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Development of Rasberry Pi 3 Content Filtering and Ads Blocker

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KEYWORDS

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Ads Blocker
Raspberry Pi 3
Pi Hole

ABSTRACT

Malaysian Internet penetration rate has increased to 83% in January 2020 based on digital2020 report and most Internet Service Providers in Malaysia does not include content filtering in their package. A part of that, the main objective of this project is to develop a lightweight System-on-Chip (Soc) embedded appliance web content filtering and ads blocker using Raspberry Pi 3 namely Ras3Guard. It helps parents to control their children internet access activities and can be integrated with smart home WiFi network. Finally, the performance of this appliance was evaluated and captured.

1.0 INTRODUCTION

The World Wide Web is growing at an exponential rate on daily basis and it is hard to keep track on the exact number of websites. Mostly, current web filtering products for home user are software based filters which the accuracy and efficiency are far from satisfactory. As such, there is a need for a more robust, small size and efficient approach for web content filtering. Solution should be affordable to the general public and homes users. Due to the busyness of work and daily tasks and lack of lightweight security product, parent does not have time to monitor their children's daily internet activities. With that situation, we took the opportunity to develop a lightweight product using Raspberry Pi 3 namely as Ras3Guard. Using this Ras3Guard, the parents can manage and monitor all the internet activities of their children easy and effectively without buying a third party expensive product. The main objective of Ras3Guard is to filter an unnecessary website, ads and also to control kids overuse the internet such as social media that can accessible only at certain times daily. The

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scope of the project focuses on content filtering and advertisements blocker for home user or small companies.

Several previous work has been done, (Joly et al., 2016) concentrated on creating Raspberry Pi to work as a transparent cache server with the smart phones enacting as the client. The author finding that the issues of streaming videos are ending up being more critical to customers as they pay for over-the-top substance yet, still experience exceptionally less than impressive streams. To get a quick response and decrease access latency, utilizing a cache memory is prudent. A transparent proxy cache server wipes out numerous disadvantage of ordinary methodology. Transparent proxy cache server can be conveyed in two levels, one at switch level and another at router level. The attention is primarily on http result reserve which stores URLs of Previously accessed query results. These caches might be deployed in various machines, acting about as a proxy cache cluster, or exists together in the same machine. In this proposed framework we introduce a straight forward web store middle server, to upgrade the execution. The only work to be done regarding the promise of content availability is continuous monitoring of the cache.

Other authors (Abdul Karim Gizni, 2015) reported about implementation Home Automation with NFC & Raspberry Pi. The author concentrated about build a practical home control system that works by the NFC technology at the lowest cost and highest efficiency possible. The Raspberry Pi not only kept the costs for constructing this project to a reasonable minimum, but it also maintained a much preferred level of simplicity. The idea of using an NFC contactless card reader succeeded in making sure that whoever chooses to apply this system in his office or home would rest assured that not only has he installed a safe and secure system, but also one that would never fail to protect his privacy. What with the widespread use of the Android OS, the Android application that is central to this project kept it edgy, futuristic, and easy-to-use and smooth-to-handle.

2.0 EXPERIMENTAL PROCEDURE

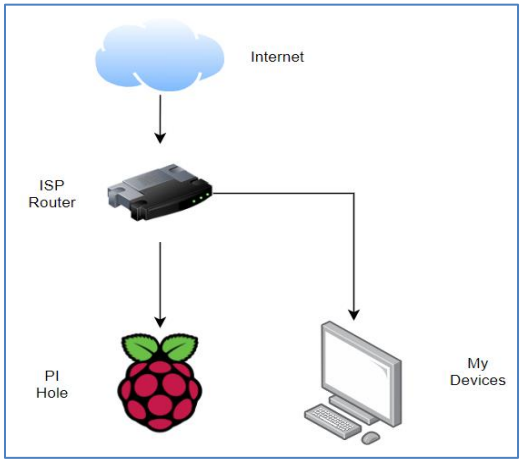

Figure 1: Block Diagram

Figure 1 showed the overall of block diagram and functionality of Raspberry Pi 3 as usable security features such as content filtering and ads blocker which is can connect by all portable devices and computer. The hardware and software that involved in this project listed below.

Hardware

a. Raspberry Pi 3 Model B
   Series of small single-board computers which is functions as Wireless Access Point that will be have three features added.

Figure 2: Raspberry Pi 3 Model B

b. USB Wi-Fi Dongle
   A device that adds wireless connectivity to a Raspberry Pi 3 to allow it to connect to a wireless system. Before the advent of consumer devices with built-in Wi-Fi connectivity, devices required the use of wireless adapters to connect to a network. USB Wi-Fi dongle often come in USB stick form, which must be plugged into a Raspberry Pi 3 device.

Figure 3: Wi-Fi Adapter

c. Ethernet Cable
   Ethernet cables connect devices within a local area network with Raspberry Pi for internet connection. This project will use standard type of cable which is CAT5.

Figure 4: Ethernet Cable

d. Power Adapter
Typically, the model B uses between 700-1000mA depending on what peripherals are connected. This project use standard charger android type USB Micro B to power up Raspberry Pi.

Figure 5: Power Adapter

e. Micro SD Card
Raspberry Pi 3 uses a micro SD card for storages (OS, libraries and user programs). This project use at least 16 GB storage on micro SD card. It place micro SD card into the slot on the back side Raspberry Pi.

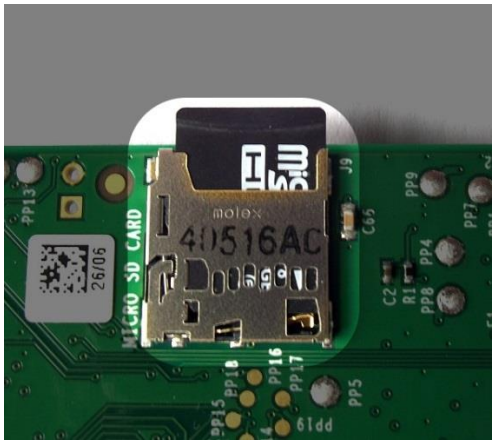

Figure 6: Micro SD Card

f. USB Keyboard and Monitor
Keyboard is used to configuration Raspberry Pi which is to setup the features while the monitor is to display a platform or Operating System to configure.

Figure 7(a)

Figure 7(b)

Figure 7(a): Keyboard and 7(b): Monitor

Software

a. Pi Hole Software
Pi-hole is a Linux network-level advertisement and Internet tracker blocking application which acts as a DNS sinkhole and optionally a DHCP server, intended for use on a private network. It is designed for use on embedded devices with network capability, such as the Raspberry Pi, but it can be used on other machines running Linux and cloud implementations. Pi-hole can block traditional website advertisements as well as advertisements in unconventional places, such as smart TVs and mobile operating system advertisements.

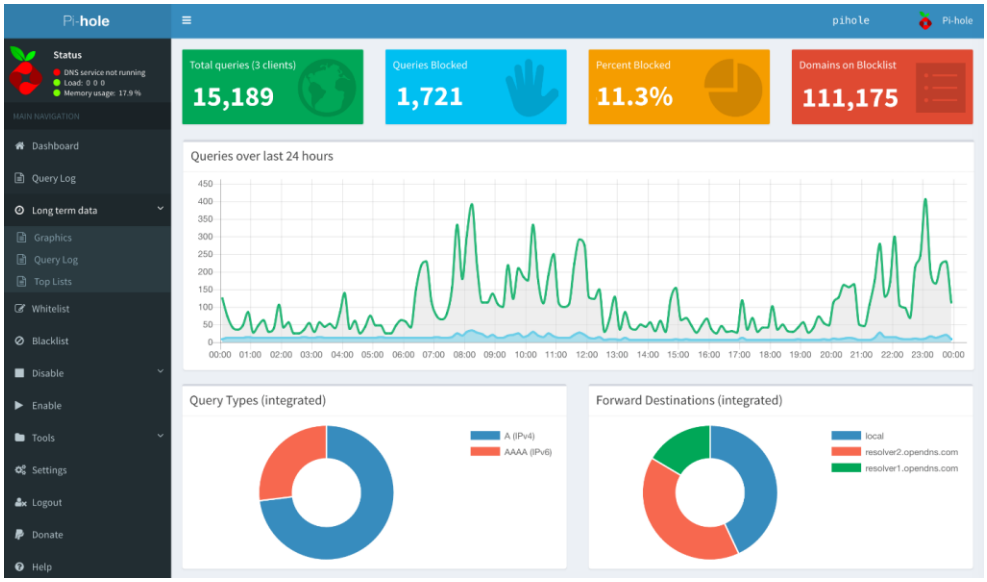

Figure 8: Pi Hole Software

b. Raspbian Stretch Lite

Raspbian is a Debian-based computer operating system for Raspberry Pi. There are several versions of Raspbian including Raspbian Stretch and Raspbian Jessie. Since 2015 it has been officially provided by the Raspberry Pi Foundation as the primary operating system for the family of Raspberry Pi single-board computers. Raspbian uses PIXEL, Pi Improved X-Window Environment, Lightweight as its main desktop environment as of the latest update.

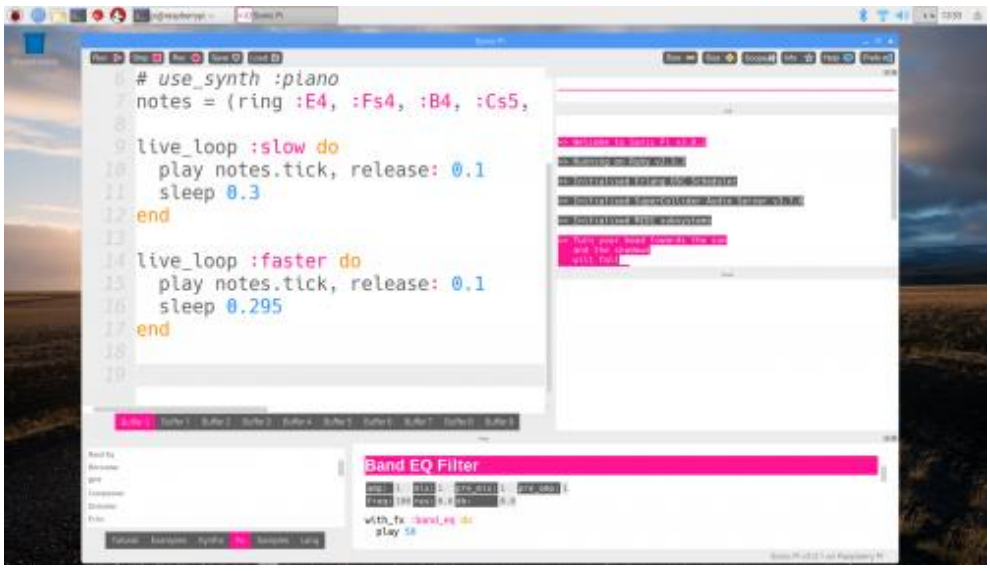

Figure 9: Raspbian Stretch Lite

3.0 RESULTS AND DISCUSSION

In order to have the expected result from this project, the right implementation of the hardware and software must be done according to the proposed method. Thus, the projects have done the analysis in order to gather the information as well as making a conclusion based on the findings. In addition, the researcher will analyzed the functioning content filtering and ads blocker of any websites available. These are to ensure the websites that have been blocked cannot be reaching or advertisements not pop out on website.

The content filtering and ads blocker device was developed by using Pi hole software. After developing the Pi hole software, the final test is needed where it will test to blocking websites and advertisements. This project devices control by admin such as parents or employer where they can choose to block any websites that not suitable for their kids or when on employee time works. For ads blocker, client not necessary to download any ads blocker software on their devices because when connect to raspberry pi it will on automatically for all client. Owner of the prototype (admin) also can check, configure and control the prototype in the web interface. Admin can check who is connected to this prototype. Admin also can monitor the data usage status, speed and etc. Admin can change their name if needed.

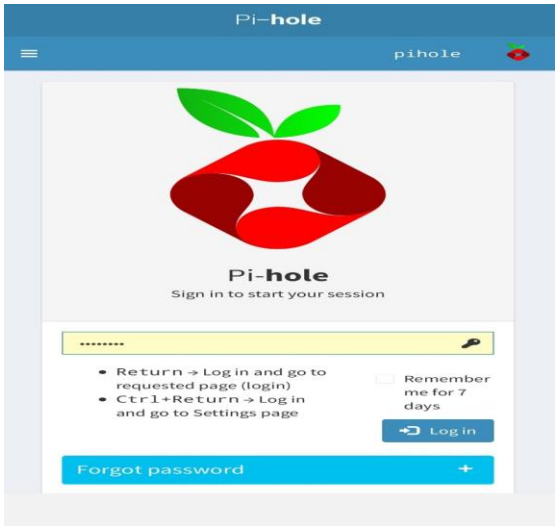

Figure 10: Admin Authorization

To show web interface, admin just enter the IP address of raspberry pi and figure 10 will show. Only admin know the password so the other users hard to get access and make the interface more secure.

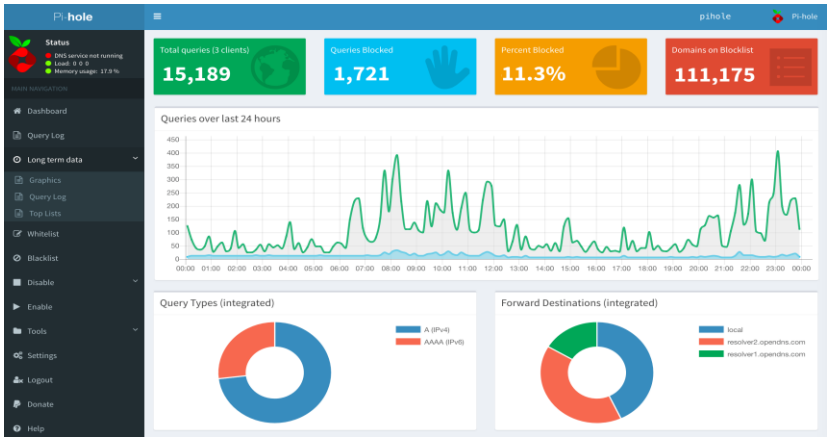

Figure 11: Web Interface Dashboard

Figure 11 shows the dashboard when admin sign in the admin authorization. Its show the result queries and domain been blocked. Plus, admin can analysis the graph of queries by day or month.

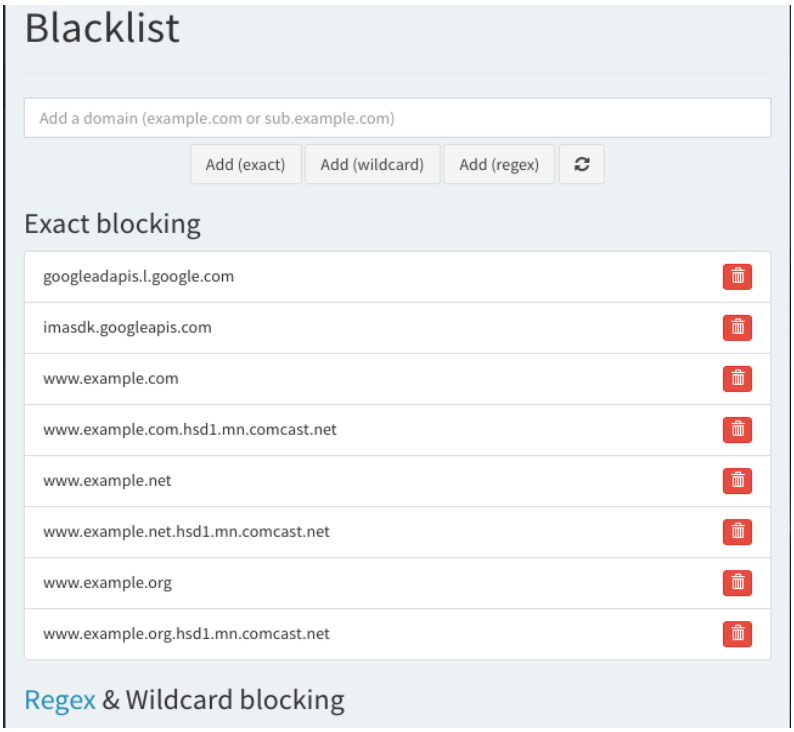

Figure 12: Blocking List Site

Admin also can add website to block by adding domain name as shown in Figure 12 and Whitelist also available to be add. Admin can monitor the queries result from all clients as shown in Figure 13 and also can choose from here to whitelist or blacklist the websites.

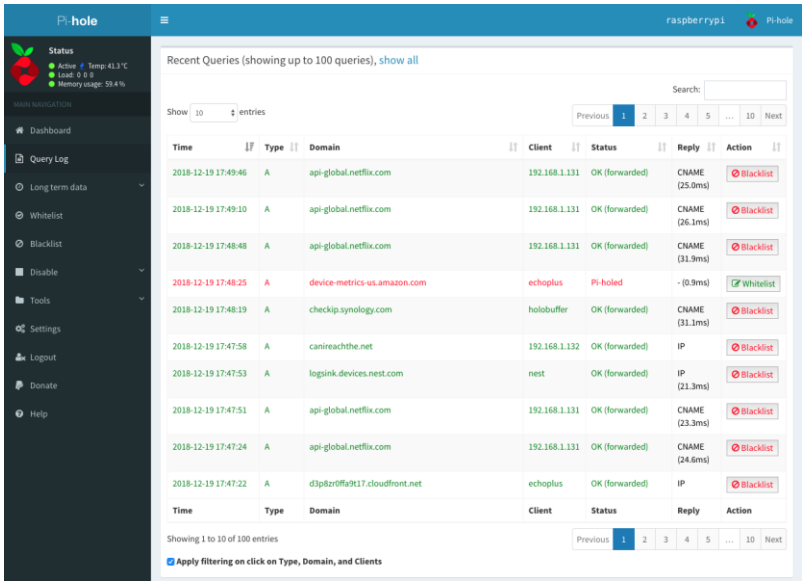

Figure 13: Queries Monitoring

4.0 CONCLUSION

All objectives of this project which is to develop an affordable and lightweight security device, to filter an unnecessary websites and ads, and to control a kids or employees overuse the internet for unhealthy activity is successful. This project use Pi Hole as a software engine that installed in Raspberry Pi 3. It works well as a content filtering and ads blocker. Future work include instead of using Pi Hole, use AdGuard Home and Raspberry Pi 4 because it has more features and high performance can be achieved. It also could be upgraded to second generation by adding Bro IDS that can detect if have malware-infected computer on home network. So it can strengthen the security on network.

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