Remote Automation Using Optical Fibre Communication

Requirements Analysis

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18/3/19	Filling, listing, and sorting of requirements	AB, JP
19/3/19	Further functional requirements and non-functional requirements	JP, AB
25/3/19	Added Gantt chart, Table of contents	JP

Contributors and Approvals

This document has been written by Anthony Baudinette and Jarred Paola. Bill Corcoran has acted as the supervisor for this project, providing Anthony and Jarred with requests, direction and guidance, and has contributed and provided approvals as such.

Introduction

Fibre optic cables are at the cutting edge of high speed and high volume data transfer. They are central to reliable and efficient wireless technologies, and require much research and optimisation to perform as intended, and as expected.

Context and Objectives

This project aims to explore the ability to utilise optical fibre connections to remotely control another computer to perform specified actions. The desire is to be able to send remote commands to facilitate a communications test-bed in order to streamline academic research, without the need for a desktop screen or alternatively installed programs other than the coding language Python.

Scope

Initial steps include setting up connections between a computer and a device using the Python language. From here, being able to communicate to the device from another computer through the first will provide a major hurdle. Translating this to a pre-existing set up of computers will take some time to adapt and execute. From here, having a running method of communication between device and local computer allows for the testing of remote access and scripting.

Types of requirements

- Core requirements - Minimum viable product specifications which define the product in its simplest usable prototype state.
- Further extensions- developments that will add value to the end product but not fundamental to its functionality.
- Assumptions - existing technologies to be used in the project which require no development for this project.
- Caveats - limitations in place by the approach taken to the project that will have to be designed around.

Gantt Chart – Timeline

[See Appendix A.]

Functional requirements

Requirements are divided by semester 1 and semester 2, giving sense of timeline for the short term and long term goals for the lifetime of the project. These are furthermore distinguished via necessity, separating into those which are more integral to the ethos of the project, against those which create convenience and polish.

	First semester	**Second Semester**
Core requirements	1. Establish communication with external device – Python 2. Set up SSH tunnel between local and remote PCs – Python 3. Remote control of signal generator, oscilloscope, etc. via SSH tunnel	1. Processing of oscilloscope data to display into other applications in real time 2. Automated sweep functionality via .csv or .txt files
Possible extensions	1. Reading of oscilloscope data into .csv files 2. Passing oscilloscope data into other applications i.e. matlab on local device	1. Build tutorial for usage of our methodology and functionality 2. GUI via python or a MATLAB app designer 3. (Any possible extensions from First Semester worth pursuing)

Caveats

- Desire for no extra programs to control embedded PC (i.e. desktop or screen sharing)
- Limited by Python's speed on existing systems to link to devices. This may become an issue depending on age of embedded PC, and type of data we are transmitting

Assumptions

- Serial link is large enough to transfer necessary data from oscilloscope to remote computer
- The oscilloscope is open to 3rd party application interaction, allowing access via python and external modules such that we don't have to use manufacturer's own program

Non-functional requirements

Security

- Since we are developing a method for remote automation, there is minimal personal risk regarding sensitive information, as we simply wish to establish the methodology.
- As per our assumption, there may be security measures when trying to access the device from an external PC

Cost

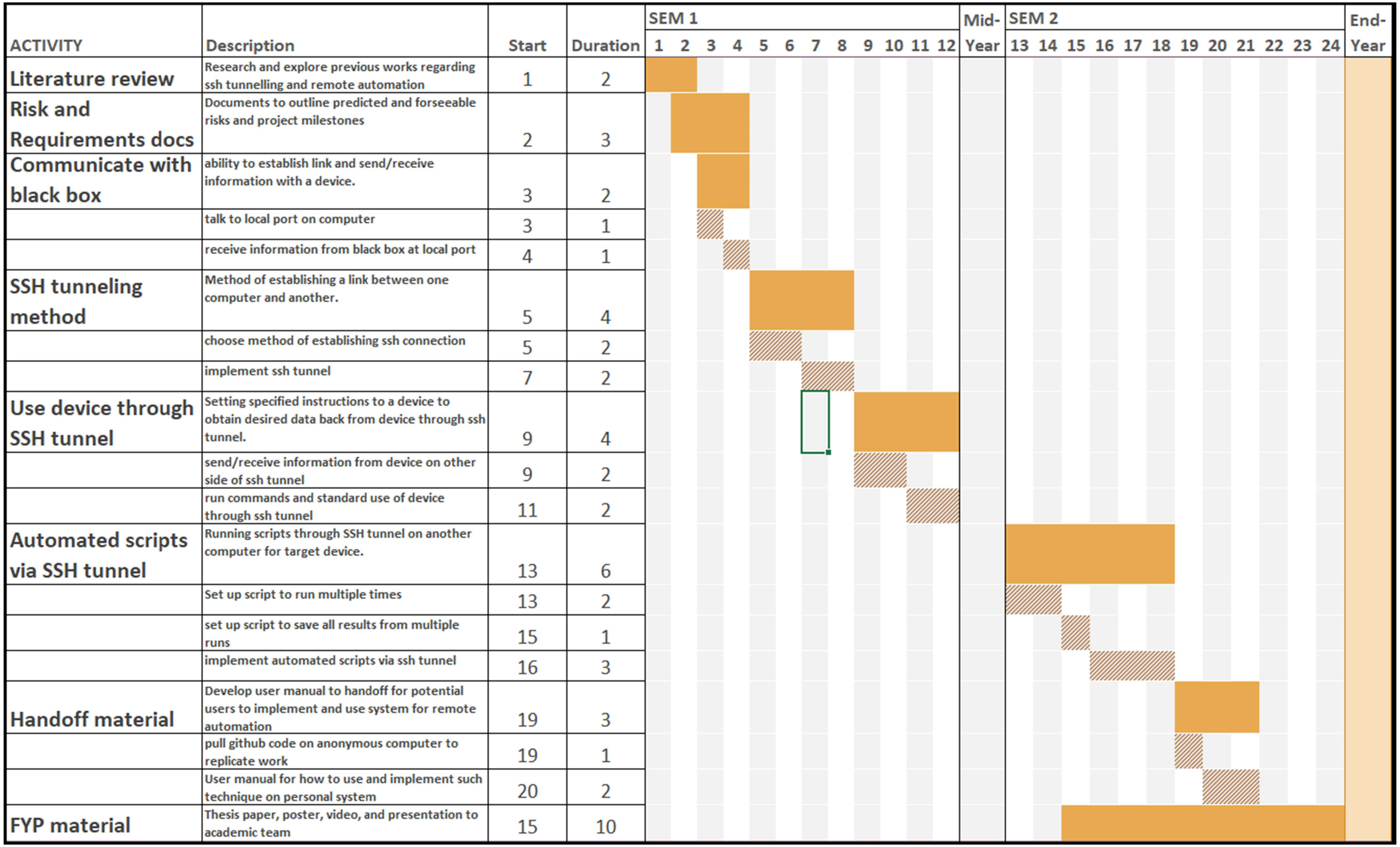
- Nominal travel fees
- Making use of existing hardware and embedded PC’s at no cost

Use-Case Scenarios

Establishing a simple, easy to use method for remote access and automation of laboratory equipment paves the way for optimisations not only across the electrical engineering field, but various academic and professional areas of research.

a. The ability to script and automate testing without the need for physical presence to reset values and machinery
b. Operating and running tests for optimisation purposing, running near same-time experiments for like-conditions and best-case discovery

Appendix A



ACTIVITY	Description	Start	Duration
Literature review	Research and explore previous works regarding ssh tunnelling and remote automation	1	2
Risk and Requirements docs	Documents to outline predicted and forseeable risks and project milestones	2	3
Communicate with black box	ability to establish link and send/receive information with a device.	3	2
	talk to local port on computer	3	1
	receive information from black box at local port	4	1
SSH tunneling method	Method of establishing a link between one computer and another.	5	4
	choose method of establishing ssh connection	5	2
	implement ssh tunnel	7	2
Use device through SSH tunnel	Setting specified instructions to a device to obtain desired data back from device through ssh tunnel.	9	4
	send/receive information from device on other side of ssh tunnel	9	2
	run commands and standard use of device through ssh tunnel	11	2
Automated scripts via SSH tunnel	Running scripts through SSH tunnel on another computer for target device.	13	6
	Set up script to run multiple times	13	2
	set up script to save all results from multiple runs	15	1
	implement automated scripts via ssh tunnel	16	3
Handoff material	Develop user manual to handoff for potential users to implement and use system for remote automation	19	3
	pull github code on anonymous computer to replicate work	19	1
	User manual for how to use and implement such technique on personal system	20	2
FYP material	Thesis paper, poster, video, and presentation to academic team	15	10