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Problem Overview

To prepare for any Over-the-Air (OTA) update to the Aerotherm G2 series, the team had to conduct rigorous functional testing directly on a fully integrated water heater's user interface. This process was labor-intensive, requiring up to five days of manual button-pressing and verification across multiple shifts. Automating this testing yields massive time savings over the long run.

Engineering Challenges

Mechanical: Fitting seven servos and assembly hardware within a tight enclosure footprint.

Software: Optimizing OCR screen-recognition accuracy and establishing reliable TCP/IP socket communication between LabVIEW and the Raspberry Pi.

System Design & Implementation

The testing device mounts to the water heater via hinged magnetic arms with an optional Velcro strap. Housed in a custom aluminum sheet metal enclosure, seven servos physically depress interface buttons while an onboard camera monitors the display. A Raspberry Pi acts as a TCP/IP server, executing commands from LabVIEW to trigger servo actions or analyze screen images via OpenCV and RapidOCR, returning real-time state feedback to LabVIEW. An integrated power supply drives all internal components, creating a fully self-contained test system.

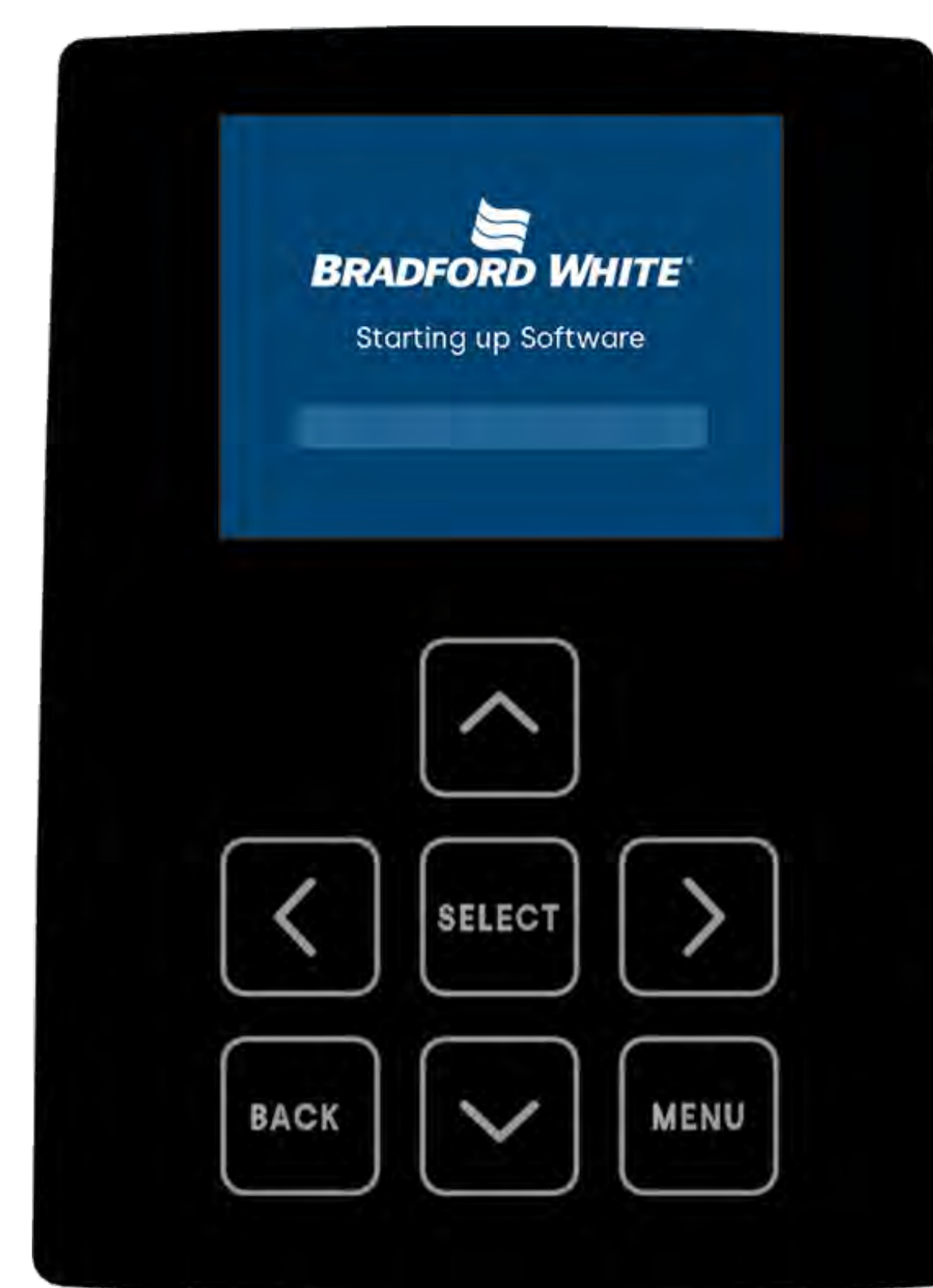


Figure 1: Target UI

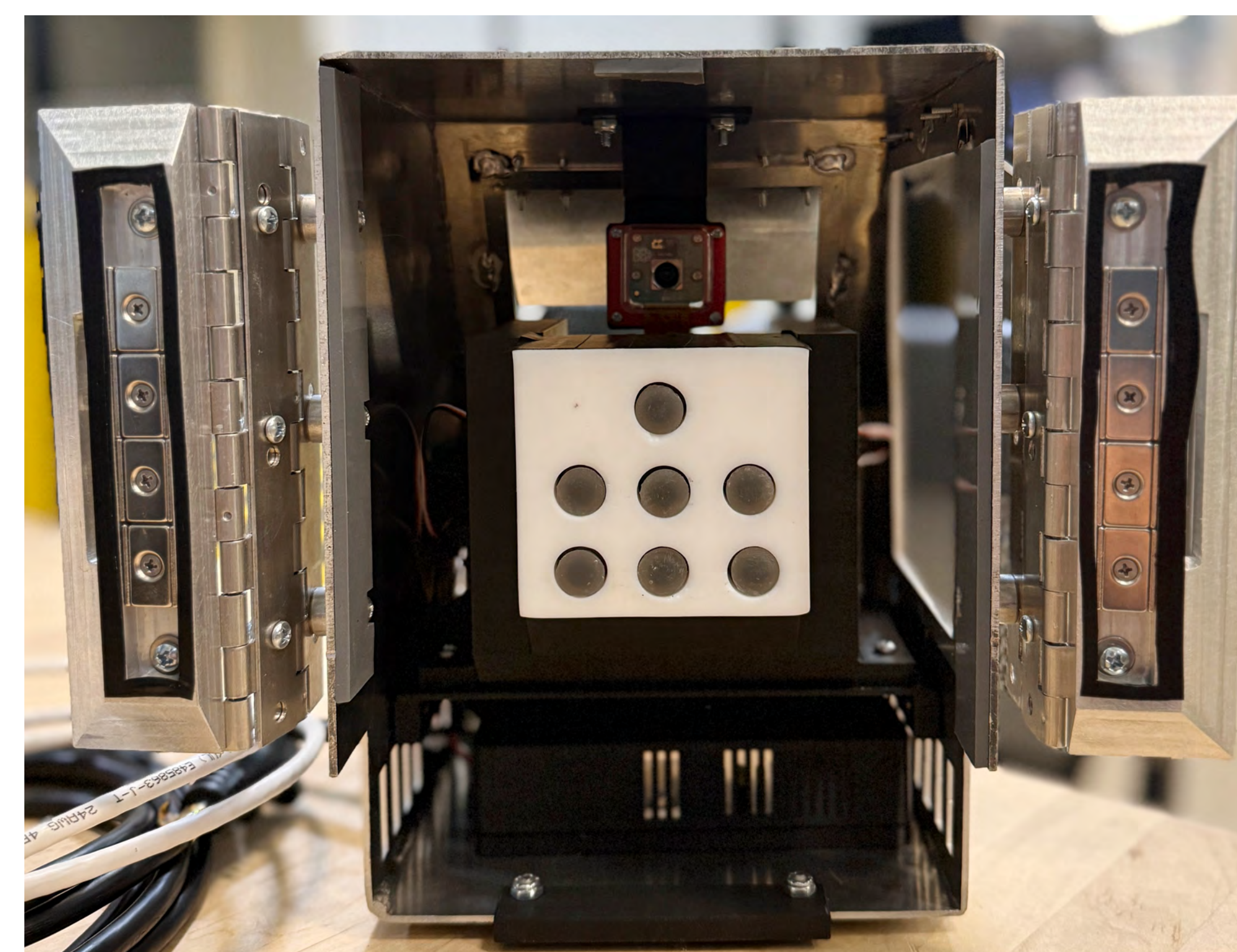


Figure 2: Testing Device

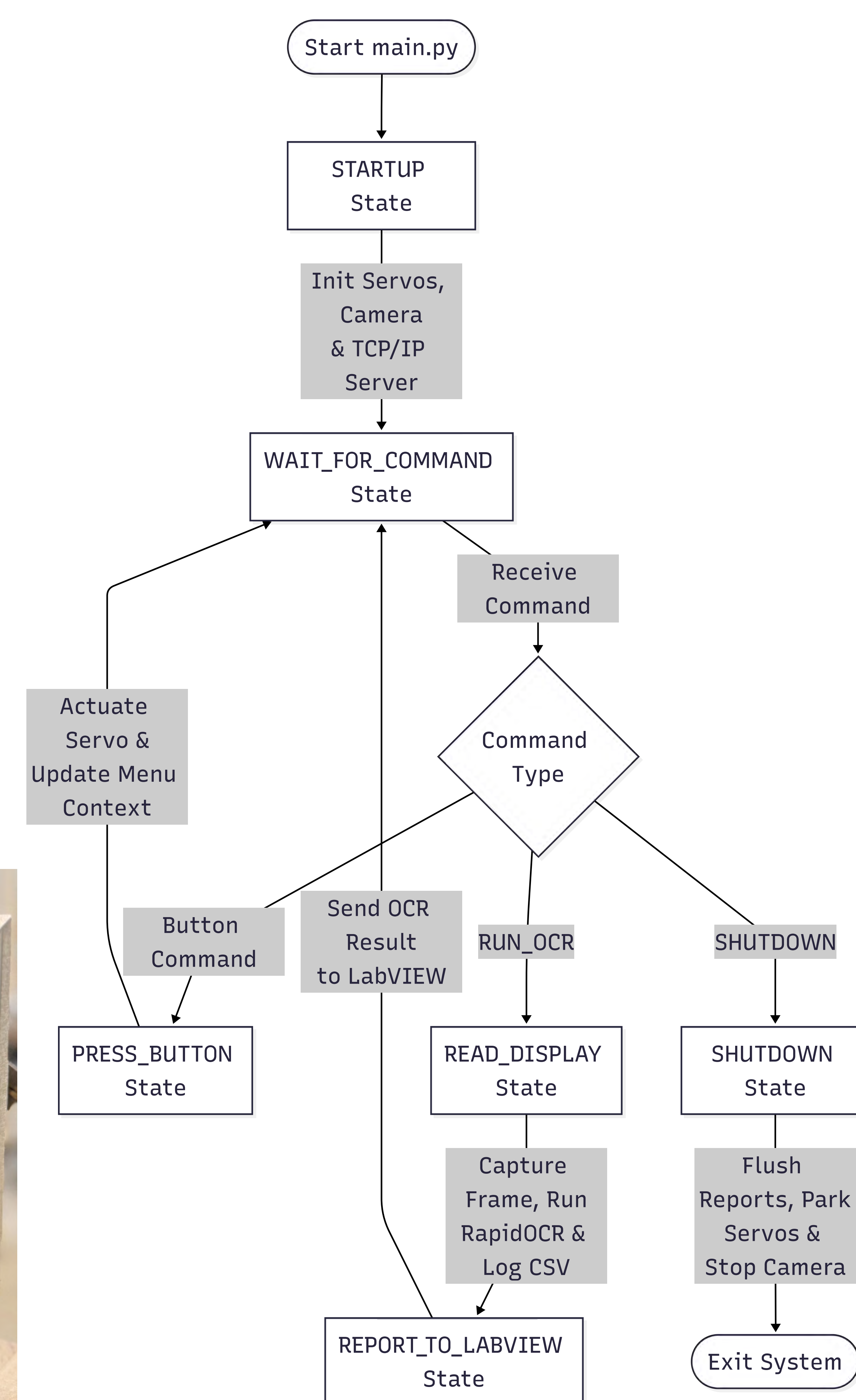


Figure 3: Software State Machine