

The Ultimate Raspberry Pi

by

Patrick McIntosh, Sudin Pradhan & Andrew Remick

Submitted to
the Faculty of the School of Information Technology
in Partial Fulfillment of the Requirements for
the Degree of Bachelor of Science
in Information Technology

© Copyright 2016



Andrew Remick

April 20th, 2016



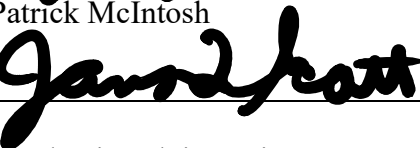
Sudin Pradhan

April 20th, 2016



Patrick McIntosh

April 20th, 2016



Academic Advisor: Jim Scott

April 20th, 2016

The author grants to the School of Information Technology permission to reproduce and distribute copies of this document in whole or in part.

University of Cincinnati
College of
Education, Criminal Justice, and Human Services

April 2016

Table of Contents

Abstract.....	3
1. Introduction.....	4
2. Project Description.....	4
3. Problem.....	5
4. Solution.....	5
5. User Profile.....	6
6. Timeline.....	8
7. Proposed Budget.....	8
8. Conclusion.....	9
9. References.....	11
10. Poster.....	12

Abstract

Turner Construction, an international construction company with a branch in Cincinnati, OH, has many pop up construction sites all over the greater Cincinnati area. Printing capability for those job sites is a necessity. Currently, the company deploys a large print server to the larger of the job sites requiring employees to first contact IT support in order to install the drivers. This is a time consuming and costly process.

The team of Andrew Remick, Sudin Pradhan, and Patrick McIntosh have developed a Raspberry Pi computer to create a low cost and portable print server. This low cost print server will have cloud printing capabilities as well as file storage. There are easy to follow instructions on how to download the drivers so that anyone can come onto the site and be capable of printing in minutes. This idea will decrease costs of labor, power, and hardware.

Introduction

We identified a problem with the way printers were accessed and shared within Turner Construction. The problem was that employees weren't able to print from remote job sites without the help of an IT admin. In this case, the IT admin would have to physically be at each job site to give employees the access to the printers. With that being said, our first idea was to create a print server out of Raspberry Pi which will provide users the access to the printers whenever they need it without having to go through IT to get permission. This would free up an IT administrator for other tasks.

Project Description

We will be using Raspberry Pi to develop a few services we can deliver to the IT department of Turner Construction. The goal is to create a useful product for the end users and to benefit the company by saving money and time. Our first idea is to create a print server to provide users with access to all of the printers at any time. In addition, we also want to use Raspberry Pi as a Google Cloud Print service. By building this feature on Raspberry Pi, we would allow users to print anything, anywhere, and allow printer sharing as well. This makes managing printers and print jobs equally easy. Another feature we want to add on Raspberry Pi is a low power NAS. A network storage device is one of the best ways to keep the data backed up. Once mapped as a network drive on the computers, users can have one common repository for files, documents, pictures, etc.

Problem

We found a problem with the way printers were accessed and shared in the company. The employees weren't able to print from remote job sites without the help of an IT admin. In this case, the IT admin would have to physically be at each job site to give employees the access to the printers. With that being said, our first idea was to create a print server out of Raspberry Pi which will provide users the access to the printers whenever they need it without having to go through IT to get permission. This would save a lot of time for an IT admin which they could use for completing other tasks.

Solution

When talking to the Ohio Regional Technology Services manager at Turner Construction, we were told about the issue of spending too much money and resources to power a print server for each of the construction work sites. The reason a print server is to be put into place is because of group policy. Windows does not allow the end users to download and run executable files without administrative credentials. There are people brought to different job-sites to assist with certain tasks. Our solution is to use a Raspberry Pi as an easily replaceable, low cost print server. We also want to use Raspberry Pi as a Google Cloud Print service. This feature would allow users to print from anywhere to any printer and it also would allow users to share their printers. This facilitates printer management and jobs. Google Cloud Print works with all printers and it also has Cloud Ready Printers that users can use where it connects directly to the web and does not require a PC to setup. With this feature, users can choose any printer and connect it to their Google Cloud Print account in seconds, and immediately start printing it. This feature supports

any type of application, on any web-connected device. Another feature that we want to add on Raspberry Pi is a low power NAS. A network storage device is one of the best ways to keep the data backed up, but we know that it can be a little pricey to set up and leave a server on all the time which requires a lot of power. For that reason, we are looking to create a cheap and low power solution. Once mapped as a network drive on the computers, users can have one common repository for files, documents, pictures, etc.

User Profile

The potential users are all employees of Turner Construction; however, primarily focusing on employees at remote job site locations. Our design will require users to have low to moderate level of experience in any browser and the Windows OS interface. It does not require users to have any direct knowledge or experience in any other specific software interface. A simple step-by-step instructions on how to use the printing and file sharing services will be provided to avoid any confusion or difficulties. The task experience will be very similar to what most users have already been doing in their computers in the past. Most users nowadays are familiar with using the Windows operating system to do basic tasks and they will also have instructions that they can follow to guide them in performing the task. These tasks will mainly include installing print drivers, and locating and navigating to different files and folders. It will also include copying, transferring, and deleting of programs and files as needed. The frequency of use will depend on the users and their job duties but services are expected to be used on almost daily basis or at least several times per week by each individual. For essential design requirements, the product must be able to manage the communication between the user's device and the server in printing and file sharing. Services must have a SLA level of 99.9% of uptime/availability. Accessing the service in Raspberry Pi must be a quick and simple process. Overall experience of the services

for the end users must be useful and smooth. Maintaining the server must be simple, minimally time consuming, and inexpensive.

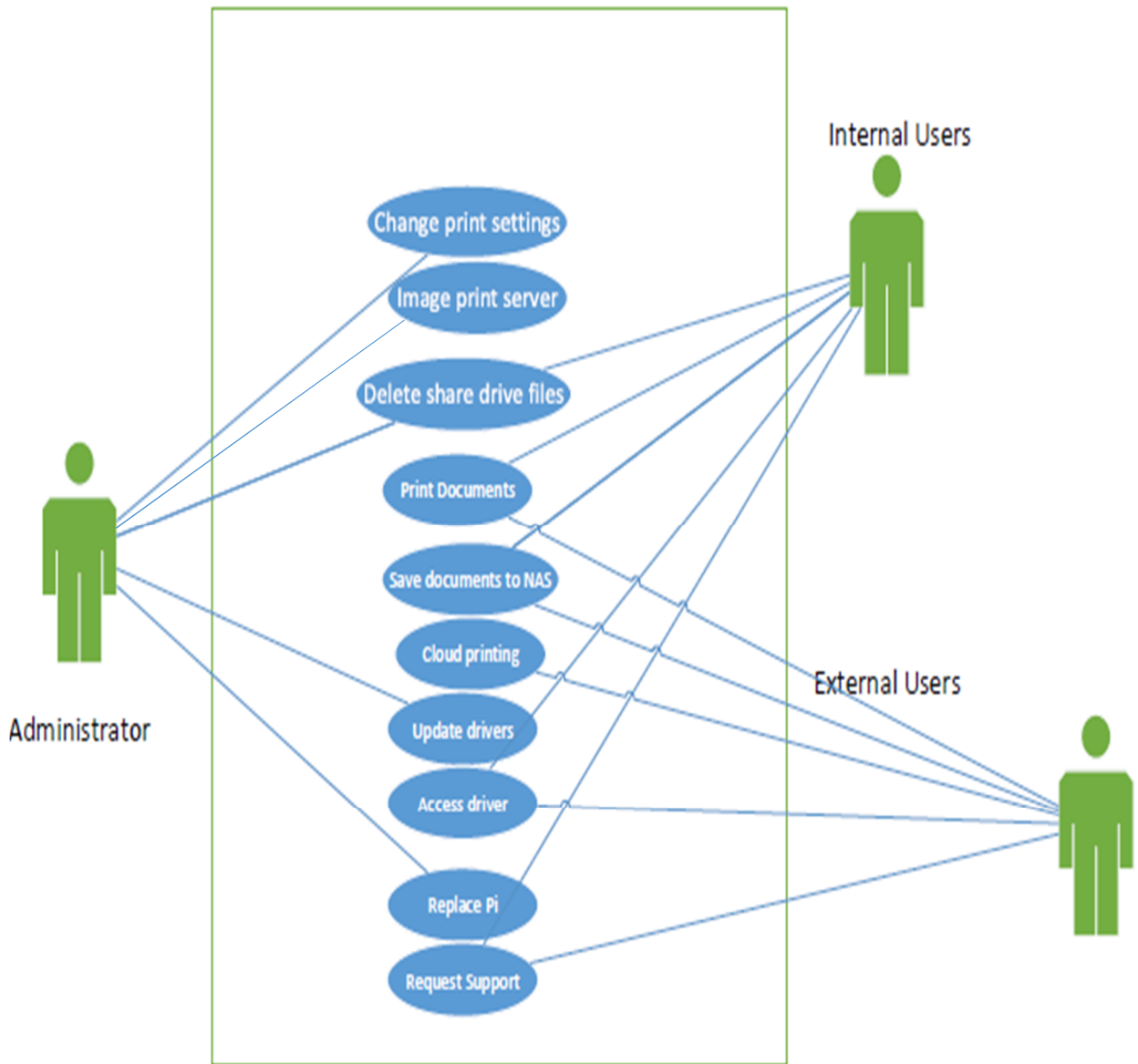


Figure 1, Users.

Timeline

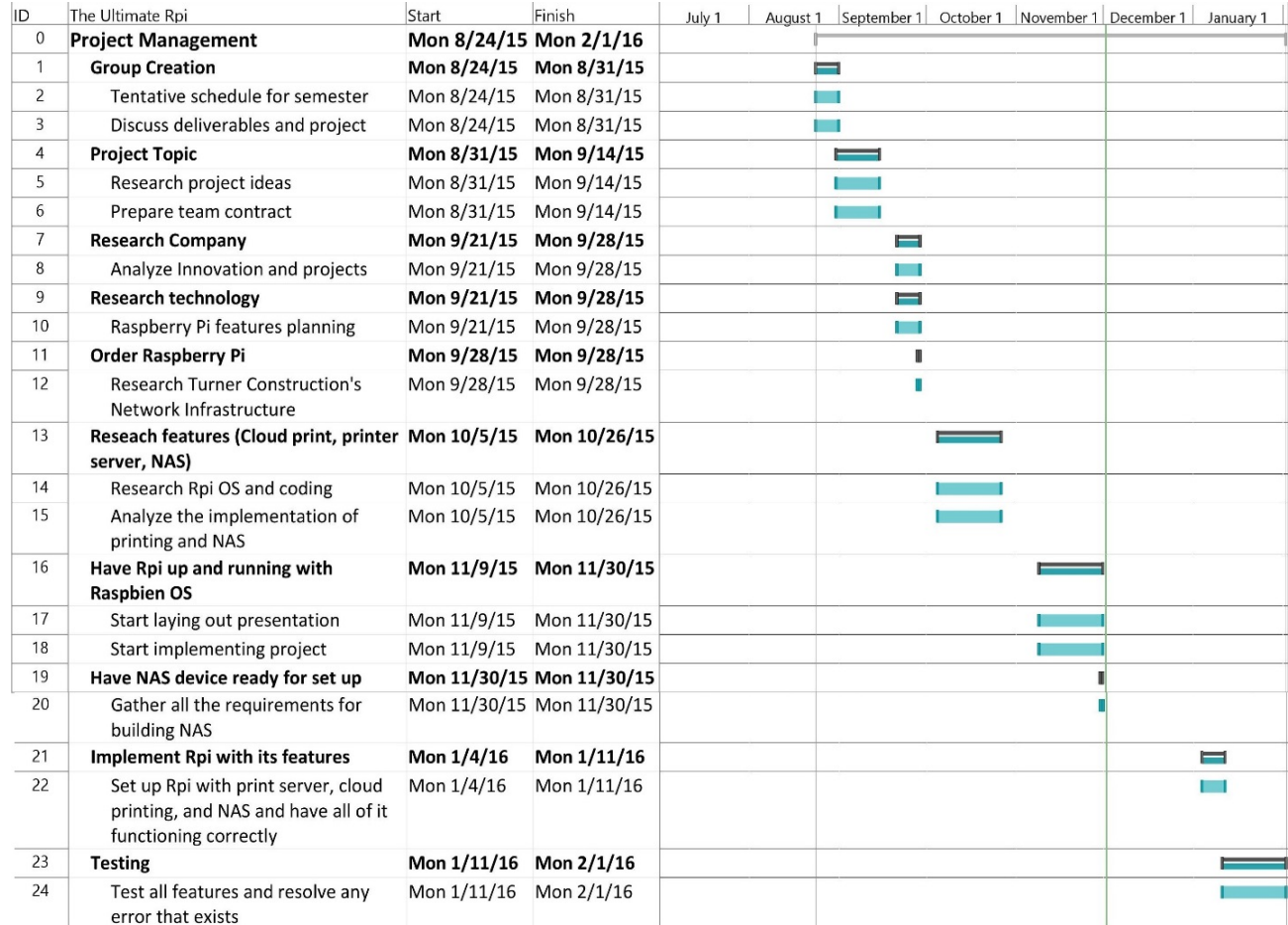


Figure 2, Gantt Chart.

Proposed budget

The proposed budget for our project including costs of hardware and labor is approximately \$5,000. We will need a Raspberry Pi unit along with a casing because the device will be on a job-site. For programming we will need an external monitor along with a keyboard and mouse. A HDMI cable will be used to connect the Raspberry Pi to the monitor. To connect to the network we will use a short cat6 Ethernet cable. We should have all of the peripherals and resources we

may need for testing and coding. Planning, configuration, and testing are the elements we considered for our labor costs. All of our costs are shown in detail below.

No.	Item	Hours	\$/Hour, Price	Item Total
1	Supplies			
	Raspberry Pi	0	\$35.00	
	Raspberry Pi case	0	\$8.59	
	External monitor	0	\$99.99	
	Keyboard & Mouse	0	\$9.99	
	HDMI cable	0	\$9.99	
	Ethernet cable	0	\$4.99	
	Supplies Total			\$168.55
2	Planning & Research			
	Labor	25	\$18	\$450.00
3	Configuration labor			
	Labor	240	\$18	\$4,320.00
4	Testing			
	Labor	15	\$18	\$270.00
	Total			\$5,208.55

Table 1, Proposed Budget.

Conclusion

Turner Construction is a large company and has numerous projects going on at any given time. Their IT staff is divided among all of the job sites which sometimes gets overwhelming. It is far from ideal and not cost effective to be waiting hours or even possibly a day or so to have an IT staff member come and set up their printer on site. Likewise, it is extremely difficult for IT staff members to travel to various job sites with different requests. The Ultimate Raspberry Pi can solve these issues along with others.

We will be using Raspberry Pi to develop a few services that we can deliver out to the IT department of Turner Construction. We want to create something out of Raspberry Pi that the

company's IT infrastructure could use to resolve an existing problem by providing a better and simpler solution. The goal here is to create a product that is useful to the end users and beneficial to the company by saving them money and time.

The time and cost savings that the Raspberry Pi will bring can help Turner Construction to finish all jobs on time and under budget. It will save both the IT staff and the job site workers time and stress. The added time can allow IT staff to work on larger projects without worrying about small tasks such as printer driver installs. The low cost to power the Ultimate Raspberry Pi will save thousands of dollars every year for the company to invest in more projects. The Ultimate Raspberry Pi is an all in one solution for job site printing and can have a huge impact on the entire company and potentially other companies as well.

References

"Adafruit Learning System." *Adafruit Learning System*. N.p., n.d. Web. 05 Sept. 2015.

"Hackaday." *Hackaday*. N.p., n.d. Web. 05 Sept. 2015.

"How to Turn a Raspberry Pi into a Low-Power Network Storage Device." *HowTo Geek RSS*. N.p., n.d. Web. 02 Sept. 2015.

"Mikronauts.com." » *Raspberry Pi 2 NAS Experiment HOWTO*. N.p., n.d. Web. 05 Sept. 2015. N.p., n.d. Web. 02 Sept. 2015.

"Setting up the Network Download the Software." *Instructables.com*. N.p., n.d. Web. 02 Sept. 2015.



Abstract

The team of Andrew Remick, Sudin Pradhan, and Patrick McIntosh will use a Raspberry Pi computer to create a low cost and portable print server. This low cost print server has cloud printing capabilities as well as file storage. There are easy to follow instructions on how to download the drivers so that anyone can come onto the site and be capable of printing in minutes. This idea cuts down on costs of labor, power, and hardware.

Problem/ Solution

- ❖ Problem: Employees weren't able to print from remote job sites without having IT Support physically on-site to give employees the access to printers.
- ❖ Solution: create a print server out of RPi which will allow users to print remotely on their own. Our RPi will also serve as a Google Cloud print server and a NAS device.

Technical Elements



Power Consumption Comparison

