Design Brief 2: Mission

Mission Mechanism

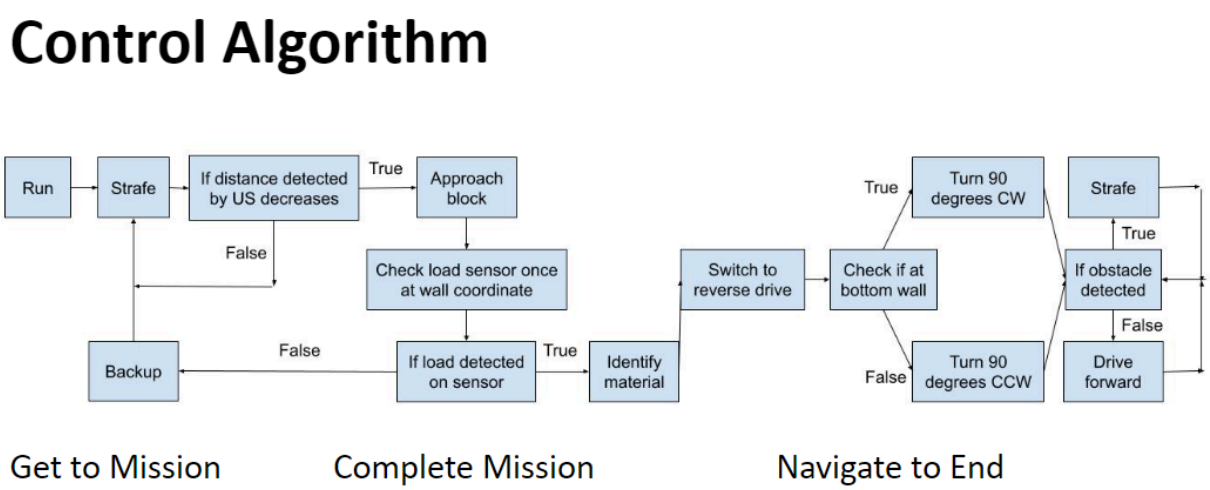
In order to complete our mission, our team designed a custom forklift that is capable of picking up the ball and housing all of the required sensors to ID the material and determine the weight. The forklift is custom designed and 3D printed, and it is made entirely of PLA. (See Appendix, Figure 1). The forklift consists of 5 main components: The body, pressure plate, ultrasonic sensor, and ultrasonic sensor mount. In unison, these components work well together in order to complete the mission (See Appendix, Figure 2). The front part of the forklift is slightly angled, allowing the block to be scooped up with ease. On the forklift, a pressure plate sits on top of the force sensor. The pressure plate is necessary because it puts the weight of the block into a concentrated point, which makes it much easier for the force sensor to read. Finally, on the mast of the forklift, an ultrasonic sensor sits that is used to ID the material.

The whole forklift itself is stationary and sits a few millimeters off of the ground, which minimizes the need for extra electrical components like a servo while simultaneously being able to pick up and weigh the block. With no moving parts, the forklift picks up the ball by driving the block into the wall. (See Appendix, Figure 4).

Mission Sensing

There are two main components to our mission sensing. The first is the force sensor located under the baseplate (See Appendix, Figure 2). When the block is picked up by the forklift, the pressure point will press down on the force sensor, allowing the sensor to read a value. Based on testing, this value indicates either a “light,” “medium,” or “heavy” depending on the measured value. The second mission sensor is the ultrasonic sensor located on the front of the forklift. The ultrasonic sensor is capable of distinguishing between the different materials the block can be. When the block is plastic, it returns an expected distance reading. However, when it is foam, the soft material distorts the ultrasonic waves, which returns a drastically incorrect distance. The discrepancy in distance allows us to determine which material it is (See Appendix, Figure 5).

Mission Control Algorithm



Appendix

Figure 1

Forklift Assembly

Figure 2

Forklift Components Unassembled

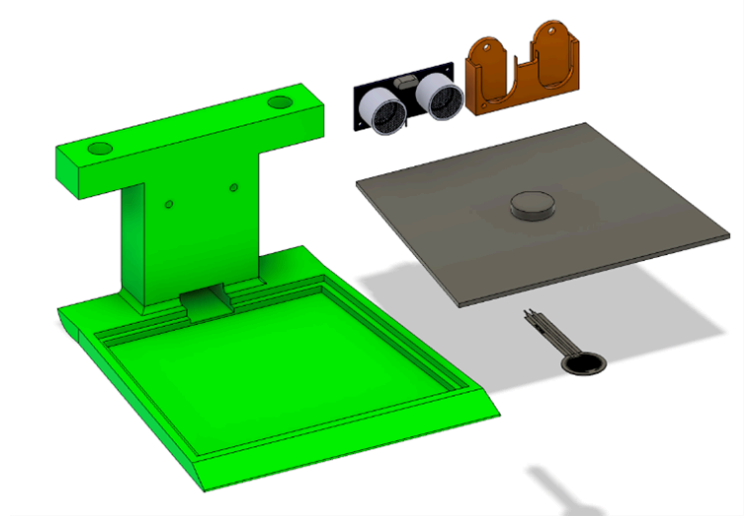


Figure 3

Forklift Proof

(forklift pushes block against wall to get it onto the base)

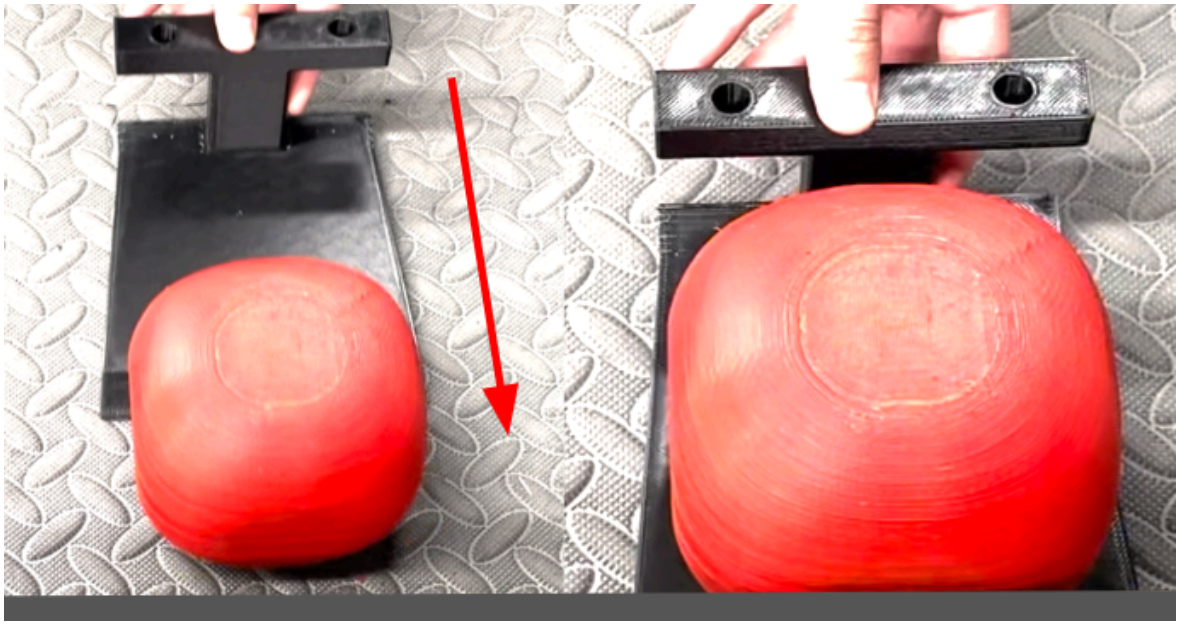


Figure 4

Ultrasonic Sensor Proof

(distance is over 1000 cm for foam block)