User Manual

A Setup Guide from Scratch

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Preface

Purpose

The purpose of this manual is to allow a person to easily set up and begin using our system. Topics covered include everything from installing an operating system on a Raspberry Pi to using our provided web interface to adjust voltage and frequency output of the device. The design document for the project is also attached for better understanding of the functionality of the system as a whole.

Structure of Manual

This document lay's out the setup process from beginning to end. Each step of the process is described in enough detail that the process may be accomplished without the use of other reference materials. No knowledge of linux systems, Raspberry Pi, or Apache Webserver is assumed. At the end of this manual is attached the design document.

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Materials

1.1 Raspberry Pi

The Raspberry Pi is an inexpensive computing device. The operating system for this device is installed on an SD card. The Printed Circuit Board containing all of the hardware for this project will be connected to the GPIO pins on this device.

1.2 Printed Circuit Board

Board containing our frequency and voltage regulating hardware. The design document covers the hardware included on this PCB in great detail. An overview of the functionality will be given here as a summary. All that must be understood for operation of the system is the inputs and ouputs of this hardware component. The inputs are the GPIO pins on the provided Raspberry Pi. The outputs are wires which may be soldered on to the PCB at the locations described. Circuit diagrams of the PCB are included in the attached design document.

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Setup and Configuration

2.1 Acquiring a Raspberry Pi

The Raspberry Pi is a small computing device which may be purchased online for less than $50. Other items which may need to be purchased along with the Raspberry Pi include:

1. micro usb power cable
2. protective case

2.2 Installing Rasbian

Rasbian is a distribution of Linux which has very light weight system requirements. The operating system is optimized to run on the raspberry pi, and contains many useful packages reinstalled.

2.3 Networking the Raspberry Pi

In order for the Raspberry Pi to be controllable from the provided web interface, the device must be connected to the same network as the controlling computer.

2.4 Configuring the Raspberry Pi - Manual Configuration

2.4.1 Install Packages

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Using the Device

3.1 Physical Connections

3.2 Using the Web Interface

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Technical Specifications

4.1 Web Interface

The web interface is hosted on the Raspberry Pi using an Apache web server. This web server displays an interface which allows the user to set a voltage and frequency output by the system. The interface is simple and interactive, implemented using cgi-scripts on an Apache web server.

The Apache Web server is configured to run as user pi on the Raspberry pi Device. User pi does not have root privileges. However, there are some operations which are required to set voltage and frequency that make root execution privileges necessary. Root privileges are necessary to set the value of the GPIO pins of the Raspberry pi directly.

It would likely not be wise to run a web server as root. If a user could discover a way to cause the web server to execute arbitrary code this could constitute a large security flaw. To provide some protection, single purpose scripts are used to handle situations in which root execution privileges are required.

These scripts utilize the ability of the pi user to use the sudo command. In other words, user pi is a member of the *sudoers* group. These single purpose scripts are written using bash. The scripts are called from cgi-scripts initiated by user interactions with the web interface. These bash scripts call other python scripts to preform preform actions requiring root access. Namely, These scripts are used to change the values associated with the GPIO pins.

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Troubleshooting

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Design Document