Project Planning

SENIOR DESIGN I

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Introduction:

In the project planning stage, a risk analysis, mitigation strategy, work breakdown structure, responsibility matrix, and project schedule will be constructed and explained. The risk analysis will contain an evaluation of all the potential risks in the design. The potential risks are rated by the severity of the risk potential, and the probability if it occurring. A chart will depict these metrics as well as a description of each risk. The mitigation strategy will contain a plan to resolve the risks that were placed above the threshold line in the risk analysis. The work breakdown structure will contain high level tasks that require work for the project to be completed. The responsibility matrix consists of a list of what areas of the project are being covered by each member of the group. Lastly, the project schedule is shown in the form of a Gantt chart. Both the responsibility matrix and project schedule are shown in the Gantt chart.

Risk Analysis:

Unable to test existing prototype:
Due to the current prototype being in Africa until November, there is a chance it will not get to be tested as planned. This would be due to unforeseen and uncontrollable events with logistics. The group would not be able to perform tests on the prototype and would have to pick components based solely on research.

Unable to obtain a particular part:
After picking all necessary components for the design, it is possible that a particular part may not be obtainable. The part may be too expensive, take too long to manufacture or ship, or may no longer be in production.

Inadequate component:
It is possible that a part may be ordered and tested, and it is then found that the part will not work as intended in the design. The component may have a hardware defect, differ from its datasheet specifications, or fail to perform as theoretically predicted.

Design has too much interference:
This would occur if the components chosen for the design were not completely compatible with each other. There would be too much noise in the system for the signals to be audible for the user on the ground. Possible sources of this noise could include the Go Pro, the GPS flight stabilization system on the quadcopter, the power source, or the receiver/transmitter subsystem.

Design is unsafe:
After building a new prototype and testing it, there is a chance that the group could deem it unsafe. This could be due to harmful frequencies being emitted or the quadcopter being dangerous for the user to operate.

Drone laws change in the United States:
There is a potential that laws may change in United States at some point in the design relating to civilian drone usage. Depending on the severity of the law change, the sponsor would have to be notified and an alternative design may have to be implemented.

Table 4.1: Evaluating the Potential Risks

Risk	Severity of Risk*	Probability of Risk*	Total**
Unable to test existing prototype	3	3	6
Unable to obtain a particular part	4	2	6
Inadequate Component	7	1	8
Design has too much interference	9	6	15
Design is unsafe	8	1	9
Drone laws change in USA	5	5	10
*Each risk rated on a scale of 1-10.			
**Threshold establish as a 5, all risks are above this threshold.			

Mitigation Strategy:

Risk: Unable to test existing prototype
Mitigation Strategy: Empirical work would need to be performed both for the old and new design. Components may have to be selected solely based on calculations and research, without testing the old model. A meeting would be set up with the sponsor to see if the group could get ahold of a similar prototype or at least individual components for testing.

Risk: Unable to obtain a particular part
Mitigation Strategy: An alternative part or manufacturer would need to be found. It must be confirmed that the new solution achieves similar performance. If said part is not critical, consider removing it from the design.

Risk: Inadequate component
Mitigation Strategy: If the component contains a hardware defect or does not perform as advertised, request a replacement from the vendor. As a last resort, replace the component with an alternative, or completely remove if it is not critical to the project success.

Risk: Design has too much interference
Mitigation Strategy: Interference can be mitigated through theoretical work and existing prototype testing. If it is not prevented with these methods, troubleshooting and component testing will be conducted on final design. The interfering component(s) will then need to be replaced accordingly.

Risk: Design is unsafe
Mitigation Strategy: Apply safety measures based on the type of unsafe performance. Use shielding for excessive RF radiation, sound dampeners in case of excessive noise footprint, shielding around dangerous moving parts, etc.

Risk: Drone laws change in the United States
Mitigation Strategy: Consult with the sponsor on whether the law change critically affects his research or this project. If it does, propose switching to the Balloon design or modifying the quadcopter solution to be in accordance with new law.

Work Breakdown Schedule:

- **Research Existing Hardware**: The components that make up the current design will be researched. Research will pertain to understanding the current hardware to compare to other possibilities. Sources of interference can be gathered from looking into the specific hardware.
    - SHF Relay
    - VHF Antenna assembly
    - Quadcopter assembly
    - Go Pro/Camera Stabilizer
    - VHF Collar

- **Research Ways to Isolate Electromagnetic Interference:** In a scenario where it is not possible to contain the interference between these components, an alternate solution can be implemented.

- **Contact Hardware Suppliers:** Inquire about any known existing sources of interference caused by these devices. This step can also be used for recommendations or whether a solution has been created to resolve the potential issues.
    - Hardware suppliers from existing prototype.
    - Potential hardware suppliers from researching components.

- **Finalize Hardware:** The hardware will be decided upon based on previous research. Ideally, the parts will be chosen to eliminate the source of interference. Final hardware will strive to be the best variation in regards to cost-effectiveness and efficient execution of the purpose; to transmit a signal received by the antenna to the user.

- **Test Existing Prototype:** The prototype currently being used will be tested to observe the behavior of the interference. Multiple tests will be done on each individual component to gain a better bearing on the source of interference. With the research done prior, the developed background on each device will enable the group to construct a well backed hypothesis of the source of interference.

- **Order Parts**

- **Build New Prototype:** From the components ordered, a new prototype will be constructed based on the prior research and what was found through testing the existing prototype with the problematic interference.

- **Troubleshoot Design:** The new prototype will require troubleshooting to observe unexpected behavior. In this stage, possible errors in the behavior will be found and solved (i.e. still contains interference, signal not coming through loud enough). The design will be improved upon based on what is found in this step.

Responsibility Matrix and Project Schedule:

	Aug				Sep				Oct				Nov				Dec			
	WK 1	WK 2	WK 3	WK 4	WK 1	WK 2	WK 3	WK 4	WK 1	WK 2	WK 3	WK 4	WK 1	WK 2	WK 3	WK 4	WK 1	WK 2	WK 3	WK 4
Wildlife Charictorization Process																				
Research Existing Hardware																				
Quad-copter Controller																				
VHF Antenna/Reciever																				
SHF Relay																				
GoPro Stabelizing Mount																				
Contact Hardware Suppliers																				
Quad-copter Flight Controller																				
VHF Antenna/Reciever																				
SHF Relay																				
GoPro Stabelizing Mount																				
Finalize Hardware																				
Quad-copter Flight Controller																				
VHF Antenna/Reciever																				
SHF Relay																				
GoPro Stabelizing Mount																				
Assemble Existing Prototype																				
Lab Testing																				
Test Built Quad-copter																				
Key Dates																				
Email Project Preferance to Instructor																				
Homework 1 Due - Problem Definition																				
Homework 2 Due - Functional Analysis																				
Homework 3 Due - Alternitives Evaluation																				
Peliminary Design Review																				
Mid-Term Self Review																				
Design Journal																				
Homework 4 - Project Planning																				
Homework 5 - Concept Development																				
Webpage										Draft										
Homework 6 - System Architecture																				
Homework 7 - Detailed Design																				
Critical Subsystem Prototype																				
Product Rollout Review																				
Critical Design Review																				
Ordering Parts																				
Final design report due																				
Design Journal submitted for review																				
Final self/peer review due																				
Final project webpage due																	Final			

Kristopher	Quad-copter Controller
Chris	VHF Antenna/Reciever
Gavin	SHF Relay
Ryan	GoPro Stabelizing Mount
All	