act as a Wifi Repeater such as connecting to existing wireless LAN (WLAN) network and broadcasting a new WLAN network. Besides that, the purpose of this project is to verify the functionality of the developed Wifi Repeater and analyse the signal strength received by mobile station (MS) of the Wifi Repeater and compare the result with the conventional Access Point (AP).

1.2 Problem Statement (PS)

Table 1.1: Summary of Problem Statement

PS	Problem Statement
PS1	Wifi signal strength degrades when MS move away from AP and no signal received by MS for out of coverage area.
PS2	The current AP devices are static and using high power.

1.3 Project Question (PQ)

Table 1.2: Summary of Problem Question

PS	PQ	Project Question
PS1	PQ1	How can WiFi Repeater help MS that located far away from AP to receive wifi signal.
PS2	PQ2	How can tools such as Raspberry Pi help in this project?

1.4 Project Objective (PO)

Table 1.3: Summary of Problem Objectives

PS	PQ	PO	Problem Objective
PS1	PQ1	PO1	To develop WiFi Repeater to help MS that located far away from AP to receive wifi signal.
PS2	PQ2	PO1	To study that if the tool such as Raspberry Pi can perform as WiFi Repeater.
		PO2	To validate that portability of proposed WiFi Repeater are better than the current AP.

1.5 Scope

The scopes for developing this project are:

1. This project will use Raspberry Pi as minicomputer to build the product because it is a new device to be explored.
2. The WiFi dongle used to connect the wireless signal from existing network to create a new WLAN interfaces.
3. Any user devices can connect to wireless using this product in specific area of wireless coverage.

1.6 Project Significance

This project will be going to help user devices to connect to the network connection through wireless connection because in this era's everybody needs the internet. Instead by buying any AP devices, build a product using raspberry pi and react as a WiFi Repeater can helps the user about the cost because the raspberry pi are cheaper than new brand AP.

1.7 Expected Result

The result from this project consists of a product and the result analysis. The product can performs when a MS access the wireless connection out of the AP coverage be able to connect to the wireless connection using the raspberry pi WiFi Repeater. The signal strength received by MS of the Wifi Repeater will be compare with the conventional AP.

1.8 Conclusion

As a conclusion, this project was developed to build a new product using Raspberry Pi and make a result analysis to compare about the signal strength with current AP.

From this chapter, the project background, problem statement, objectives, scope, project significance and expected result are being identified in order to develop the project.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

This chapter will discuss about literature review of the related published information with this project. All the information and discussion regarding Raspberry Pi, Wireless Access Point, and Repeater is collected from various related conference papers. A wireless Repeater having an integrated displays that concurrently displays a receive signal level, a transmit signal level and repeat wireless signals. The purposed of this chapter are to collect all the information and find a best solution to solve a previous work that related to this project.

2.2 Related Work/Previous Work

2.2.1 Raspberry Pi

Eben Upton formed the Rasberry Pi Foundation and designed a BCM 2835 into series of Broadcom chips. Raspberry Pi is a cheap mini-computer yet reassembles the real computer designed based on the series of Broadcom chips. It uses Broadcom SoC, a 700MHz ARM11 processor handles basic computations input outputs and calculations. Operating systems are mainly ARM-Linux distributions and it comes with programming languages already installed. In Raspberry Pi, the programming languages that will use are Scratch and Python. The original model of Raspberry Pi has 512MB RAM, 2 USB ports and an Ethernet port [2].

2.2.2 Wireless Access Point

A wireless client in IEEE 802.11 wireless networks heavily depends on the client's ability to identify the Access Point (AP) that will offer the best service. The current AP affiliation mechanism implemented in most wireless clients is based on signal strength measurements received by the client from all the APs in its neighbourhood. The client then affiliates with the AP from which it receives the strongest signal [3]. It is well-known that such an algorithm can lead to sub-optimal performance, due to its ignorance of the load at different APs.

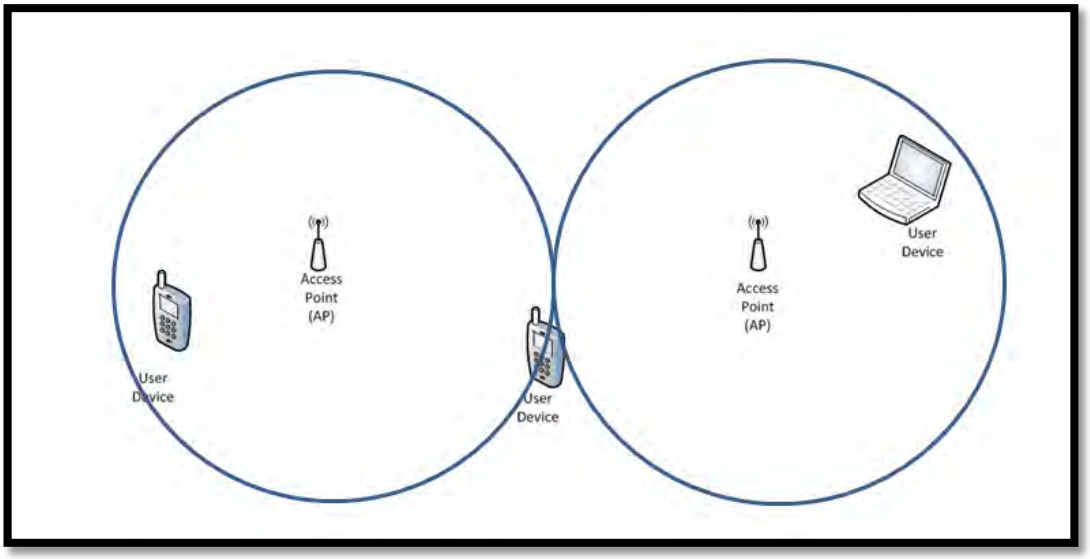

Figure 2.1: Access Point signal range and Clients

2.2.3 Wireless Repeater/ Signal Booster

A Repeater is responsible to boost or increasing wireless signal strength. If the Repeater in not functioning, a user then can move the Repeater around until the Repeater can capture the signals. When the Repeater is receiving a signal of acceptable signal strength and the Repeater is able to amplify and transmit the signal, the receive level may indicate an input signal strength and the transmit level may indicate an output signal strength. On the other hand the Repeater (also known as a wireless range extender) is built for one specific purpose. It's built to fetch and repeat the signal as strongly as possible and generally will get a better connection than your standard wireless adapter. It really depends on how the Repeater was set up. If the Repeater was configured with a different name (which is a new Service Set Identifier (SSID), users can connect between the two networks depending on where the users are. So really a wireless Repeater is just there to make the wireless even more flexible [4].

2.3 Previous Research

Based on the **Charles Severance (OCTOBER, 2013)** in his *Computing Conversations Column* article wrote why and how Eben Upton formed the Raspberry Pi Foundation [2]. The main purposed for build a cheap mini-computer yet reassemble the real computer is to show young generations what's actually inside the computer and to inspire them to write programs, create their own video games or even create any robotic projects. The Raspberry pi concepts are based on the series of Broadcom chips and they do all the software development process where decides on ARM-based Linux system for the raspberry pi platform and yet the BCM 2835 already had all the features such as support for HDMI, standard display, a video and 3D accelerator, a camera processor, digital signal processors and a USB controller.

This project is designed to create such a Wi-Fi and build a low cost server using off-the shell, low cost hardware and open source software. This project used Raspberry Pi as the CPU because the features of the Pi. Besides that, this project used IEEE 802.11 Network Service as a device to propagate network around a specific area and to provide DHCP server that will connect other Wi-Fi devices in range.

Marc Cieslak [5] was reported that UniNet as an internet provider for South African has set up a system of base station (BS) or mobile station (MS) that will provide Wi-Fi signal around the coastal town of Knysna. For the community access purposed, with the help of municipal authorities installed computers in places the whole community has access to. In this project, the new method purposed was to build a growing infrastructure using cellular system such as Repeater and growing the number of Wi-Fi hot spots.

John Cheong Wai Ngan [6] was claims that when a wireless device is positioned in a cell, the wireless device and the BS can communicate each other in various channels through the radio frequency air interfaces. With the

growth in number of MS that using wireless communication there can cause some problems. The cellular wireless communication can suffer from varying levels of degraded as signals are carried over the air interface between wireless devices and MS. The approach that was used to increase wireless signal strength within a building is to provide a distributed antenna. For example hub is connected via wired to one or more Repeater. The hub transmits the radio frequency signal from base station to the Repeater via the wired.

WiFi Repeater is the devices that help to increase the signal of current AP signal. The tool use to build this product is a mini-computer Raspberry Pi. Based on the previous work, Raspberry Pi has compatibility as a real computer and it has used by many other networking projects.

2.4 Critical review of current problem and justification

Table 2.1: The critical review of current problem and justification

No	Research Title	Purpose	Description	Problem
1	Why and how Eben Upton formed the Raspberry Pi Foundation [1].	Raspberry Pi product was designed to give young generation an experience and learn what actually computer is and what there can do with a cheap mini-computer.	The concept based on Broadcom chips, same as any standard computer size. The BCM 2835 have all features that can act as a mini-computer.	Do Raspberry Pi mini-computer have the capability to manage the load works as a real computer size?
2	Village Wireless LAN', A Low Cost Network	To build a solar powered, low cost, fully fledged	Because of the growth in technology in that area, the ITU	Do Raspberry Pi mini-computer