THE ELEMENT SORTER

EGR314 Spring 2025:
Embedded Systems Design Project II

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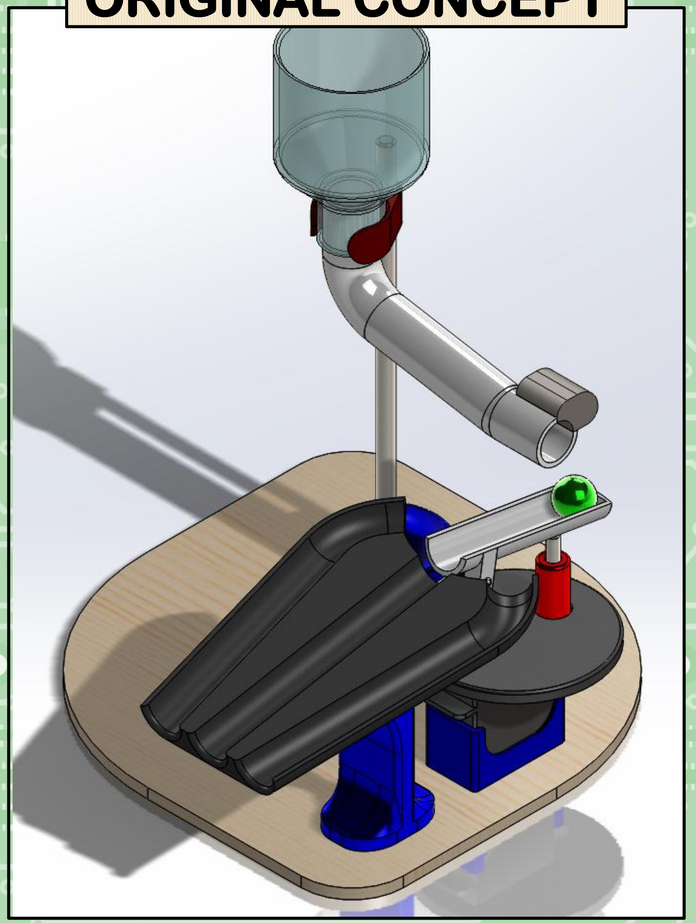
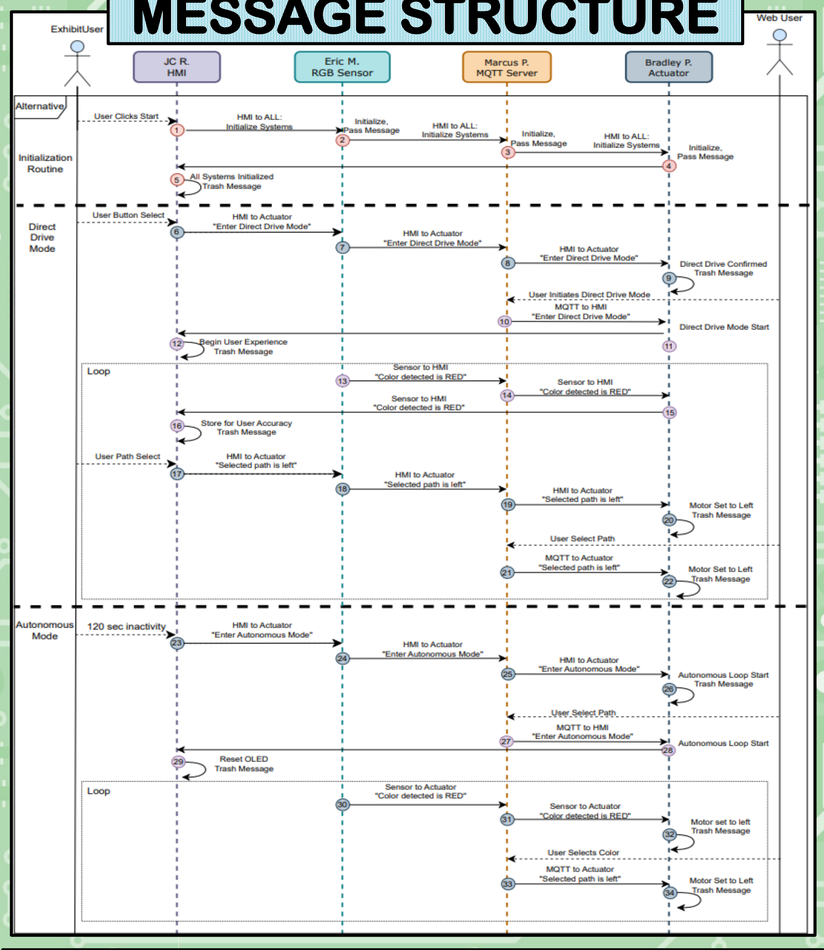
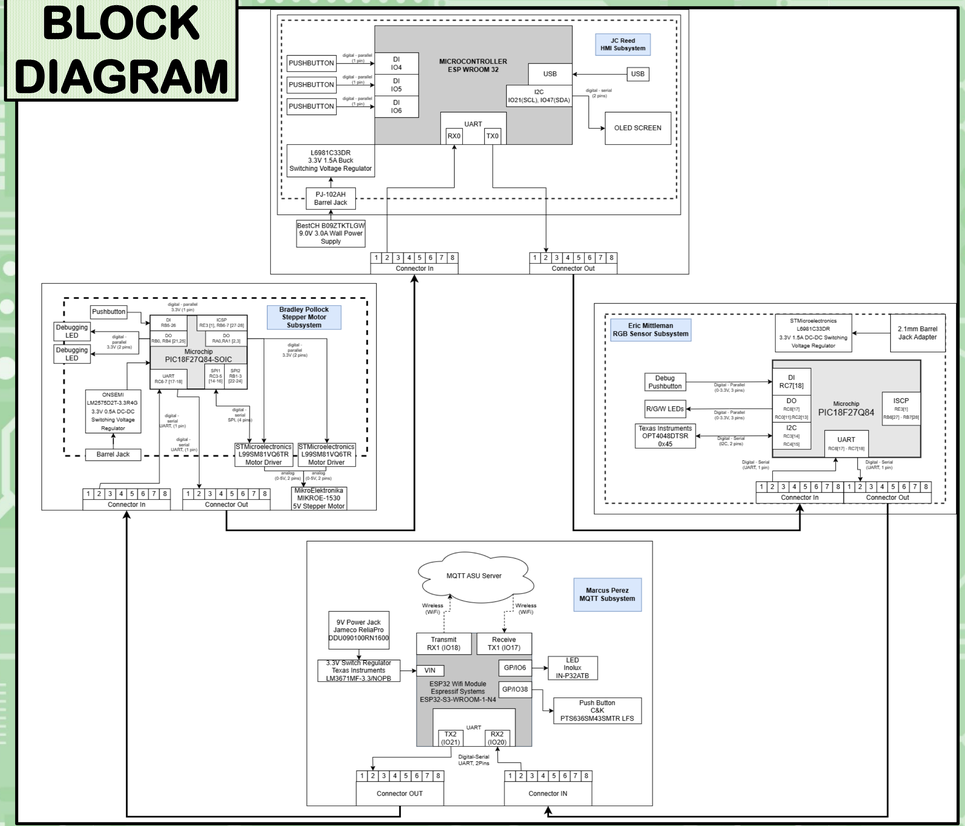
ORIGINAL CONCEPT



MESSAGE STRUCTURE

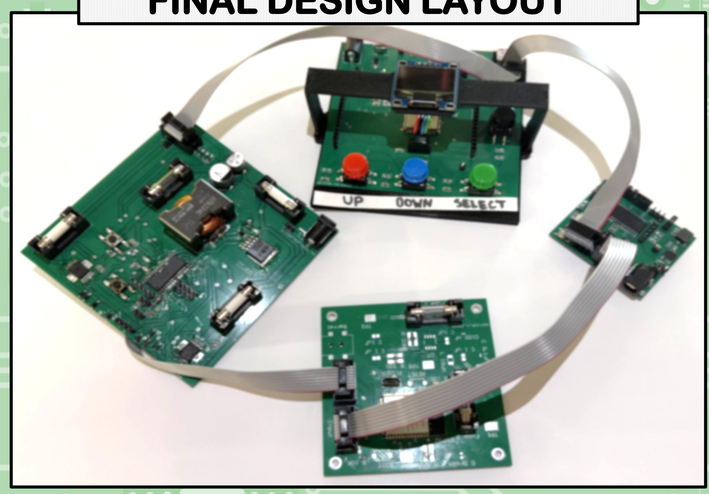


BLOCK DIAGRAM



Each team member is responsible for the following roles:
JC manages user input (HMI) using an ESP32 and an OLED-displayed menu system, Eric's subsystem detects the color of incoming elements using an OPT4048RGB sensor, Bradley uses a stepper motor controlled by two H-bridges to send the element down a specific track, and Marcus enables bidirectional communication and control of the device via MQTT.

FINAL DESIGN LAYOUT



"As this team values the needs of middle school students, we strive to increase their interest in STEM through an interactive display. In addition to inspiring youth, the display will also meet professional engineering standards." – Team 201

Museum-goers, especially middle school students, need exhibits that are **interactive**, **easy to use**, and **safe**. Team 201 worked together over the course of the semester to create an element sorter, which prompts students to test their knowledge of basic element types (metals, nonmetals, and metalloids) in a color-based sorting game.

The message protocol employed uses four main message types (labeled 0-3) communicated over character messages sent over UART from teammate to teammate in the daisy chain (see block diagram for UART lines). Message type 0 handles the initiation routine; messages of this type are sent by JC to enable overall device function. Message type 1, sent by JC and received by Bradley, toggle the device between autonomous function and direct drive. Message type 2, sent primarily by Eric, contains sensor data and is used by JC and Bradley. Message type 3 contains user input data, and is sent from JC to Bradley, determining the motor's final position. Marcus has the capability to send messages of type 1, 2 and 3, allowing remote operation of all device function. Messages are terminated by their author upon completing a full loop around the daisy chain.

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