

PORTLAND STATE UNIVERSITY
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING



2019 ECE CAPSTONE
TEAM 21

FACULTY ADVISOR: ROY KRAVITZ, M.S.

SPONSOR: SIGHTLINE APPLICATIONS

UAV Landing Aid - Design Report

Authors:

TAI PHAM

KIMBALL S. DAVIS

May 13, 2019

Abstract

SightLine Applications has developed a precision visual landing aid for UAV's. The Landing Aid supports autonomous landing operations by automatically finding and tracking an easy to place landing pattern. Integration of the SightLine Landing Aid for end users is problematic for two main reasons:

1. Connectivity issues with a wide range of cameras.
2. Communication issues with a wide range of flight controller hardware and software.

Currently the end user selects a camera to be used with the SightLine processing hardware. A wide range of cameras must be supported, and custom A/B boards must be designed for each one to interface with the SightLine hardware. Each of these A/B boards can have cable, power, and electrical connectivity issues that are problematic for the end user. There is also a wide range of flight controller hardware and software, each with a myriad of different communication protocols. Installing software components to facilitate this communication is fine for the end user, but if any programming needs to be done this is usually a complete show stopper. The proposed solution to these problems is to develop an all in one unit with plug and play capabilities that can be directly connected to a consumer level flight controller. By doing so camera connectivity and selection problems are eliminated, and communication and software deployment are made much easier for the end user.

The project is divided into three sections:

1. Choosing and building an "off the shelf" quadcopter that uses a Pixhawk 4 flight controller that can be used for testing
2. Designing a camera based on the On-Semi AR0134CS optical sensor that connects directly to the SightLine hardware, distributes power, and facilitates communication between the flight controller and SightLine hardware
3. Research and development of documentation and software installers to meet plug and play expectations using QGroundControl flight control and mission planning software

We quickly found that none of these tasks are easy or simple. The selection, build, and testing of a custom quadcopter is a complicated task with many variables. GPS signal degradation made indoor flight tests impossible, and safe outdoor testing locations were hard to find. We did successfully autonomously fly the built drone using QGroundcontrol mission planning. A camera board, The SLA1500CAM was designed and tested.

Insert Hardware Test Results Here

Insert Software Results Here

What are the limitations?

Future implications of project?

Contents

1	Project Overview	4
1.1	Problem Definition	4
1.2	Solution(10,000ft view)	4
2	Results(Technical Detail)	4
2.1	Quadcopter	4
2.2	Hardware	5
2.3	Software	5
3	Conclusion/What's Left to do	5
4	Appendix	7
4.1	I	7
4.2	II	7
4.3	II	7
4.4	IV	7
4.5	V	7
5	References	8

List of Figures

1	<i>This is a caption for a blank figure</i>	4
2	<i>This is a caption for a blank figure</i>	5
3	<i>This is a caption for a blank figure</i>	5
4	<i>This is a caption for a blank figure</i>	5
5	<i>This is a caption for a blank figure</i>	6

1 Project Overview

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

1.1 Problem Definition

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

1.2 Solution(10,000ft view)

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

Figure 1: *This is a caption for a blank figure*

2 Results(Technical Detail)

2.1 Quadcopter

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie

ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

Figure 2: *This is a caption for a blank figure*

2.2 Hardware

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

Figure 3: *This is a caption for a blank figure*

2.3 Software

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

Figure 4: *This is a caption for a blank figure*

3 Conclusion/What's Left to do

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam

rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

Figure 5: *This is a caption for a blank figure*

4 Appendix

4.1 I

4.2 II

4.3 II

4.4 IV

4.5 V

5 References

1. Mali, P. (1960). *Magnetic Amplifiers*. New York, NY: John F. Rider.
2. Figure 1. Simple saturable reactor. Reprinted from *Magnetic Amplifiers*(pg. 27), by Paul Mali, 1960, New York, NY, John F. Rider Publisher, Inc.
3. Figure 2. Full-wave self-saturating magnetic amplifier. Reprinted from *Magnetic Amplifiers*(pg. 35), by Paul Mali, 1960, New York, NY, John F. Rider Publisher, Inc.