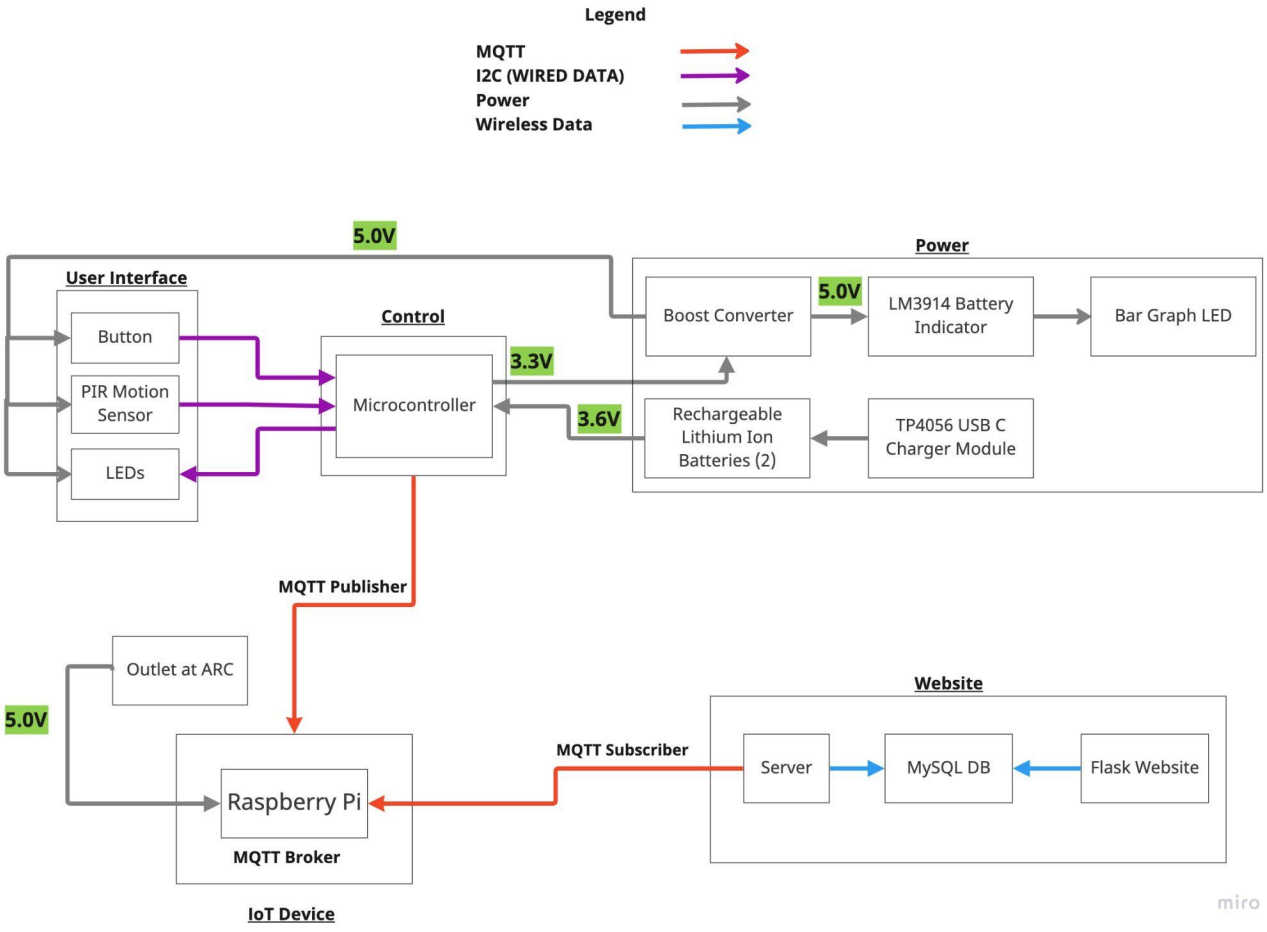
High Level Requirements

Battery Life: System should be able to last for multiple hours without a direct power source.

Machine Status: Changes in machine availability are correctly and efficiently communicated using multiple peripherals (button and PIR motion sensor).

Website Access: Website is accessible to users and correctly displays the most up to date availability of a machine.

Block Diagram



Subsystem RVs

User Interface

Button Requirements	Verification
Requirement 1: A button press should be able to send a MQTT packet to our IoT device.	Verification 1: On our IoT device, which will act as a MQTT server, we can verify what devices are requesting information on it, by a simple command on the IoT device.
Requirement 2: When a user presses the button to use the ARC machine, the LED should light up to signify the machine is in use.	Verification 2: This can be easily verified by pressing the button on our system and visually checking the activation of the red led.
Requirement 3: When a user presses the button after using the ARC machine, the LED should be off to signify the machine is not in use.	Verification 3: This can be easily verified by pressing the button on our system and visually checking whether the led is lit.
Requirement 4: Multiple machines must be able to send messages simultaneously	Verification 4: on the IoT device command line can be used to check what devices are trying to send messages to the device
Motion Sensor Requirements:	Verification:
Requirement 1: Motion sensor should only be able to detect continuous movement from when the machine is in use	Verification 1: We will mimic continuous movement in front of the motion sensor for a defined time interval and check whether or not the website is updated with machine availability.

IoT Device

IoT Device Requirements	Verification
Requirement 1: Manage multiple MQTT publish messages from a single ESP32 Device	Verification 1: Command line within the IoT device interface can be used to verify whether or not each publish message from a particular ESP32 device is being received
Requirement 2: Manage and differentiate multiple MQTT publish messages from multiple ESP32 Devices.	Verification 2: Command line within the IoT device interface can be used to verify if the IoT device is receiving all packets from multiple ESP32 devices

Website

Server Requirements	Verification
Requirement 1: Server must be able to receive MQTT messages from Raspberry Pi	Verification 1: Server has a console to interface with its servers. We can use the server console to ensure the proper packets are being sent from and to the server.
Requirement 2: Server must send packets to our database with information on which machine is in use.	Verification 2: Database has been updated with the correct information.

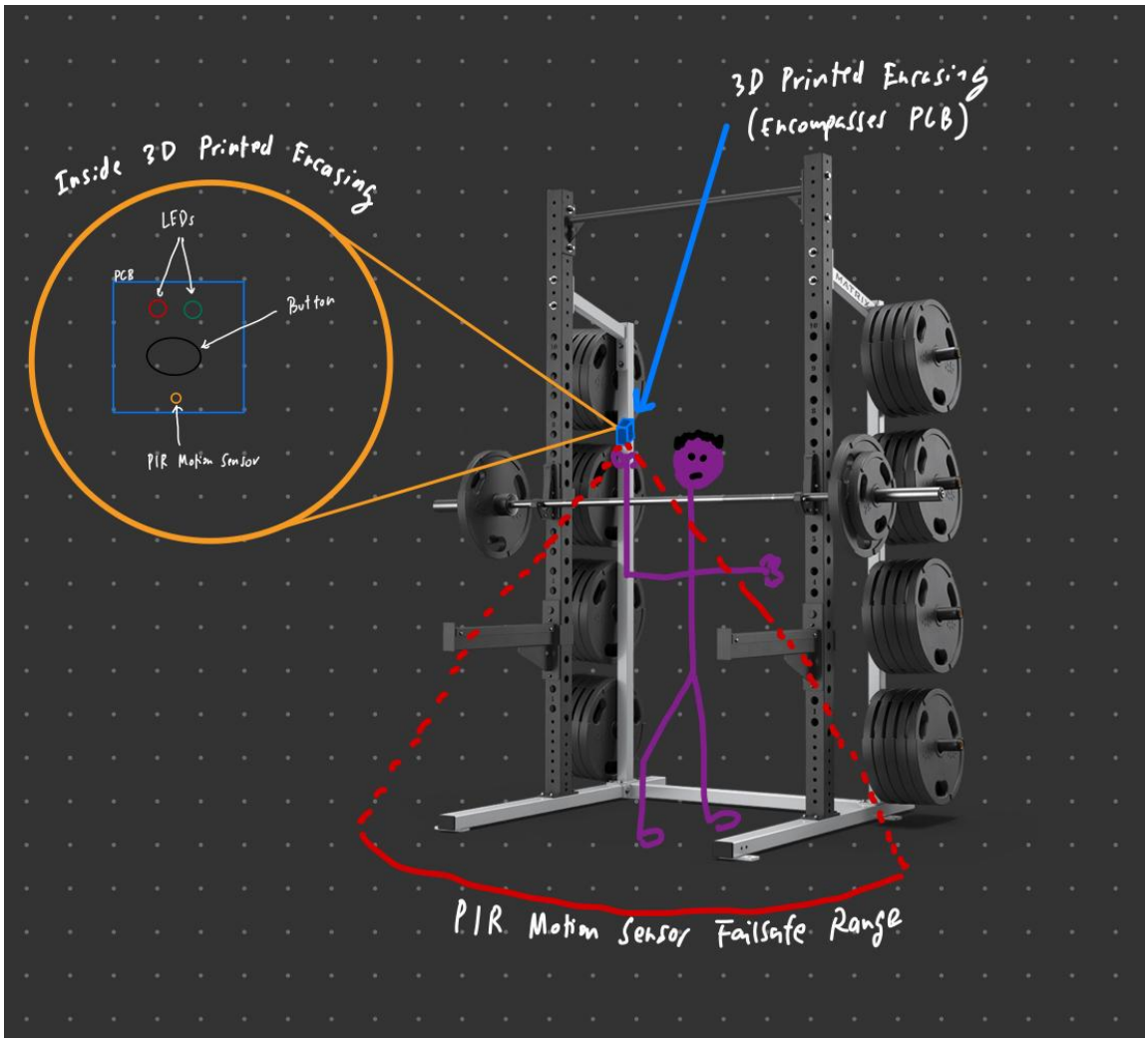
Flask Application Requirements	Verification
Requirement 1: Machine availability is correctly updated on website based on information in MySQL database	Verification 1: Table displayed on website has the most up to date availability information for all machines.

Power

Power System Requirements:	Verification:
Requirement 1: Be able to power all on-board components.	Verification 1: All subsystems are supplied with the appropriate amount of power to operate.
Requirement 2: Be able to sustain power to all on-board components for 4 hours.	Verification 2: All subsystems work as intended for 4 hours worth of operation hours at the ARC.
Requirement 3: Be able to display when a battery needs to be recharged for the convenience of ARC employees.	Verification 3: We are using the LM3914 bar graph LED to provide a visual to when the batteries will need to be recharged.

Machine Availability Decision

- Button press changes led from off to on and vice versa to signify machine availability
- If led is on, but PIR sensor detects no movement over a period time, led is turned off
- If led is off, but PIR sensor detects movement over a period of time, led is turned on
- Led status is communicated to website to show machine availability


Inside 3D Printed Encasing
LEDs
PCB
Button
PIR Motion Sensor
3D Printed Encasing
(Encompasses PCB)
PIR Motion Sensor Failsafe Range