3. **SOFTWARE DESIGN**
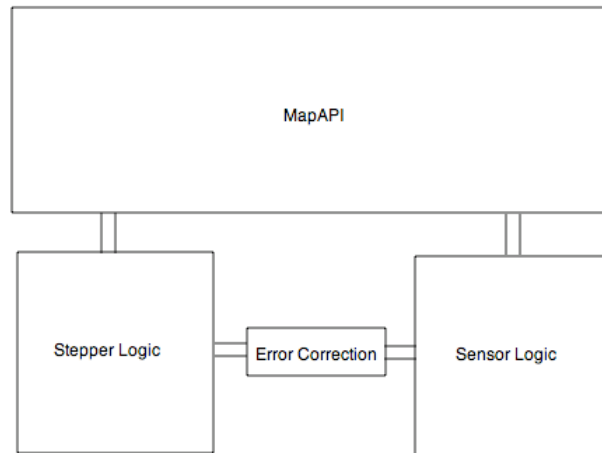
The following is a high level overview of how the software works.

I worked on the MapAPI, the Stepper Logic, and the integration of the software components (shown in the diagram below).

Mark worked on the Sensor Logic.

The Error Correction was a joint effort between Mark and myself.

MapAPI:
- Handles floodfill and writes to the mouse's internal map.

- Tells the Stepper Logic when to start stepping and how many steps to take.

- Tells the Sensor Logic when to fire the sensors and maps in a wall if either the left or right sensor report seeing a wall.

Stepper Logic:
- Moves the stepper motors based on desired displacement, which is either passed in from the MapAPI or the Error Correction.

- Has the ability to move either linearly, angularly, or a combination of both.

Sensor Logic:
- Reports whether a wall is present or not to the MapAPI.

- Reports the distance from the walls to the Error Correction.

Error Correction:
- Checks to make sure the mouse stays as centered and straight as possible by checking wall distances passed in from the Sensor Logic.

- Tells the Stepper Logic to make any physical corrections if necessary by telling it how many additional steps to take on either the left or right stepper motor.

Continuous Exploration
This section describes how the mouse maps walls without stopping.

Continuous Exploration works by utilizing the top and bottom halves of the diagram below.

The top half is mainly the MapAPI's functionality, which is mapping walls by taking values from the Sensor Logic, running floodfill, and feeding the Stepper Logic with a displacement (both angular and linear).

The bottom half is the full-blown movement of the mouse that includes movement with error correction running.

The halves are separated by a thick black line as shown below.

In addition, a small module is embedded in both the MapAPI and the Stepper Logic to enable the program to cross over back and forth between the halves while the mouse is in motion.

The end result is a mouse that can map walls without having to stop (unless a turn is needed due to a front wall).
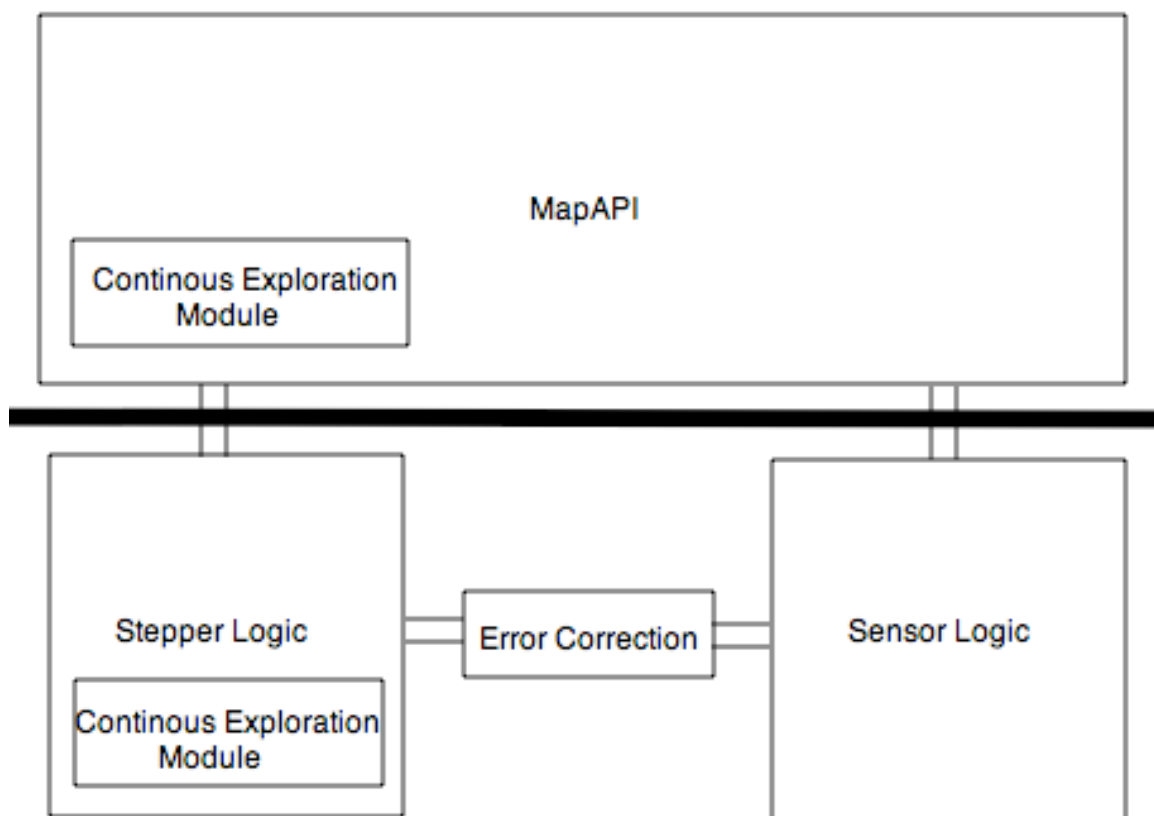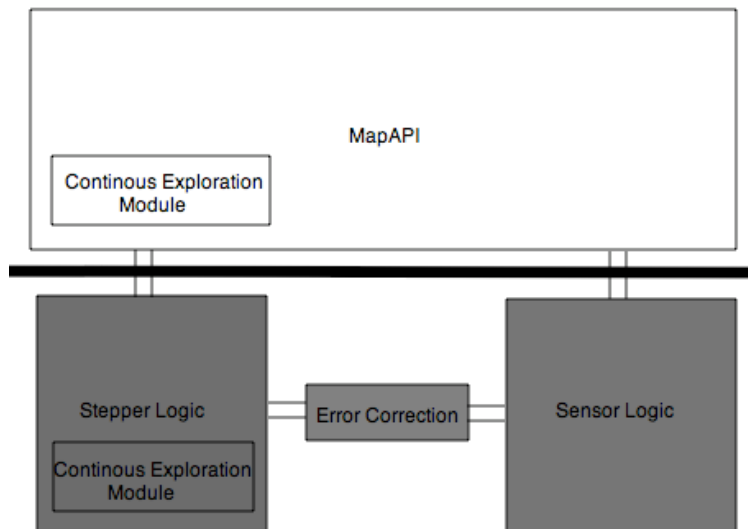
How It Works

First, we start in the upper half (indicated by the respective shading).
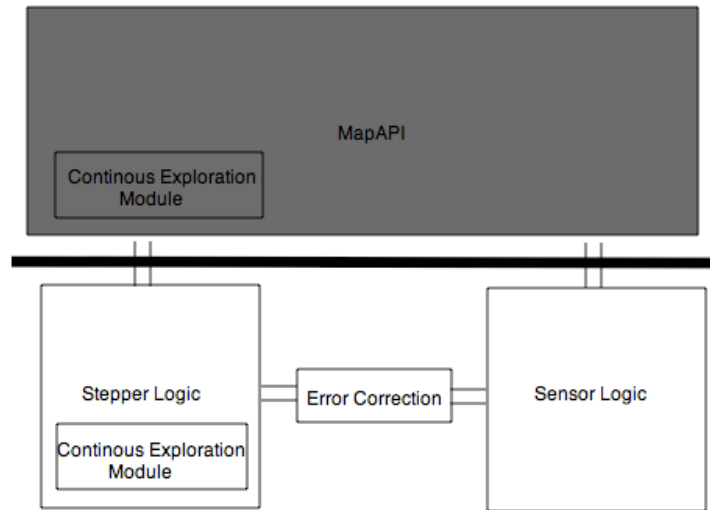
The Continuous Exploration Module of the MapAPI feeds the Stepper Logic a very large linear displacement. This will cause the mouse to move forward and accelerate to full speed.

Once the mouse is in motion, the program is now in the lower half.

The mouse will stay in motion until one of two things happen:
- The front sensor reports a front wall is approaching.

<div align="center">or</div>

- The number of steps taken so far is equal to the number of steps it takes to travel a one cell distance.

Once either of the above happens, the Continuous Exploration Module brings the program back into the upper half and the cycle starts again.