TEAM 6-7 MHZ

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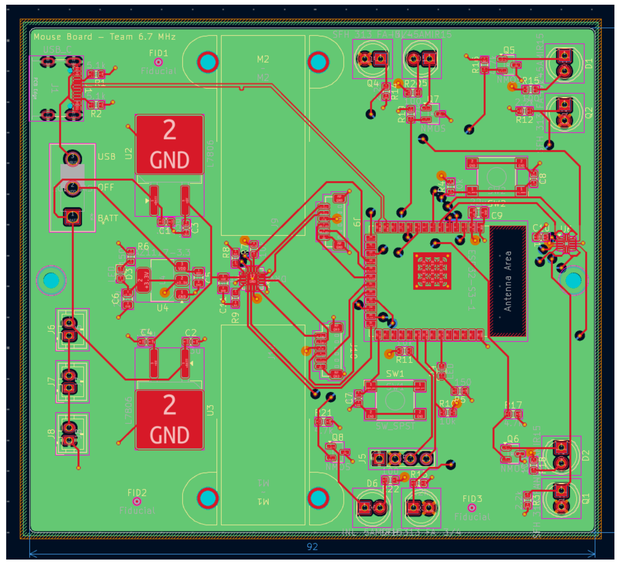
Introduction

This project focuses on the design and implementation of an autonomous robotic mouse capable of navigating and completing a maze in the least amount of time possible. To meet competition requirements, the system must operate under certain physical and functional constraints, including a maximum footprint of 25 mm by 25 mm and the ability to traverse a grid made up of 18 cm by 18 cm maze cells.

Objective

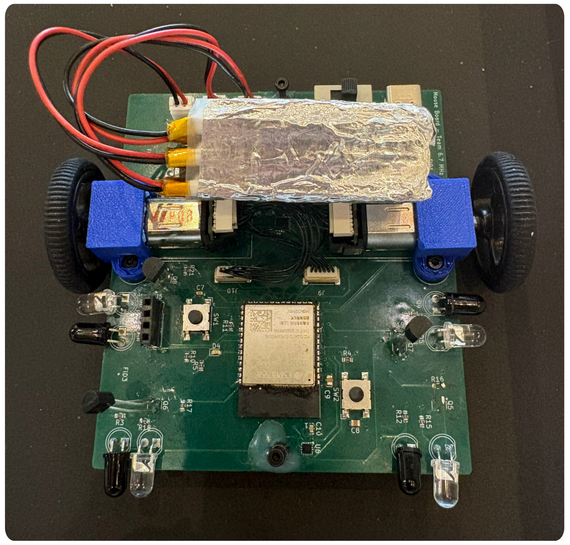
Our objective is simple: Efficiently complete the maze with consistent and reliable performance.

PCB Layout



The board takes in power either over the USB bus or from lithium polymer batteries. Voltage regulators provide 6V and 3.3V for the board's systems. The board is a 4-layer board with ground and 3.3V planes, allowing easy powering of the components. The high speed serial bus is differentially routed and tuned to equal length

Our Mouse



Components

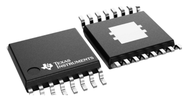
Motors: Two micro gearmotors with encoders for driving, turning, and tracking position.

Sensors: IR emitter/detector pairs detect maze walls and help keep the mouse centered.

Microcontroller: ESP32-S3 runs the maze algorithm and controls sensors, motors, and encoders.

Power: 3.7 V LiPo batteries with 6 V and 3.3 V regulators

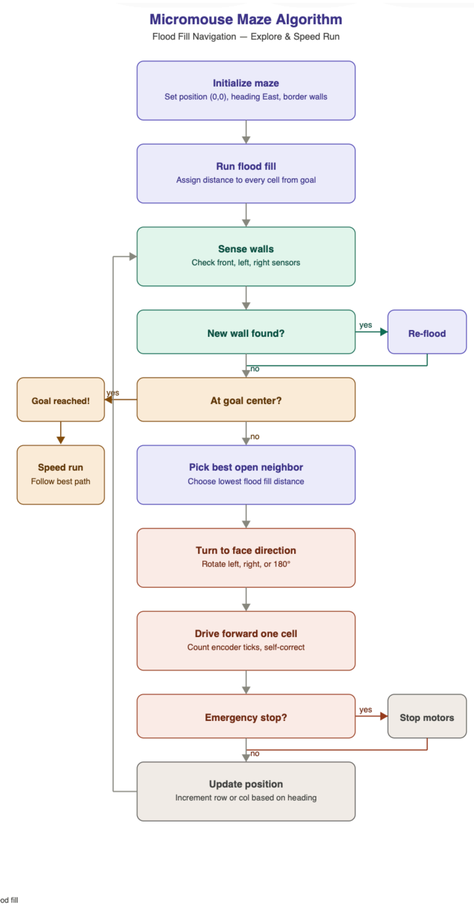
Motor Driver: DRV8411 uses PWM signals to control both DC motors.



Other: MOSFETs, op-amps, switches, USB-C, and connectors support control, programming, and signal conditioning.

Algorithm

When the mouse starts, it only knows about the outer border walls. So the flood fill calculates distances assuming every path is available.As the mouse explores, it discovers new walls, which means the distances to the goal changes too. By re-flooding after every new wall discovery, the mouse always has an accurate map of the best path to the goal given everything it currently knows.



Key Sources & Acknowledgements

Mishra, S. & Bande, P. (2008). Maze Solving Algorithms for Micromouse.

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