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| SIGHTLINE CAPSTONE PROJECT |
| STATEMENT OF WORK |
| UAV PLUG AND PLAY PRECISION LANDING AID |

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**PROJECT OVERVIEW**

### **BACKGROUND**

### SightLine Applications has developed a precision visual landing algorithm that provides an excellent set of benefits:

* Works in degraded and denied GPS environments – Safety and reliability.
* Reduces operator training and landing phase complexity.
* Provides detection functions for landing zone safety - detect people, animals, or objects from entering the landing zone
* Provides a rich set of telemetry for flight controllers. 30 Hz data with range, XY offsets, relative azimuth, etc.
* Supports landing on moving platforms - ground vehicles, marine.
* Is not impacted by bright sun or low light conditions.
* Can be used with Thermal (IR) cameras as well as visible (EO) cameras
* Effective range of operation (distance to target) only limited by the size of the landing pattern used

### **PROBLEM**

Integration of the SightLine Landing Aid for end users is problematic. Often drone operators want to just “plug in” a component and fly their mission. Installing software components is acceptable, but any requirement for programming is a barrier to entry or a complete show stopper. Various cables, power, and other electrical connectivity issues are also difficult for vehicle integrators. Rugged or at least robust mechanical enclosures, easy mounting, and environmental reliability are equally important. Lastly, choice of optical system (camera) for the greatest range has cause adoption delays in that it has been a decision left to the integrator. Recognizing the needs from the end-users and the current developed benefits, Sightline want to develop a plug and play precision landing aid for UAVs and expect that this new project will be highly valuable to a wide range of multi-copter integrators.

**PROJECT REQUIREMENTS**

* Develop a set of electrical sub-assemblies that will allow integration of Sightline Precision Landing Aid (1500 OEM + Airborne Camera + accessories) for PX4 running on Pixhawk 4 autopilot
* Design and produce a prototype enclosure for the hardware. The enclosure should be smaller than 3” x 2” x 2”
* Develop documentation and software installers to meet plug and play expectations

**PROJECT DESIGN SPECIFICATIONS**

* Use Pixhawk 4 autopilot
* Use PX4 as an open source flight control software for drones
* Use QGROUNDCONTROL as a ground control station and mission planning
* 1500 OEM and its accessories are powered using 5V output from the Pixhawk 4 kits
* Use RS-232 or 3.3V TTL to communicate between hardware and autopilot
* Use DJI Flame Wheel F450 quadcopter

**LEVEL 0 BLOCK DIAGRAMS**

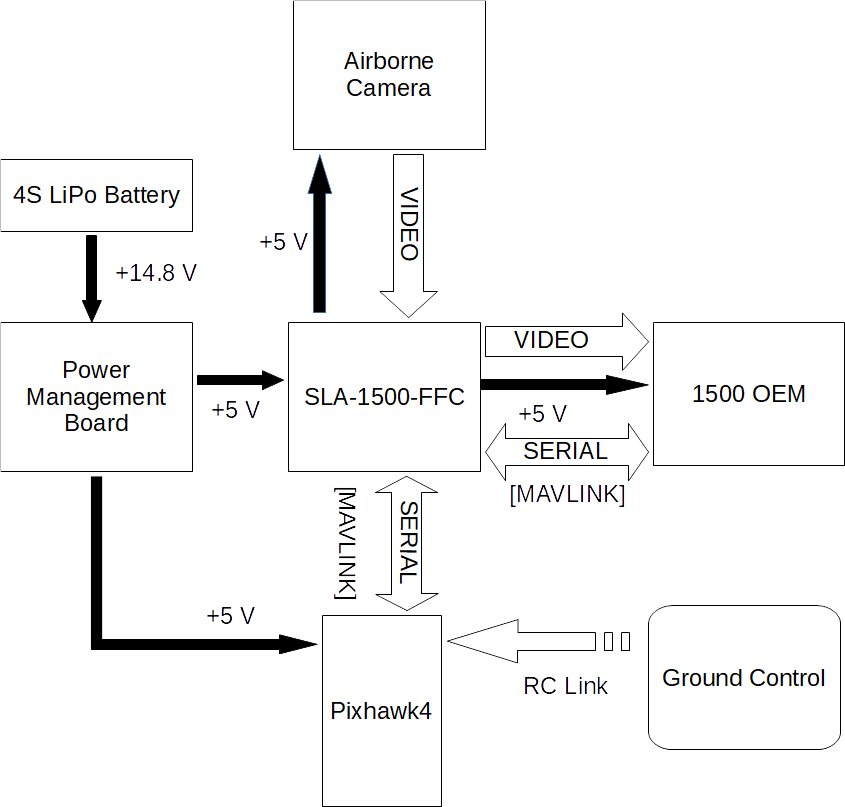


Figure 1: Level 0 diagram of current configuration

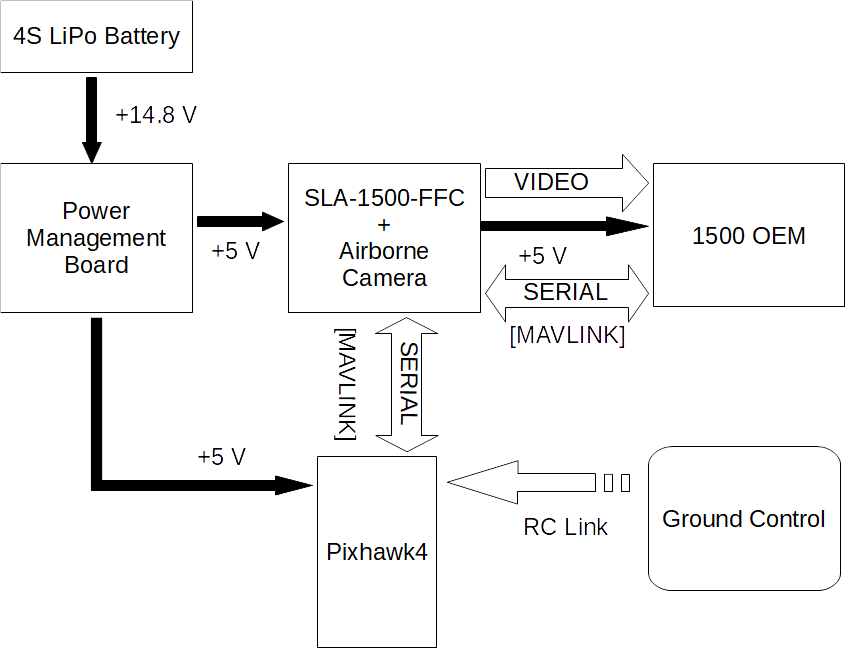


Figure 2: Level 0 diagram of desired configuration

**HARDWARE AND SOFTWARE REQUIREMENTS**

**FIRST ORDER COST ESTIMATE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UAV Plug and Play Precision Landing Aid | | | | |
| Qty | **Hardware description** | **Mfg** | **Unit cost** | **Total Cost** |
| 1 | DJI FLAMEWHEEL F450 ARF KIT | DJI | $229.00 | $229.00 |
| 1 | DJI FLAMEWHEEL LANDING GEAR (4 pcs) | DJI | $17.50 | $17.50 |
| 1 | FrSky Taranis X9D Plus 16-Channel 2.4ghz ACCST Radio Transmitter | FrSky | $229.00 | $229.00 |
| 1 | FrSky X4RSB 3/16CH Telemetry Receiver Full Range | FrSky | $31.99 | $31.99 |
| 4 | Gens ace 14.8V 5000mAh 45C 4S LiPo Battery Pack | Gens Ace | $64.99 | $259.96 |
| 1 | PIXHAWK 4 ADVANCED DEVELOPMENT KIT | Holybro | $210.95 | $210.95 |
|  |  |  | **Total:** | $978.40 |

**TIMELINE**

Winter term 2019 – Tentative Schedule

[Click here for Project Timelines (Gantt Chart)](https://github.com/phamtaiece/Capstone-Sightline/blob/master/Project%20Timelines/Sightline_ProjectTimelines.pdf)

**Week 1: 01/07 – 01/13**

* Finish a first draft version of Statement of Work
* Do Qgroundcontrol learning and researching
* Create a tentative schedule for our project
* Ask question?

**Week 2: 01/14 – 01/20**

* Complete Statement of Work
* Do Qgroundcontrol learning
* Do Pixhawk 4 learning
* Answer “How to fly indoor safely”
* Review Jeremy question in Docs
* Ask question?

**Week 3: 01/21 – 01/27**

* Start understanding the sample code
* Expect to receive the quadcopter from Sightline.
* Do Quadcopter learning
* Do Pixhawk 4 learning
* Ask Question?

**Week 4: 01/28 – 02/03**

* Learn from the sample Code (cont)
* Expect Pixhawk 4 arrive at Sightline
* Do Pixhawk 4 learning
* Do Quadcopter learning
* Start drawing schematic for new board
* Ask question?

**Week 5: 02/04 – 02/10**

* Draw schematic for new board (cont)
* Start working with quadcopter + Pixhawk 4 + Qgroundcontrol
* Code writing
* Ask question?

**Week 6: 02/11 – 02/17**

* Send schematic for manufacture (expect 2 weeks)
* Start working with quadcopter + Pixhawk 4 + Qgroundcontrol (cont)
* Code writing (cont)
* Ask question?

**Week 7: 02/18 – 02/24**

* Start working with quadcopter + Pixhawk 4 + Qgroundcontrol (cont)
* Code writing (cont)
* Working with simulation model
* Ask question?

**Week 8: 02/25 – 03/03**

* New board arrives at Sightline
* Schematic test and debug
* Code writing (test)
* Working with simulation model
* Ask question?

**Week 9: 03/03 – 03/10**

* Schematic test and debug
* Enclosure 3D model create
* Working with simulation model
* Ask question?

**Week 10: 03/11- 03/17**

* Schematic test and debug (cont)
* Enclosure 3D model create (cont)
* First demo