System Requirements

Floorplan, typical obstacles, lighting conditions (for vision), and any unusual features of the indoor environment (e.g., narrow hallways, glass surfaces).

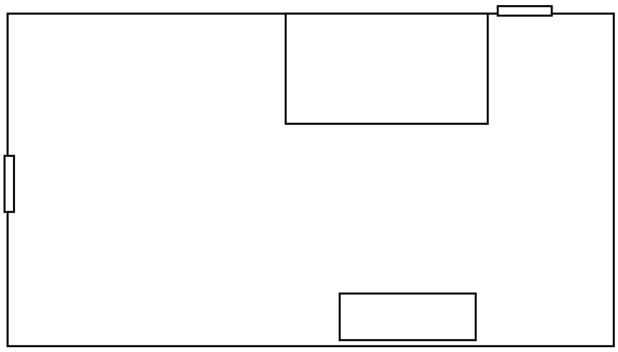
- **Floorplan:**

The area is 11.7 X 9 Meters, with an enclosure within of size 1.5X2.8 Meters at 5 meters to south from the left corner. Two doors, one at 5 meters from left corner to the east, another at 8 meters from left corner to south. There is a cabinet of size 2X.5 Meter in the South west corner at 6.5 meters from the right corner to south.

There are no glass surfaces.

The floor is polished stone.

Lighting is as in normal indoors in daylight. It can be improved if necessary.



- **Expected Navigation Range and Speed**: How fast and how far the system needs to move in one session.

The vehicle is of size 0.5m X 1m, and needs to move at 4-5km/hour. It needs to cover about 3km in a session.

- **Precision Requirements**: Any specific requirements for distance accuracy or margin of error in obstacle avoidance (e.g., tight spaces needing high precision).

There is no need for precision, except that the vehicle should not get stuck in corners.

Budget for hardware

A lidar – RPLidar A1 from Slamtek is already available, but is not interfaced to the controller. The budget is about 1000 – 1500 USD.

A platform of size 0.5X1 meter is also available, based on an ESP32 with WiFi communication to a base remote control. The ESP32 also controls two motors for combined drive/steering of the platform. A basic command set for speed and turning is available, and can be improved upon.

Two batteries of 4000mAh, 11 volt are used on the platform.

Obstacle Types and Motion Scenarios

□ Types of Obstacles: Sizes, shapes, and materials of obstacles (e.g., tables, chairs, walls, and smaller items).

Obstacles here are really the walls and furniture as described above.

□ Static vs. Moving Obstacles: Whether obstacles are stationary or moving, and if moving, their typical speeds.

No moving obstacles to be planned for.

□ Navigation Goals: Any specific tasks (e.g., follow a wall, avoid certain areas, go to specific points).

Path should keep varying when the platform is moving by itself. In one mode of operation, It is required that the platform should be propelled manually and steering should be automated. If the platform gets stuck in any corner, it should be automatically retrieved on to a clear path.

Follow the wall could be one of the modes.

Sensor and Vision System Preferences

- **Type of Vision Required**: Whether you want object detection (to identify specific objects), simple depth sensing, or SLAM for real-time mapping and localization.

  To be decided solely upon the requirement of being able to get out of a 'stuck' scenario and obstacle avoidance.

- **Camera Specifications**: If a specific camera resolution, frame rate, or field of view is required (e.g., high-resolution camera or a wide-angle lens).

  No unusual requirements are foreseen.

- **Sensor Range and Sensitivity**: The maximum distance the system should detect obstacles and any resolution requirements.

  About 2 feet.

Processing and Control Preferences

- **AI and Machine Learning Capabilities**: If you have a preference for specific ML models or libraries (e.g., TensorFlow Lite, OpenCV) or limitations in processing power that might affect model size and type.

  No preference, except that it should not unnecessarily require an expensive controller, and should offer maximum assistance from AI in coding.

- **Preferred Control Algorithms**: If you already have control strategies in mind (e.g., PID, reinforcement learning) or if you're open to algorithm selection.

  No strategies in mind, but am used to PID.

Data Logging and Feedback Needs

- **Data Collection for Improvements**: Whether you need data logging for post-deployment analysis to refine the system (e.g., obstacle types encountered, success rates of avoidance maneuvers).

  Yes, that would be beneficial.

- **Real-Time Feedback**: If you want real-time data monitoring or feedback mechanisms (e.g., visual display, alerts for close obstacles).

  Does not seem necessary at this point in design.