# Requirement Analysis

## Functional Requirements

Basic modular requirements would be powering on, the ability to move, the ability of the line sensors to detect lines, ability to detect distance using the ultrasonic sensors

Interfacing requirements would be speed and turning control which comprises of fine control of the H-bridge; communicating with the line and ultrasonic sensors.

Complex microcontroller requirements would be the ability to record, store and analyse routes and intersections; stopping at certain criteria and decided when to measure distance; controlling the direction and speed of the robot.

## Constraints

* Voltage supply and logic level is 5V
* Veroboard 100mm x 50mm, no breadboard
* Operate off 2 x 18650 3.7V Battery (series) (AMS1117-5.0)
* Ultrasonic sensor at the front
* Maximum of 5 line sensors
* Specified components to use
* Time
* Availability of parts
* Axel length and wheel diameter

## Possible Bottlenecks

* Processing and sensor speed
* Battery power
* High turning speed stability
* Subsystem Design

# Sub System Design

## Subsystem and Sub-subsystems Requirements

* + 1. Power

Regulate to 5V. Supplying sufficient current to all subsystems. UVLO? RP? CURRENT Reg

* + 1. Microcontroller

Interpreting sensor data, outputting data to drive systems, logic control flow. Must process data faster than the sensors. Have LED to indicate when US sensor in running

* + 1. Motor drive and Motors

Forward and reverse and turn control and speed

* + 1. Mechanical

Host all components and chassis must be strong. Protection.

* + 1. Sensors

Fast and accurate data from line and US sensors

## Subsystem and Sub-subsystems Specifications

* + 1. Power

Regulate to 5V from between 6 and 8.4V. Supplying sufficient current to all subsystems. UVLO at 6V. RP uses less than 1mW. Current regulator must prevent LVR from going kaboom.

* + 1. Microcontroller

Receive 5V power and convert the output 3V3 logic to 5V using a Logic Level Converter. Calculations between the line sensors and H-Bridge output must be done in less than 1ms

* + 1. Motor drive and Motors

Motors must be able to rotate at constant speed. Must be supplied with 5V and max 5A.

* + 1. Mechanical

100mm x 50mm Veroboard

* + 1. Sensors

Data transmission must happen in less than 10 clock cycles, sensor speed higher

## Inter-subsystems Interactions

## UML Diagrams were possible

# Acceptance Test Procedure

## Figures of merits based on which you would validate your final design.

* Does it power on
* Interconnectivity
* Does it move
* Speed and turning control
* Follow a line
* Resolve an intersection
* Ability to map paths
* Stop at a measuring point and measure distance
* Terminate at the stop point

## Experiment design to test these figures of merit.

* Check power system and LEDs
* Check if uC can communicate with all components
* Input a move command to the uC
* Input a specific move command with speed and turning
* Create line path with a turn, apply robot
* Add an intersection to path
* Check that every path of the intersection is taken
* Add a measure point and object
* Add a stop point

## Acceptable performance definition

# Development Timeline

# References