Remote Automation Using

Optical Fibre Communication

## Requirements Analysis

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# Document Control

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| --- | --- | --- |
| ***Date*** | *Task* | *Contributors* |
| **12/03/19** | General overview and layout of requirements analysis | JP |
| **16/03/19** | introduction, Objectives, Context Scope, and project overview | JP |
| **18/03/19** | Filling, listing, and sorting of requirements | AB, JP |
| **19/03/19** | Further functional requirements and non-functional requirements | JP, AB |
| **25/03/19** | Added Gantt chart, Table of contents | JP |
| **02/04/19** | Clarified wording | JP |

### Contributors and Approvals

This document has been written collaboratively by Anthony Baudinette & Jarred Paola. Bill Corcoran has acted as the supervisor for the duration of 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 essential to reliable and efficient wireless technologies and require further research and optimisation to perform as intended, and as expected. Communication over long distances is currently easily created, but there are more opportunities yet to be explored.

### 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 from a remote computer to an embedded PC that is in communication with a network of facilities and devices, facilitating 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

On a small scale, we wish to be able to connect to an external device and communicate on basic terms, before attempting to communicate with another PC. As we scale up, communicating to a connected device on an embedded PC from a remote PC will provide the foundation of the project. From here, testing communication with different connected devices, and different types of connections, on the embedded PC will prove fundamental in establishing simple and clear instructions to replicate across different remote PCs.

### 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 project, against those which create convenience and polish.

|  |  |  |
| --- | --- | --- |
|  | **First semester** | **Second Semester** |
| *Core requirements* | 1. Establish communication tunnel with external device via Python 2. Adapt tunnel between local and remote PCs via Python 3. Remote control of signal generator, oscilloscope, etc. via 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. Sending files and executing on embedded PC, returning results. 2. Executing files on remote PC and sending requests to embedded PC to receive results concurrently. 3. Reading of oscilloscope data into .csv files from remote computer 4. Passing oscilloscope data into other applications i.e. Matlab on remote computer 5. Executing | 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)
* Possibly creating executable files or other explanations to facilitate ease of use for cross-OS integration.
* Limited by speed of Python’s 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 via tunnel.

### Assumptions

* Serial link is large enough to transfer necessary data from connected device to embedded PC, then communication tunnel is capable to forward to remote computer.
* The connected devices are open to 3rd party application interaction, allowing access via Python, Matlab, and any 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. Hence, as a proof of concept, an insecure connection tunnel is viable. Moving forward there may be a strong desire for security, so an SSH tunnel may become a better implementation for a general or “sellable” product.

### Cost

* Nominal travel fees
* Making use of existing hardware and embedded PC’s at no cost
* Using two Raspberry Pi development kits for further testing and extrapolation

# 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.

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

# Appendix A

