Microcontroller-Based Survey Vehicle

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① Aim & Objectives

To design and implement a cost-effective roaming vehicle that can be used to survey an area of terrain. Object detection is the main surveillance feature, with the possibility of adding or changing sensors. The vehicle should scan the area without overlapping and map the location of features relative to the starting point.

The vehicle should be able to follow a pre-programmed path with a precision of about ±20cm with a mechanism for location awareness. It should be capable of 45, 90, and 180 degree turns. The vehicle should be able to autonomously scan an and roam an area.
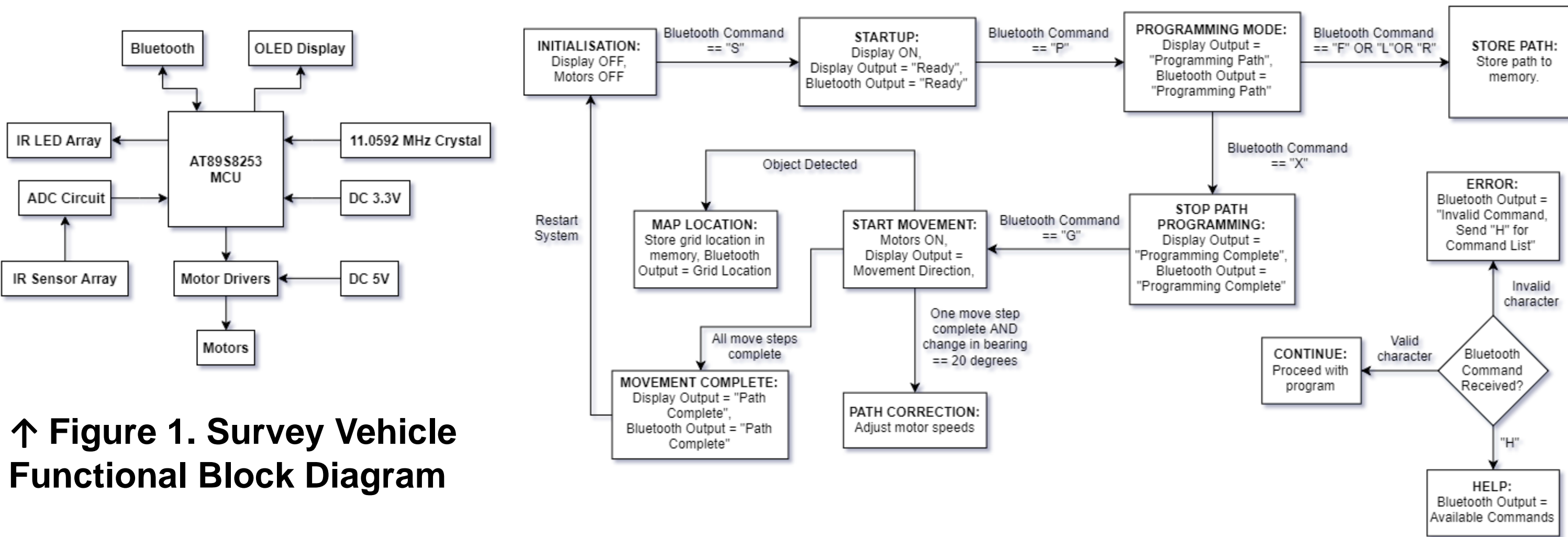
② Design Overview

Components:
- Microcontroller: AT89S825
- Stepper Motors: 28BYJ-48
- Motor Drivers: ULN2003A
- Bluetooth: HC-05
- Display: 128x64 IIC OLED
- Sensing: Infrared
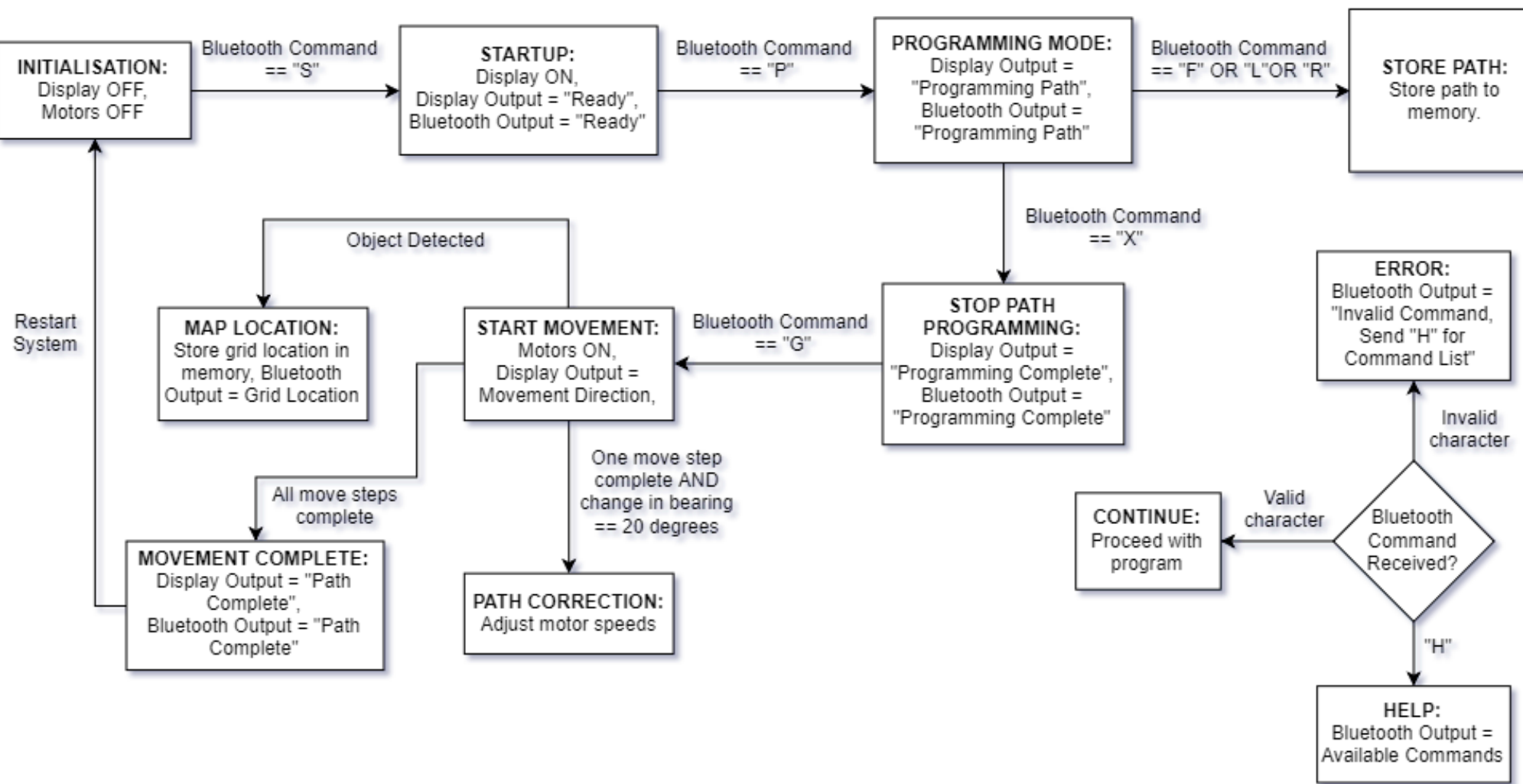- Analogue to Digital Convertor: LM311

Software:
- MCU8051 IDE
- EasyPRO Programmer
- Dataman-Pro PG4UW Programmer
- Fritzing
- Draw.io

Programmers:
- EasyPRO 90B
- Dataman 48Pro2C

↑ Figure 1. Survey Vehicle Functional Block Diagram

↑ Figure 2. Survey Vehicle System Behaviour Overview

③ Methodology

When design the system, each component was tested individually. After each component was confirmed to be working as intended, they were tested together with other components. Following this process, all the components were tested together and ensured working.

After writing snippets of code for each component, simulations were run to ensure the code behaved appropriately, before implementing it on the hardware. The MCU8051 IDE was used to compile and simulate the code.

④ Results

The images on the right show the results of testing each component individually before interfacing them all together.

Each component was tested multiple times to ensure they worked flawlessly.
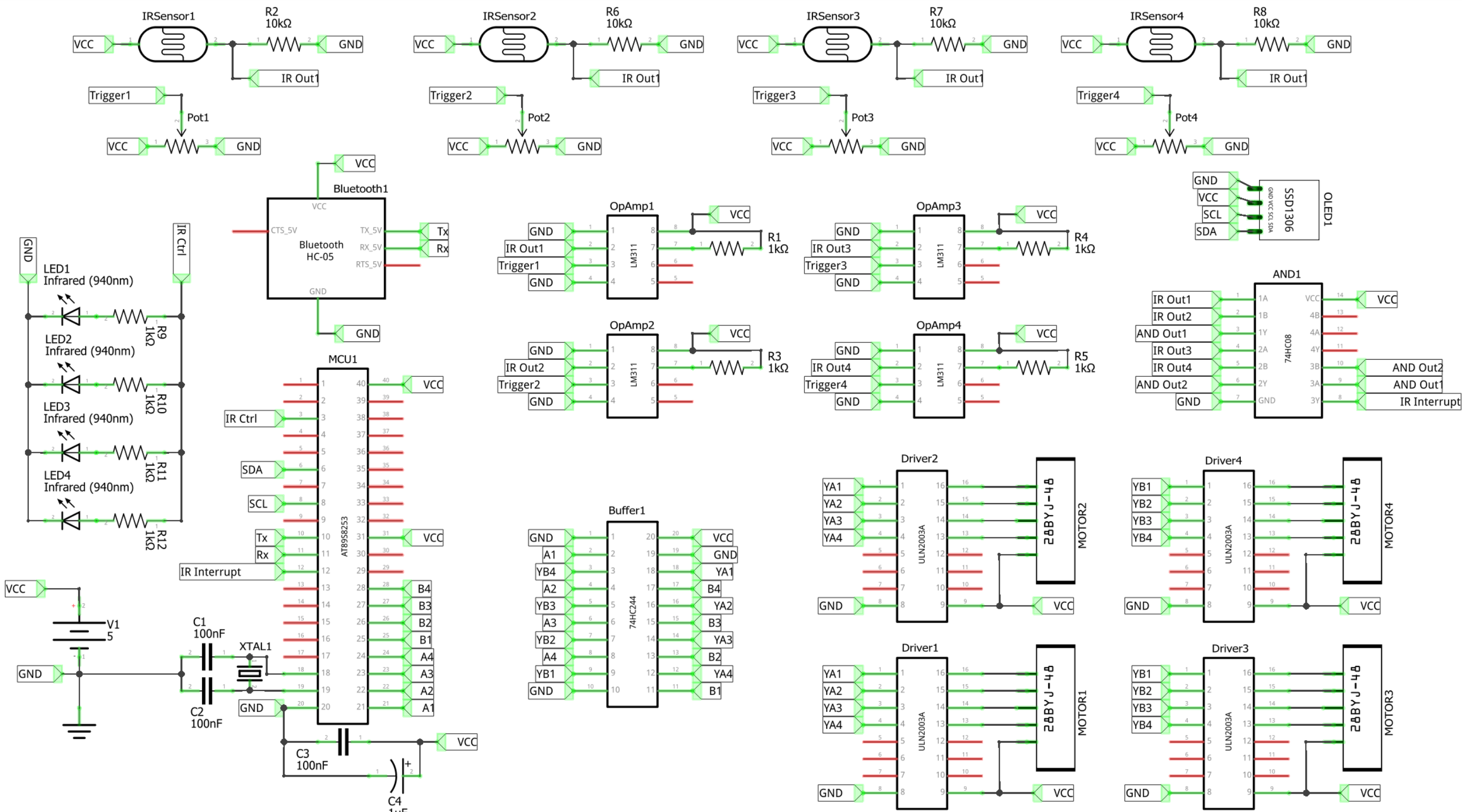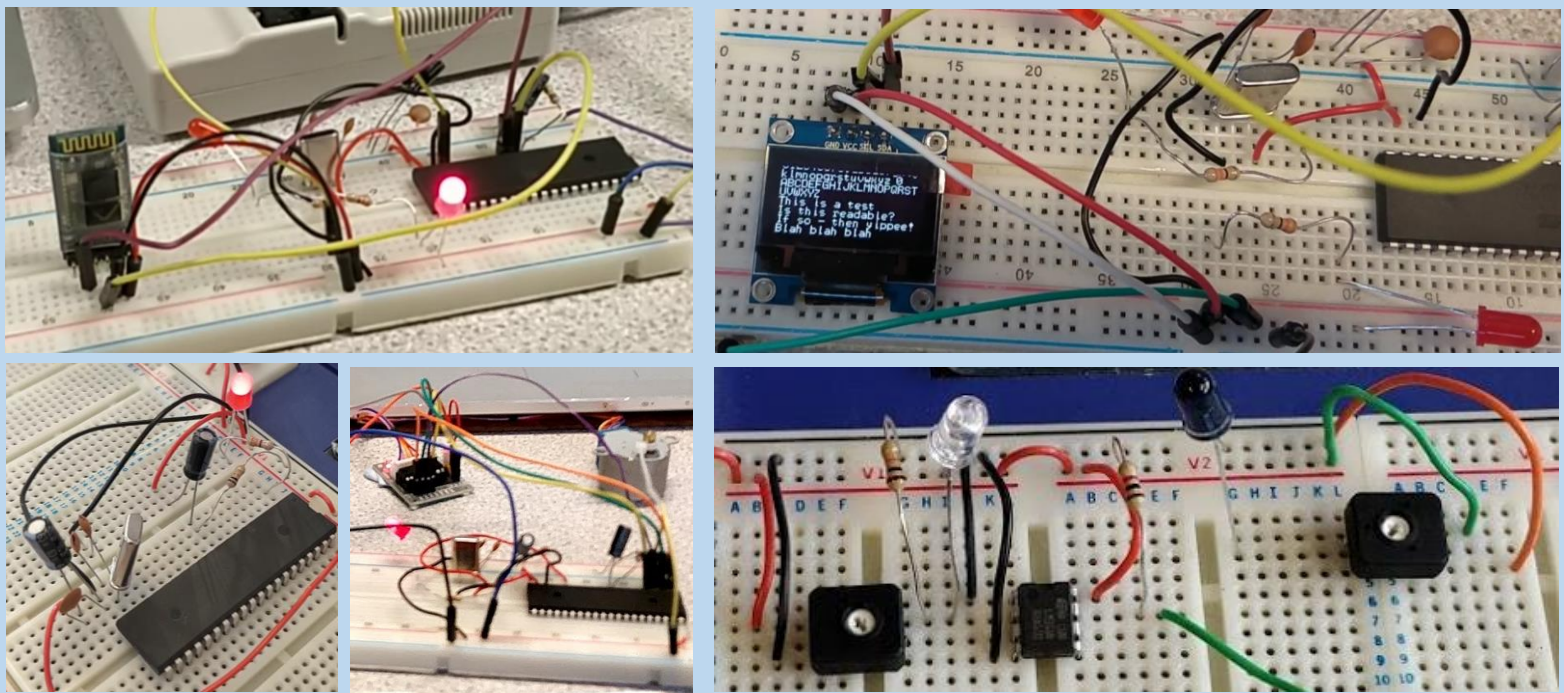
↑ Figure 3. Low-Level Schematic of Survey Vehicle

⑤ Conclusion

A small survey vehicle was designed and implemented using an 8051 microcontroller. It is capable of object detection via infrared sensing and precise movement using stepper motors, featuring Bluetooth communication.

Future improvements include (but not limited to) adding orientation awareness, increasing power efficiency, and additional sensors for surveying different features of terrain.

Acknowledgments
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References
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