

**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
THE UNIVERSITY OF TEXAS AT ARLINGTON**

**DETAILED DESIGN SPECIFICATION
CSE 4317: SENIOR DESIGN II
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**VENDING SERVICES
AUTOMATED VENDING AND RESERVATION SYSTEM**

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REVISION HISTORY

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1 INTRODUCTION

The smart vending machine should be able to a) allow ordering from remote locations via mobile app b) reservations /inventory checks from remote locations c) vending goods d) detect and report errors/tampering with the machine.

We expect it to be used either by people who frequent the building it is located in / around (using mobile app) or by random visitors with the touch screen. Commercially, we would expect this to be bought by vending service companies (for large corporations, universities, etc.) or small businesses for convenience. This product is designed for a wide spectrum of potential customers. It is intended for general use.

2 SYSTEM OVERVIEW

The smart vending machine behaves similarly to a regular vending machine, but it has additional features allowing users to pay for and reserve snacks in advance. The user will do this through an app which will display the available inventory of the selected machine and handle dummy transactions. It will then give the user a four digit code which they will input into the machine to retrieve their reserved snacks.

The smart vending machine consists of three layers: the Database Layer, the Machine Layer, and the App Layer. Below is an architectural layer diagram of the entire system. Each layer will be discussed later in the document.

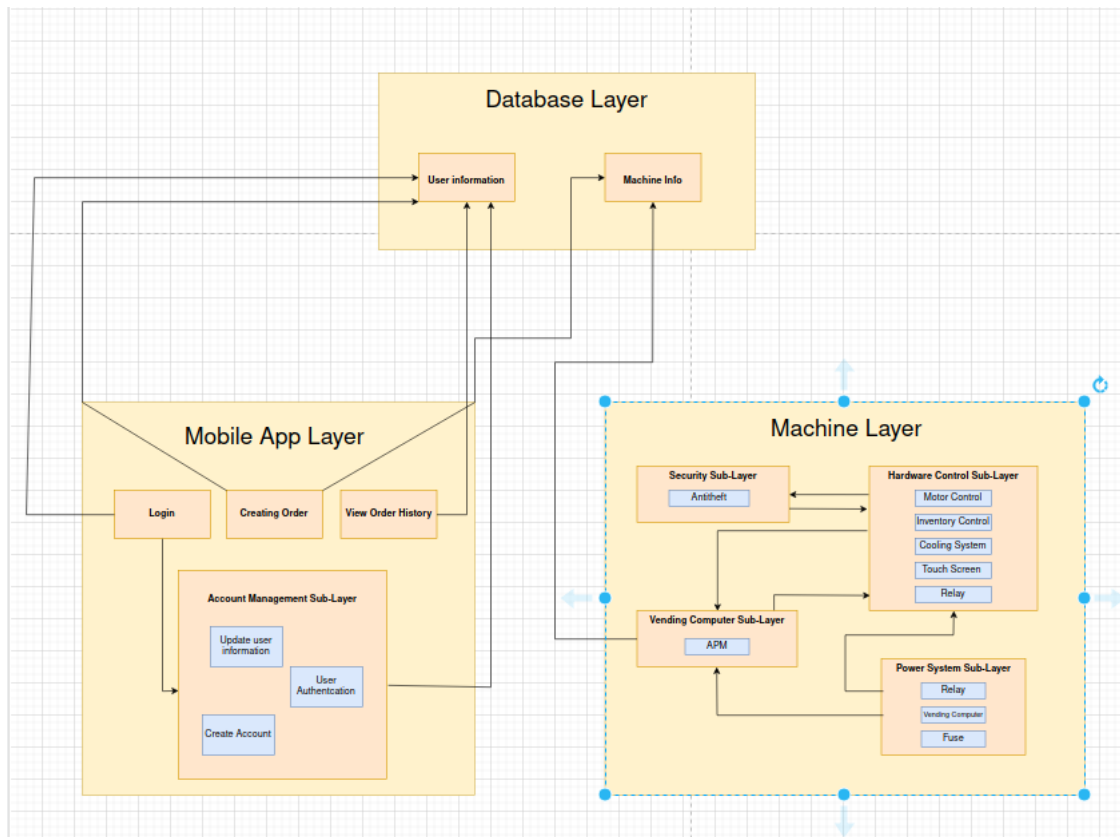


Figure 1: System architecture

3 DATA LAYER SUBSYSTEMS

3.1 LAYER OPERATING SYSTEM

The operating system for this subsystem is to be determined.

3.2 LAYER SOFTWARE DEPENDENCIES

The software dependencies for this layer is to be determined.

3.3 USER INFORMATION

The user information subsystem is the cloud-based system concerned with handling data for the mobile customers.

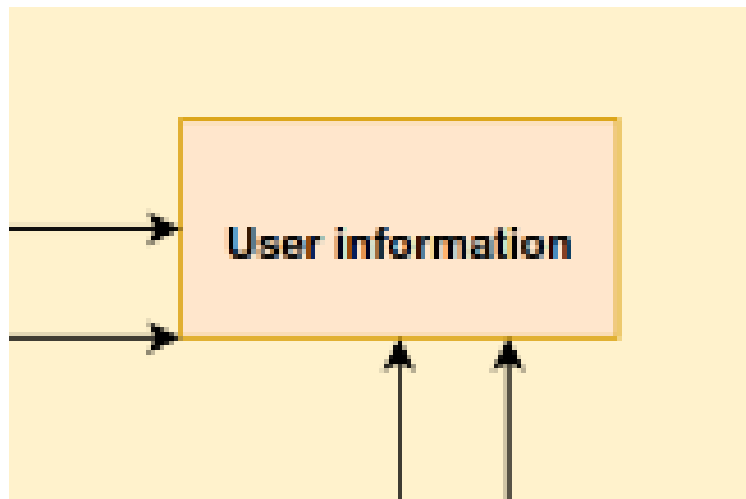


Figure 2: Example subsystem description diagram

3.3.1 SUBSYSTEM SOFTWARE DEPENDENCIES

Firebase is a dependency required by this subsystem

3.3.2 SUBSYSTEM PROGRAMMING LANGUAGES

The programming languages used in this subsystem is NoSQL.

3.3.3 SUBSYSTEM DATA STRUCTURES

The data structure of this subsystem is to be determined

3.3.4 SUBSYSTEM DATA PROCESSING

The data processing for this subsystem is to be determined

3.4 MACHINE INFO

The machine info contains the unique identification for each and every vending machine that is deployed by an owner. It consists of a software UUID and a physical hardware plate that also contains the country of manufacture.

3.4.1 SUBSYSTEM SOFTWARE DEPENDENCIES

Firebase is a dependency required for this subsystem

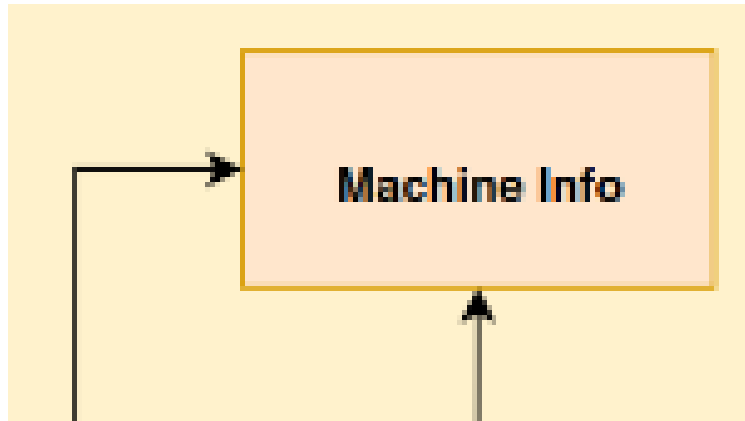


Figure 3: Example subsystem description diagram

3.4.2 SUBSYSTEM PROGRAMMING LANGUAGES

The programming languages used in this subsystem is NoSQL

3.4.3 SUBSYSTEM DATA STRUCTURES

The applicable data structures are to be determined for this subsystem

4 MACHINE LAYER SUBSYSTEMS

4.1 LAYER HARDWARE

Hardware Components	Description
Raspberry Pi 4B	Broadcom BCM2711, quad-core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz /2.4 GHz and 5.0 GHz IEEE 802. 11b/g/n/ac wireless LAN, Bluetooth 5.0, BLE
Touch Screen	7.9 inch 1280 x 400 IPS Capacitive 5-Point Touch Screen
Power Supply	Output Voltage: 5VDC & 12VDC, Output Current: 4A, Max Output Power: 32W
Motors	Speed: 30RPM, Voltage: 12VDC
Relay	5V 10A transistorized 8-relay single board package.
Fuse	6x 2A automotive-style ATO bladed fuses
Cooling Fan	Tower structure, 5mm copper tube, multi-layer heat sinks, 7 blades powerful fan, reduce the temperature of the Raspberry Pi from 80 to 40 degree Celsius.

4.2 LAYER OPERATING SYSTEM

The Operating System used in this subsystem is Raspberry Pi OS v 2022-01-28

4.3 LAYER SOFTWARE DEPENDENCIES

The full software dependencies for this layer are to be determined

4.4 SECURITY

The Security sub-layer is designed to protect the assets that is of the vending machine hardware and its products. It consists of a gyroscope and an accelerometer and combined with software on the Vending computer alerts an owner about tamper events that may occur to the machine

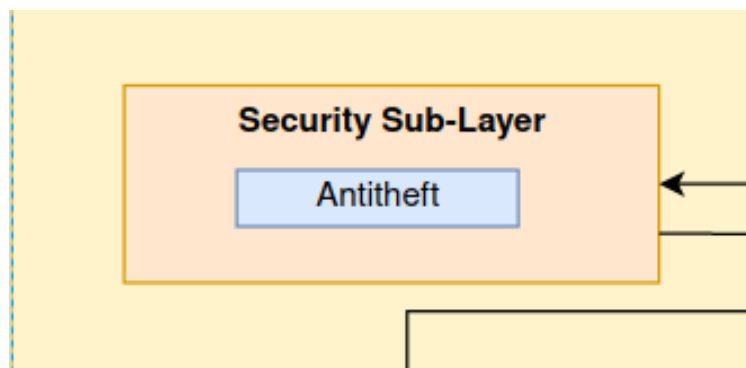


Figure 4: Example subsystem description diagram

4.4.1 SUBSYSTEM HARDWARE

The security subsystem hardware is to to be determined

4.4.2 SUBSYSTEM OPERATING SYSTEM

The security subsystem operating system is to to be determined

4.4.3 SUBSYSTEM SOFTWARE DEPENDENCIES

The security subsystem software dependencies is to to be determined

4.4.4 SUBSYSTEM PROGRAMMING LANGUAGES

The security subsystem programming languages is to to be determined

4.4.5 SUBSYSTEM DATA STRUCTURES

The security subsystem data structures is to to be determined

4.4.6 SUBSYSTEM DATA PROCESSING

The security subsystem data processing is to to be determined

4.5 HARDWARE LAYER

The Hardware Layer is concerned with the basic operation of the vending machine. It is the combination of hardware and software that makes up this layer.

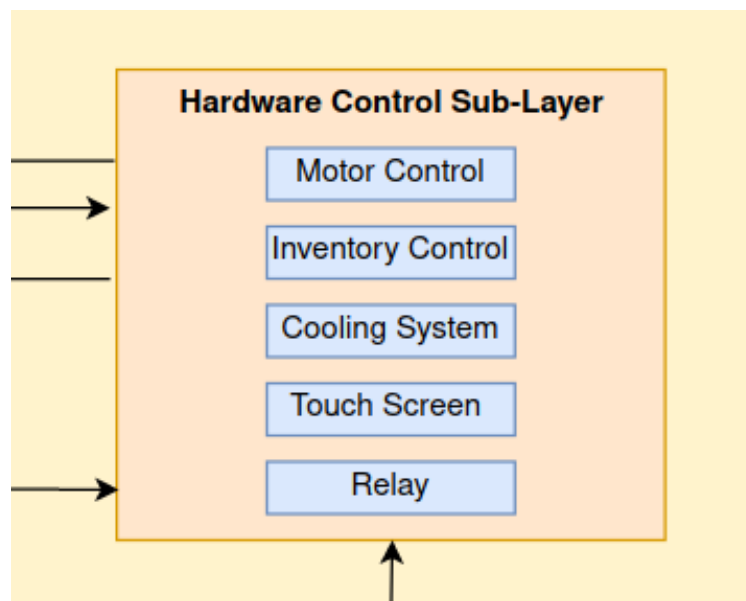


Figure 5: Example subsystem description diagram

4.5.1 SUBSYSTEM HARDWARE

A Raspberry Pi 4B v1.1 is used as the basis for the Vending Computer

4.6 POWER SYSTEM

The Power System is an entirely hardware-dependent subsystem concerned with providing power to the entire vending machine. All voltage regulation, amperage control, and main computer power are handles through here.

4.6.1 SUBSYSTEM HARDWARE

A power supply, the vending computer, and fuse are all the components of the power system

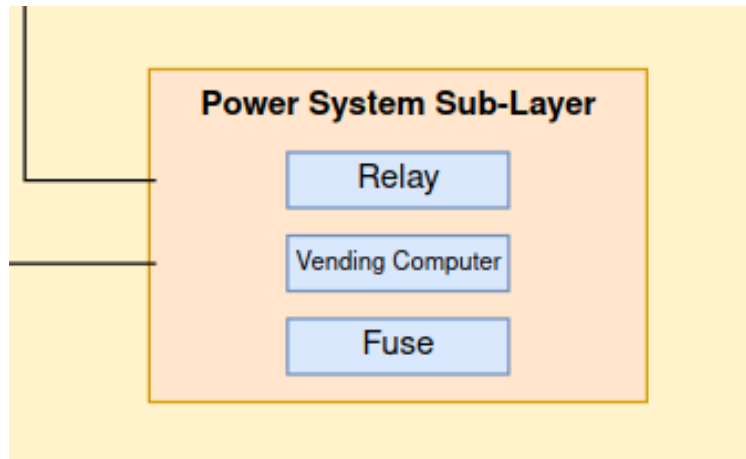


Figure 6: Example subsystem description diagram

4.7 VENDING COMPUTER

The Vending Computer is an assembly of various hardware and software components. It is the hardware that actually does the logic control of the vending machine.

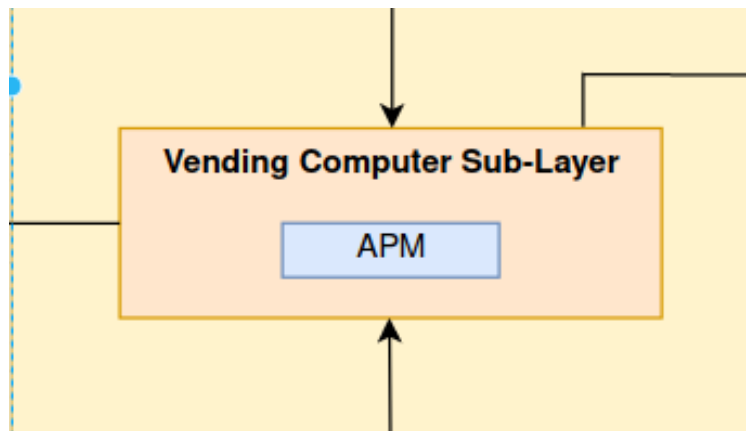


Figure 7: Example subsystem description diagram

4.7.1 SUBSYSTEM HARDWARE

There is a relay controller, a infrared sensor, a cooling fan, and a 7 inch touchscreen used in the Hardware control subsystem

4.7.2 SUBSYSTEM OPERATING SYSTEM

The Operating System used in this subsystem is Raspberry Pi OS v 2022-01-28 and it is used to control the touchscreen, cooling system, and preform motor control.

5 APP LAYER SUBSYSTEMS

5.1 LAYER OPERATING SYSTEM

The user must have an iOS device running iOS 12.0 or later, or an Android phone that is version 8.0 or greater

5.2 LAYER SOFTWARE DEPENDENCIES

Firebase v7.20.0, JavaScript, Node 17.6.0, React Native 0.67.2, NPM 8.5.1, and Firestore are the primary software dependencies of this layer

5.3 LOGIN

The Login system sublayer is a class within the mobile app, it handles user authentication so that the user activities are tied to each and every user

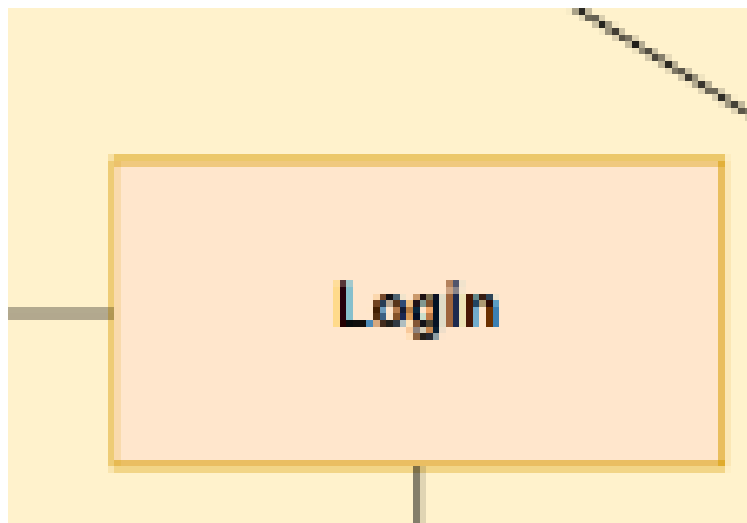


Figure 8: Example subsystem description diagram

5.3.1 SUBSYSTEM OPERATING SYSTEM

The user must have an iOS device running iOS 12.0 or later, or an Android phone that is version 8.0 or greater

5.3.2 SUBSYSTEM SOFTWARE DEPENDENCIES

Firebase is a library required as a dependency in the development in the app

5.3.3 SUBSYSTEM PROGRAMMING LANGUAGES

JavaScript is used in the language of the create order subsystem

5.3.4 SUBSYSTEM DATA STRUCTURES

The auth object handles user authentication with Firebase.

5.3.5 SUBSYSTEM DATA PROCESSING

The data processing for this subsystem is to be determined.

5.4 CREATING ORDER

This sub layer class is concerned with the creation of remote orders in the mobile app. It is the main function of this application. The user may select items that are available at a vending machine and make a reservation.

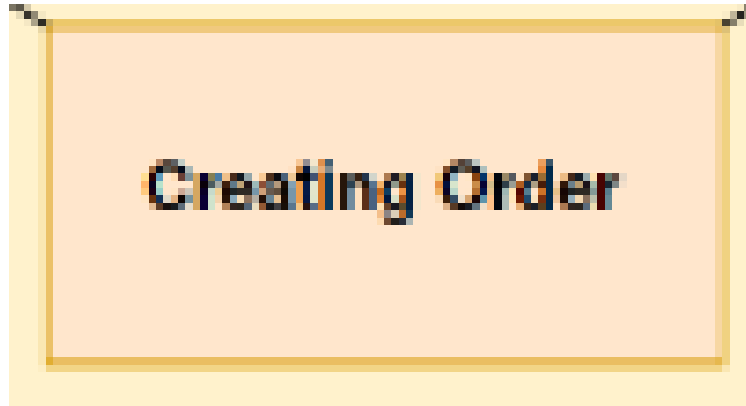


Figure 9: Example subsystem description diagram

5.4.1 SUBSYSTEM OPERATING SYSTEM

The user must have an iOS device running iOS 12.0 or later, or an Android phone that is version 8.0 or greater

5.4.2 SUBSYSTEM SOFTWARE DEPENDENCIES

Firestore and Firebase are dependencies used to associate an order to the user and send the order to a database

5.4.3 SUBSYSTEM PROGRAMMING LANGUAGES

JavaScript and NOSQL is used in the language of the create order subsystem

5.4.4 SUBSYSTEM DATA STRUCTURES

The data structures for this subsystem is to be determined.

5.4.5 SUBSYSTEM DATA PROCESSING

The data processing for this subsystem is to be determined.

5.5 VIEW ORDER HISTORY

An additional feature of the mobile application is for our users to review their orders for tax reasons, expense reports or simply place another order. It is a class within the mobile application.

5.5.1 SUBSYSTEM OPERATING SYSTEM

The user must have an iOS device running iOS 12.0 or later, or an Android phone that is version 8.0 or greater

5.5.2 SUBSYSTEM SOFTWARE DEPENDENCIES

A description of any software dependencies (libraries, frameworks, design software for mechanical parts or circuits, etc) required by the subsystem.

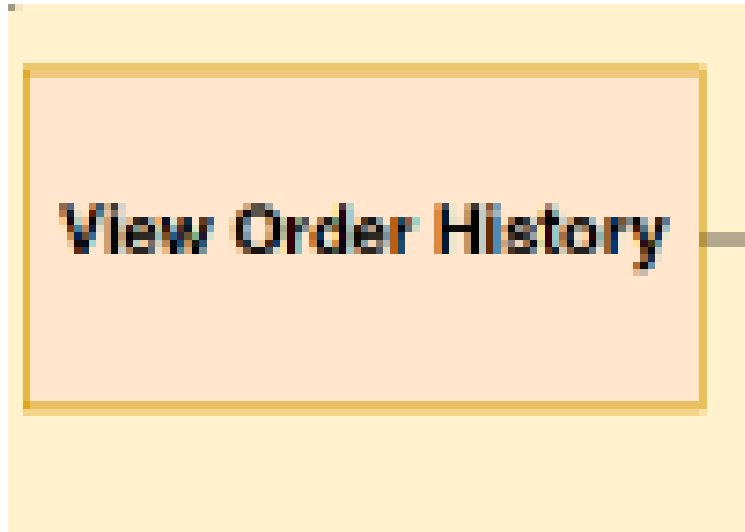


Figure 10: Example subsystem description diagram

5.5.3 SUBSYSTEM PROGRAMMING LANGUAGES

JavaScript and NOSQL is used in the create order subsystem

5.5.4 SUBSYSTEM DATA STRUCTURES

The data structures for this subsystem is to be determined.

5.5.5 SUBSYSTEM DATA PROCESSING

The data processing for this subsystem is to be determined.

5.6 ACCOUNT MANAGEMENT

As the user is required to create an account to use the app, there is cloud-based account management in the mobile application that takes care of tasks such as changing email, payment method, password, or general identification.

5.6.1 SUBSYSTEM OPERATING SYSTEM

The user must have an iOS device running iOS 12.0 or later, or an Android phone that is version 8.0 or greater

5.6.2 SUBSYSTEM SOFTWARE DEPENDENCIES

Firebase is used as a software dependency in order for account management to occur.

5.6.3 SUBSYSTEM PROGRAMMING LANGUAGES

JavaScript is used in the language of the create order subsystem

5.6.4 SUBSYSTEM DATA STRUCTURES

The data structures for this subsystem is to be determined

5.6.5 SUBSYSTEM DATA PROCESSING

The data processing for this subsystem is to be determined

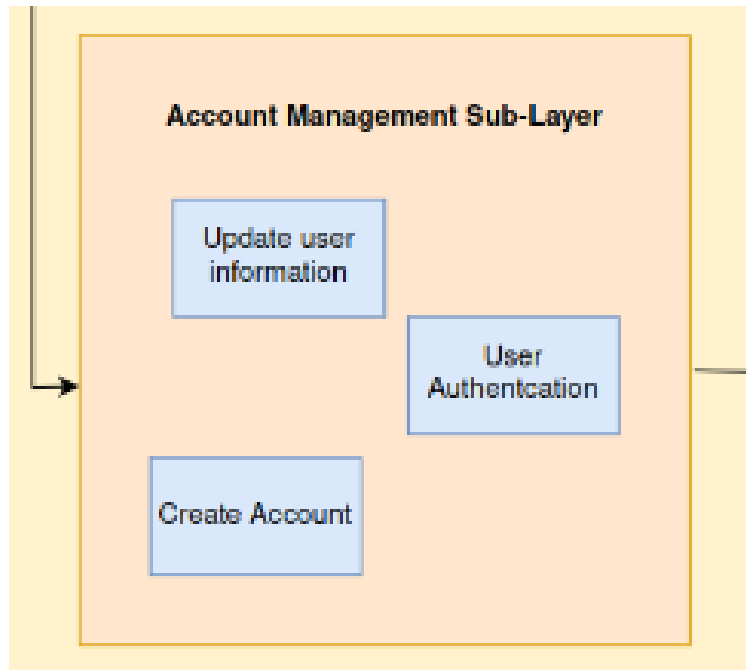


Figure 11: Example subsystem description diagram

6 APPENDIX A

Wiring / circuit diagrams can be seen below. They are color coded to match wire insulation color. Double lines indicate cables.

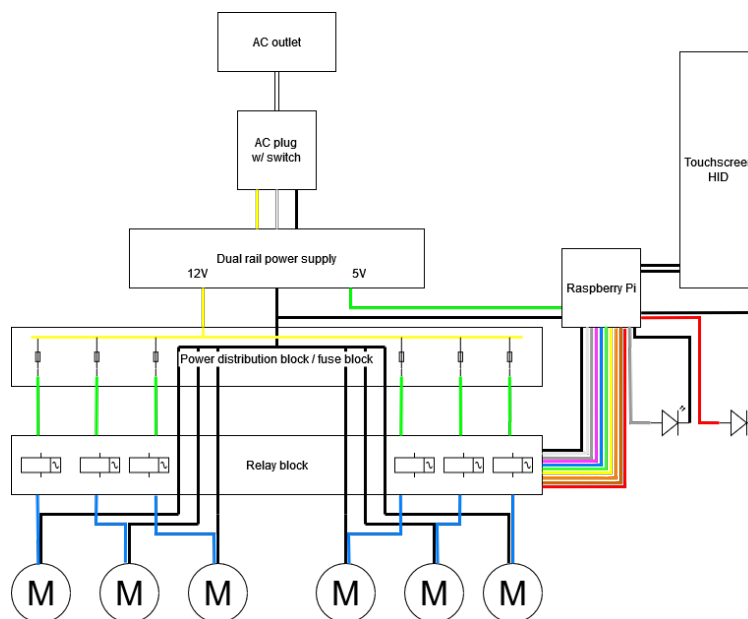


Figure 12: Wiring diagram

REFERENCES