

Abstract

The final object of the Croomba project is to create a robot capable of inspecting a crawlspace autonomously while taking pictures and recording sensor data. This edition of the Croomba aims to improve navigation capabilities with continuous satellite mapping and the ability to ascend a 30-degree incline.

Compass Constraints

Precision Limitations:

The compass system must provide accurate readings within ± 3 degrees Gauss and a digital resolution of 0.73 mg/LSb. To ensure enhanced accuracy, error estimation or filtering techniques should be applied to address potential errors in the measured magnetic field values.

Solution:

Implementing error estimation and filtering techniques will help improve the precision of the compass data. By applying these techniques, the system can compensate for any inaccuracies or variations in the measured magnetic field values, resulting in more reliable data.

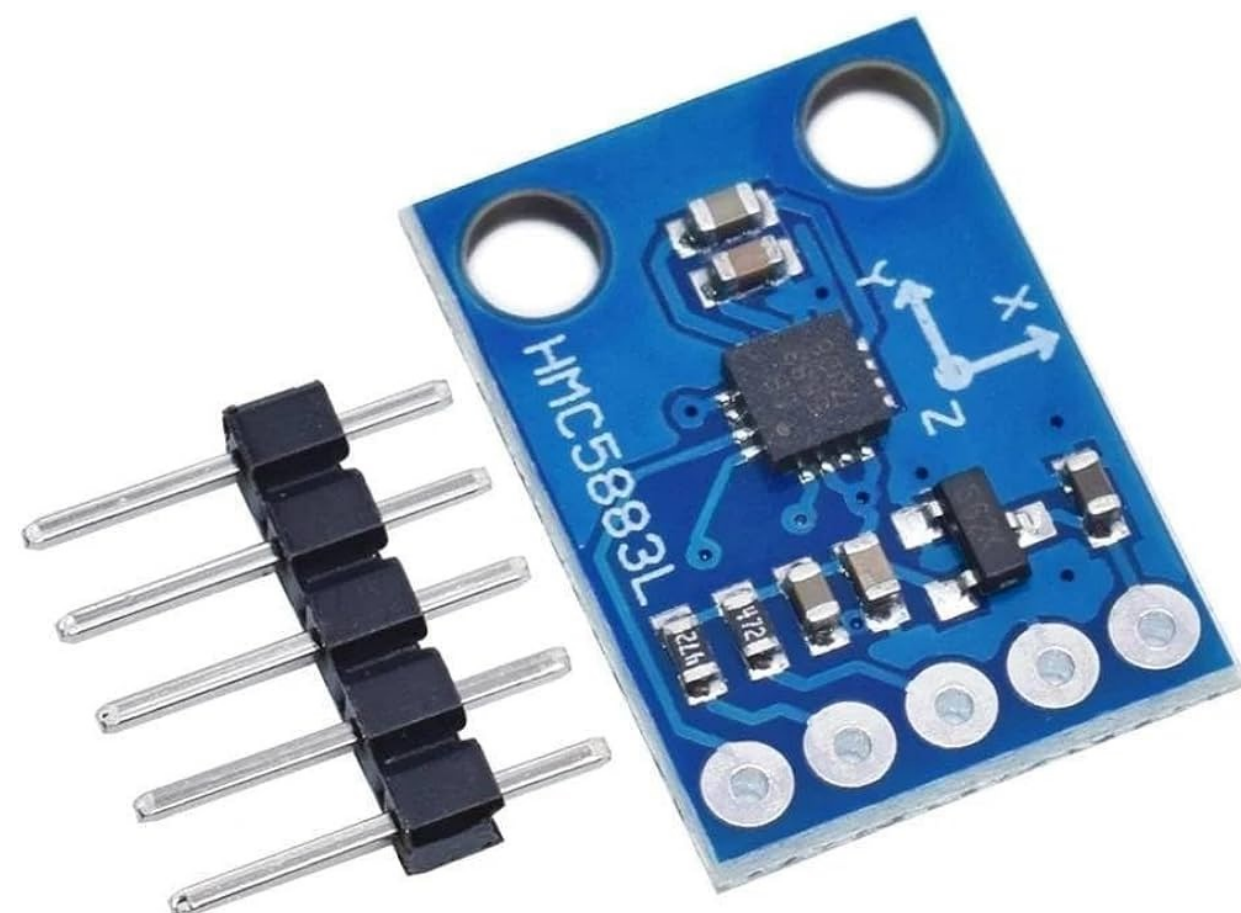


FIGURE 1: HMC5883L Compass

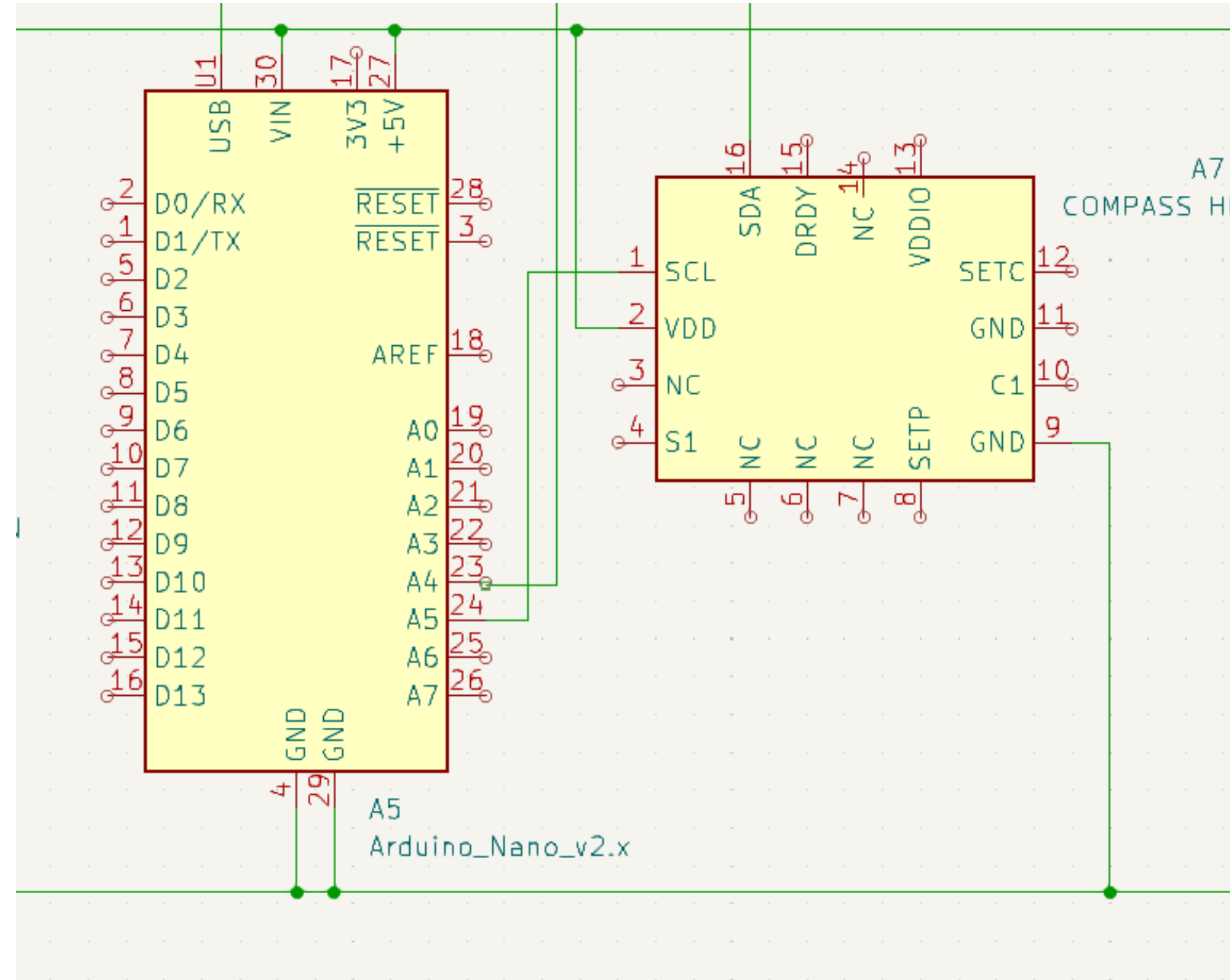


FIGURE 2: Compass Electrical Schematic

Compass Analysis Results

Sensitivity Analysis:

We determined the LSB value and range for different sensitivity settings.

Compass Heading Accuracy:

Calculated the compass heading accuracy in degrees/LSb.

Correction Factor:

We determined the correction factor to compensate for a consistent bias in the sensor readings.

Measurement	Raw X	Raw Y	Raw Z
1	-34	14	149
2	-32	-66	147
3	-103	-50	-50
4	15	32	138
5	-80	-89	117
6	-82	-97	115

FIGURE 3: Compass Experimentation Data

Chassis and Motor Constraints

Chassis:

- The chassis width and length shall be under 300 mm
- The chassis height shall be under 300 mm
- Enable the robot to ascend a 30-degree incline

Motor:

- The motor shall be 25 millimeters in diameter.
- The motor shall not exceed 79.7 millimeters.
- The motor shall have a shaft diameter of 4mm length.
- The motor shall have a load capacity of at least 2.6802 kg, exceeding the robot's weight by more than 75%, ensuring safety, reliability, and adaptability.



FIGURE 4:
TS-25GA37 Motor

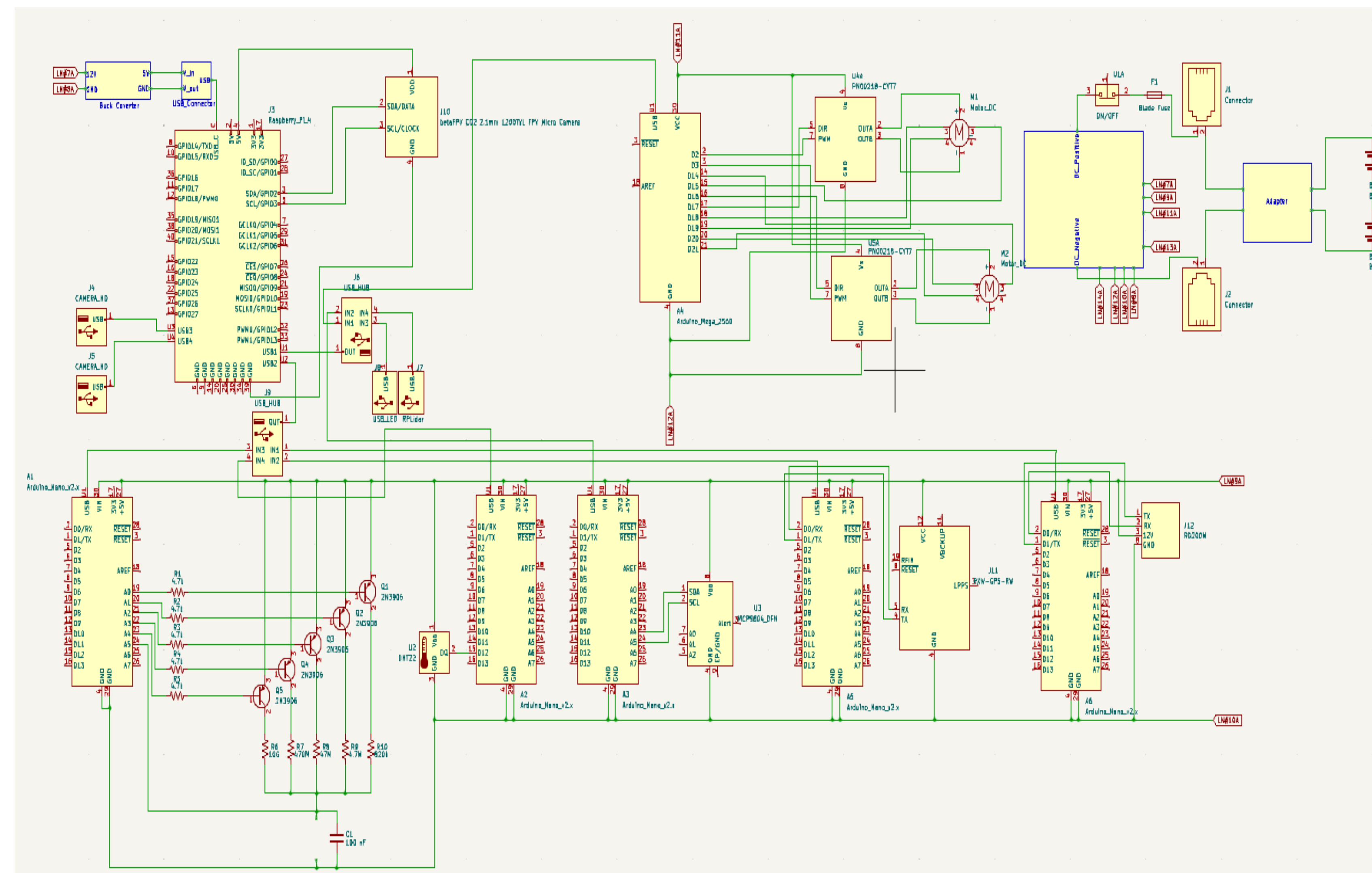


FIGURE 5: Croomba Electrical Schematic

Name of Items	Used in which subsystem	Part Number	Manufacturer	Quantity	Price	Total
compass	compass	HMC5883L	adafruit	1	6.69	6.69
Arduino Nano	compass	A000005	Arduino	1	24.90	24.90
Metal DC Geared Motor	Movement	TS-25GA37	Bemonoc	2	14.88	29.76
					Total Cost:	61.35

FIGURE 6: Project Expenses

Reflection

As the second iteration of the Croomba project, the group ran into several difficulties. Certain extensions were too cost-ineffective to add. It also took time to return the Croomba to its previous state and limited the amount of changes the group implemented. With more time and proper planning, the group thinks more extensions could've been added

Future Work

This iteration of the Croomba project has shown that there are still plenty of opportunities for future improvements on later iterations of the robot. Future possibilities include the addition of more sensors to help improve inspecting capabilities, live-stream capabilities to replace image stitching, and upgrades to the hardware. The Croomba will continue to be a legacy project that future teams will continue to develop.