Automated Wireless Servo Mapping System

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Introduction

CFAR uses a VN-100 rugged (an IMU with direct RS232 connection) with an RS232 cable to relay the needed angular information to create servo state tables to a computer for processing and analysis. This solution, while functional, is lacking in that it produces unnecessary harness pressure. The goal of this project is to replace the current cabled solution with a wireless system, alleviating the hassle and harness pressure produced by a wired system.

Materials

The Automated Wireless Measurement System uses a surface-mount VN-100 IMU/AHRS connected to a BGX220P Bluetooth module on a custom PCB to relay information to a secondary BGX220P Bluetooth module on a development board connected to a computer.

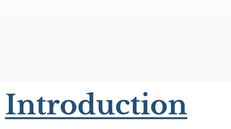

Figure 1: Automated Wireless Measurement System [VECTORNAV]

Figure 2: BGX220P Bluetooth Module [Silicon Labs]

PCB Design

The final PCB design is a 2-layered board, and measures only 5cm* 5cm.

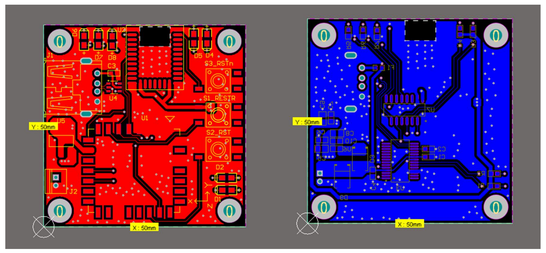

Figure 3: PCB Design

Design Methodology

After literature review, Bluetooth was determined to be the best communications protocol to implement communications at the desired bit rates and ranges. Because of a lack of Bluetooth firmware development experience among the project team, it was decided to implement a communications system consisting of two BGX220P modules.

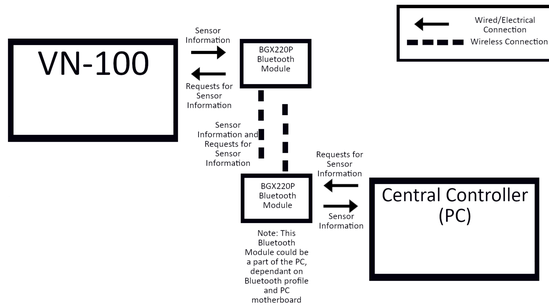

Figure 4: Automated Wireless Measurement System Communication Outline

After selecting the BGX220P and VN-100 as the communications system and sensors, respectively, a circuit was designed to provide an interface for the two modules, as well as provide ESD, overcurrent, and reverse polarity protection.

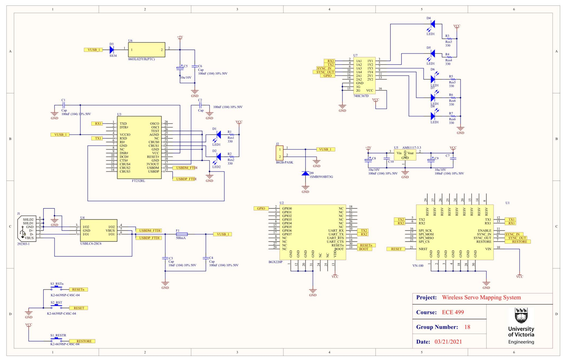

Figure 5: Automated Wireless Measurement System Circuit Diagram

Testing

Due to last minute design revisions making producing a prototype in time impossible, it was impossible to produce meaningful test results for the circuit. The communications system was still tested, using a close analogue to the actual communications system of two BGX220P development boards, one fed ASCII data at a known rate and the other receiving.

Results

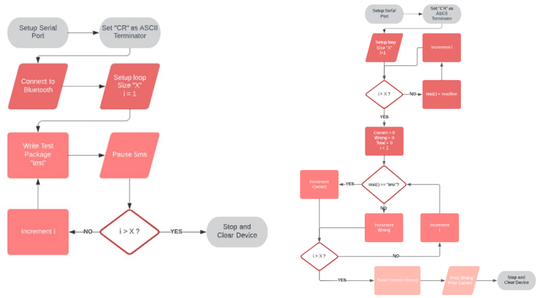

Figure 6: Overview of the Testing Software

Testing software was done with the transmit and acknowledgement features of the paired BGXP220P modules set to different settings. The results of this testing can be seen in the following tables:

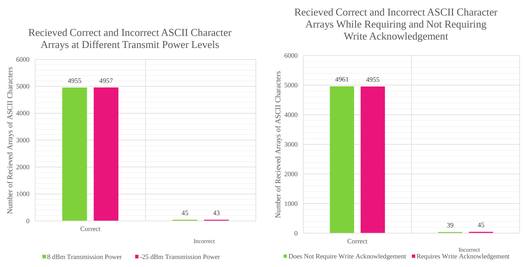

Figure 7: Communications Testing Results

Conclusion

The automated wireless servo measurement system's communications system seems to work very well, based on testing done with a similar system to what will be used. It is impossible to verify the operation of the circuit without testing the physical PCB, which is yet to be printed, but from calculations and review of data sheets it is expected to function.

Recommendations

Implementing a SoC SPP Bluetooth communications system in place of the existing communications system would increase system throughput and remove the need for a module to be attached to the computer in most cases, but would require experience in Bluetooth firmware development to implement in a reasonable time period.

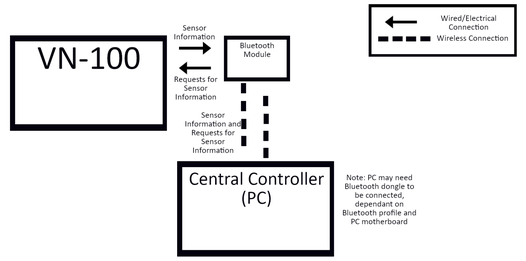

Figure 8: Recommended New Communication System Outline

Acknowledgements

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