Deliverable E - Project Schedule and Cost

GNG 1103D

Group #9

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Contents

List of Figures

List of Tables

Problem Statement

The JAMZ developers need an emergency beacon that transmits accurate and quick location information about the drone to the operator in live time by interpreting the data received from the sensors as well as alerting nearby citizens of the downed drone with flashing lights and a voice system.

Summary of Previous Deliverable

In our last deliverable, we laid out the design criteria for our product.

The main points were to have an emergency beacon that would transmit the location of where the drone disconnected, to have a light and sound system that would alert pedestrians to stay away from the drone, and a microcontroller that would send information from the drone to the operator.

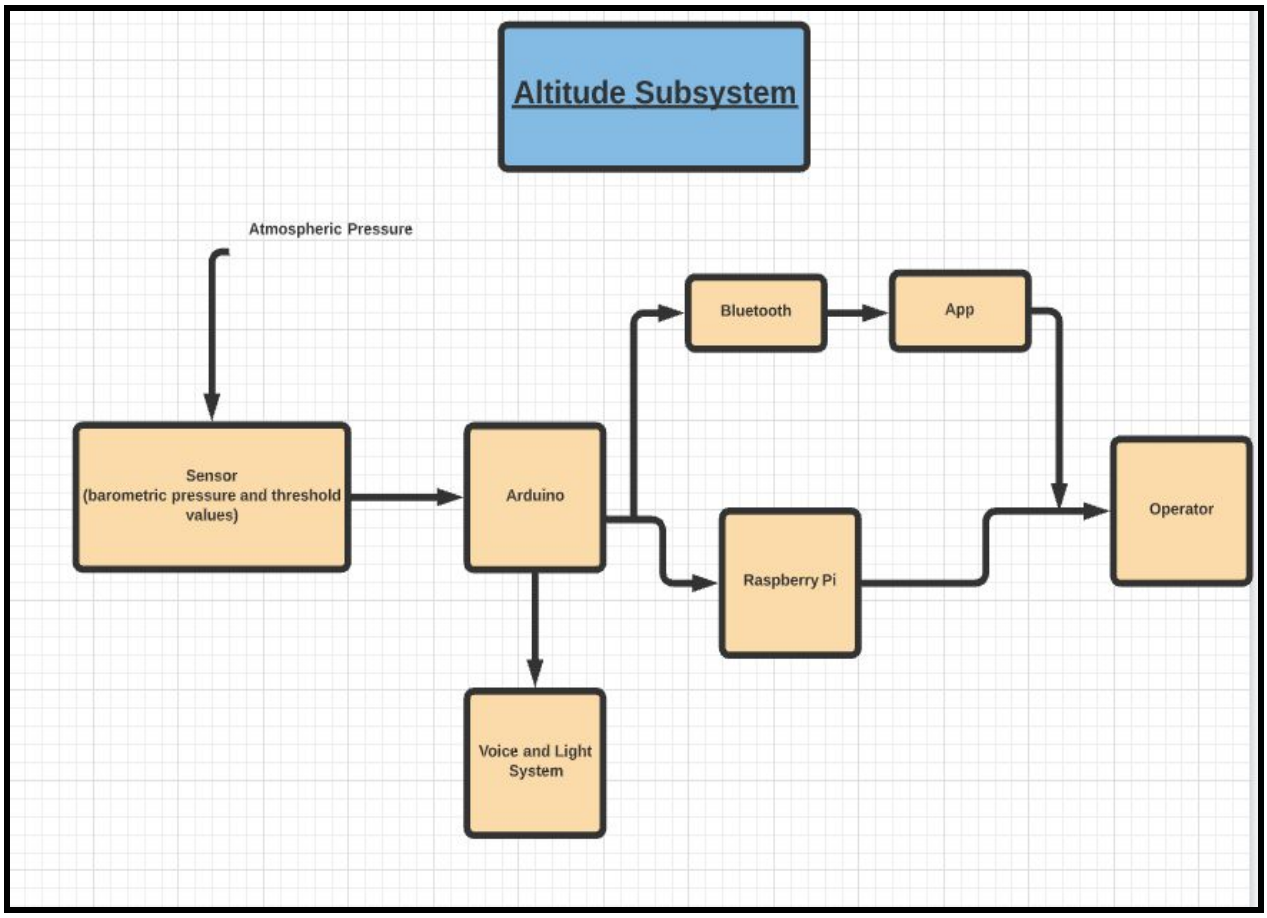


Figure 1 - Diagram of the Altitude Subsystem

The first subsystem is the GPS subsystem **(Figure 1 - Diagram of the Altitude Subsystem)** that would send location information from the drone to the operator. The module that was decided upon was a GPS chip, that can relay location and altitude information from the chip to the Arduino, then send the data to the operator from there. The next subsystem is the microcontroller subsystem (**Figure 2- Diagram of the Location Subsystem)**, which consists of a two piece Arduino component that can directly send data of any kind from the breadboard of the Arduino to the other piece that resides with the operator. The last subsystem is the voice and light subsystem (**Figure 3 - Diagram of the Voice and Light Subsystem**), which has the sole purpose of alerting pedestrians to stay 5 metres away from the drone.

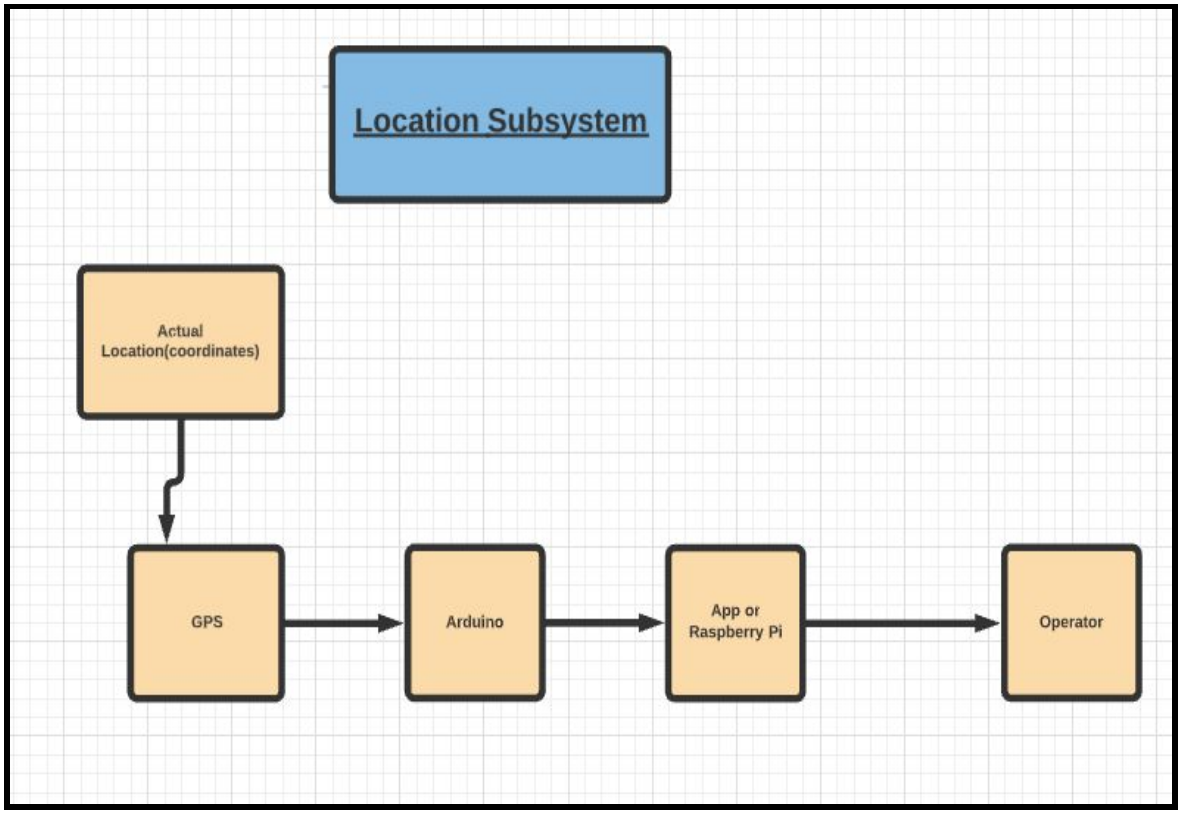


Figure 2- Diagram of the Location Subsystem

The first global concept involves the GPS chip and the microcontroller chip attached to an Arduino on the drone via a breadboard, with the GPS chip sending data to the microcontroller chip through the Arduino, from which the data is sent to the operator directly. The voice system consists of Arduino speakers connected in tandem with LED lights, that will be triggered to play a prerecorded message and perform a strobe light sequence if the GPS sensor detects that the drone has landed at a location other than the desired destination.

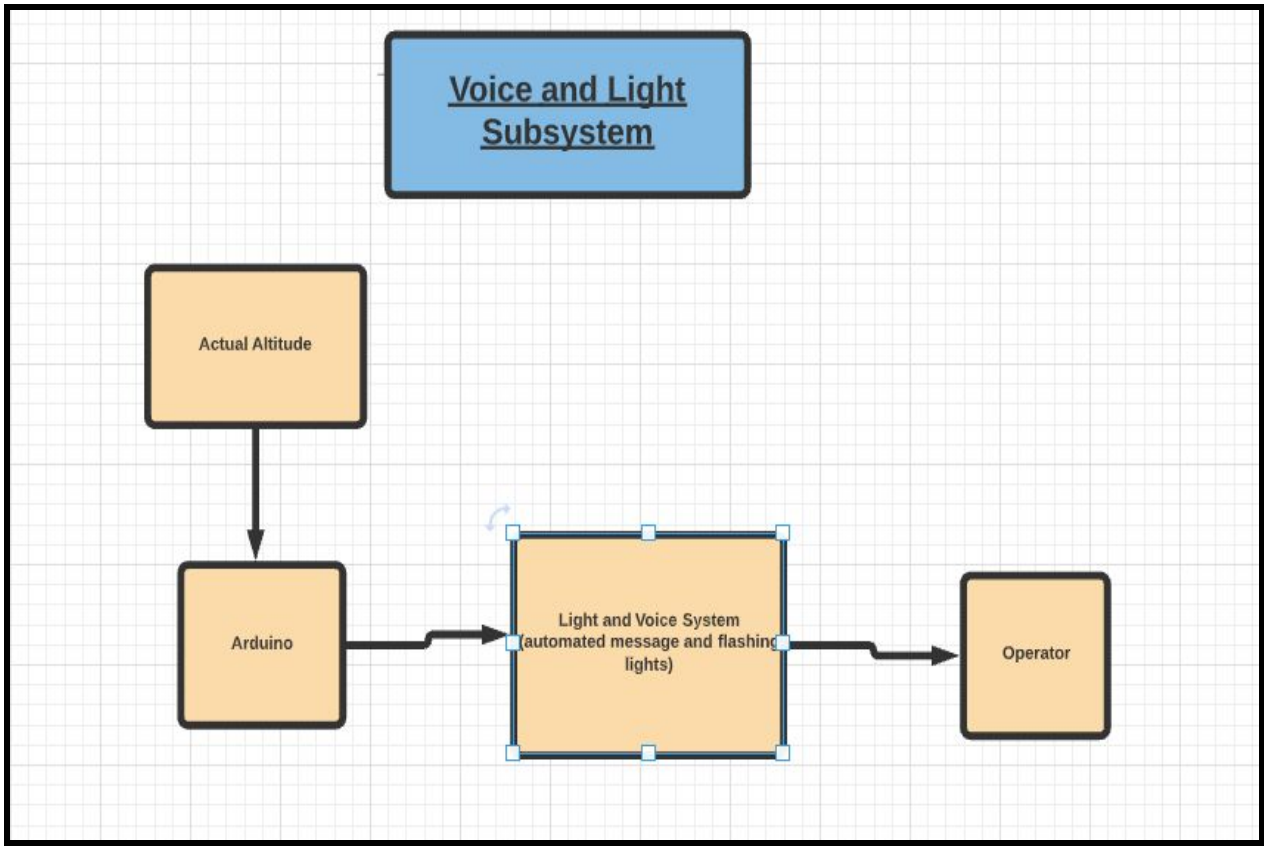


Figure 3 - Diagram of the Voice and Light Subsystem

The second global concept involves the GPS sensor sending data to the Arduino via a breadboard, however, the data will then be sent to a microcontroller, which transmits the data to the operator's smartphone via a bluetooth application. The voice and light systems consist of a voice controlled drone which can have a live audio message played via the onboard speakers. The light system consists of LED lights in a strobe pattern once again.

Detailed Global Concept

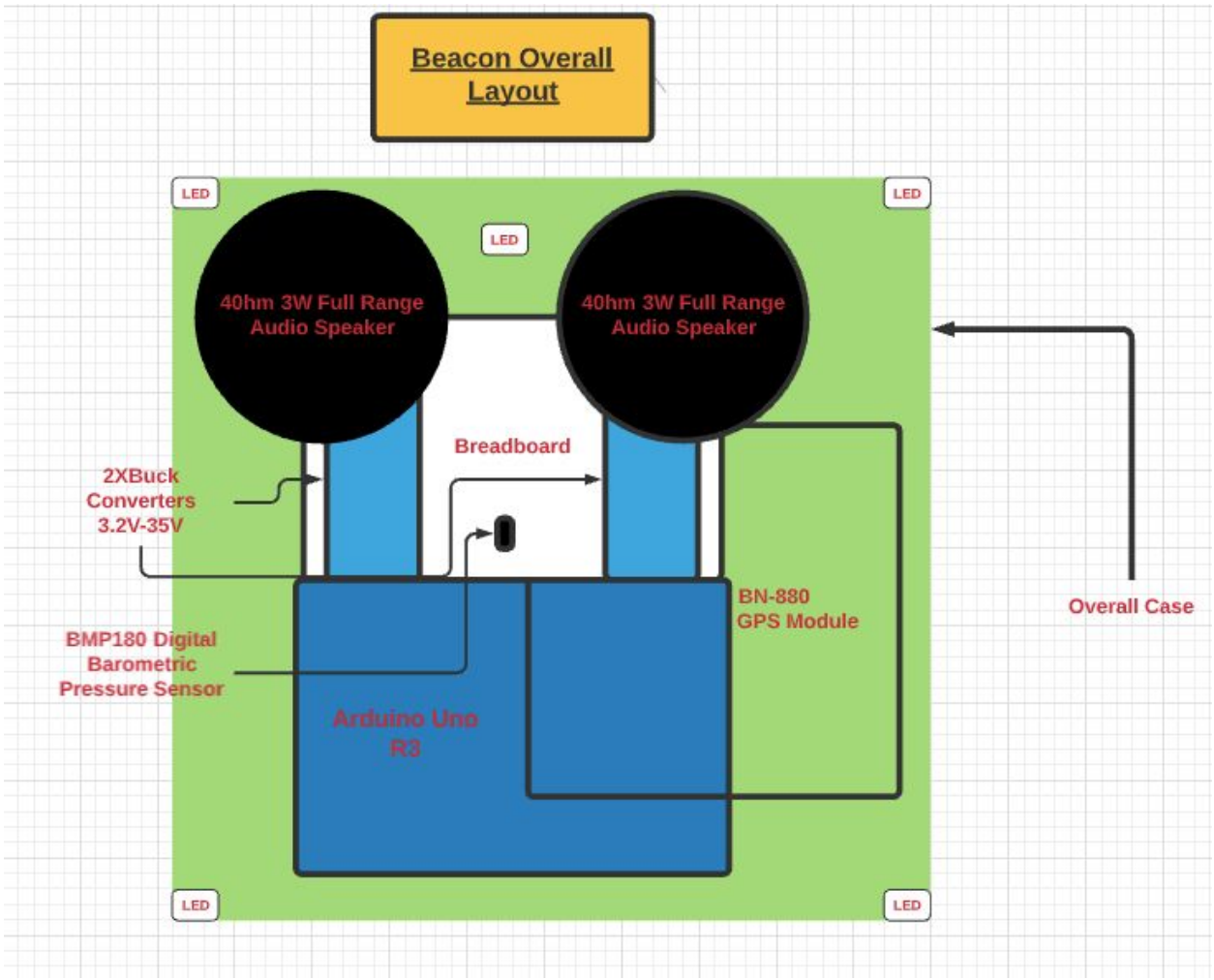
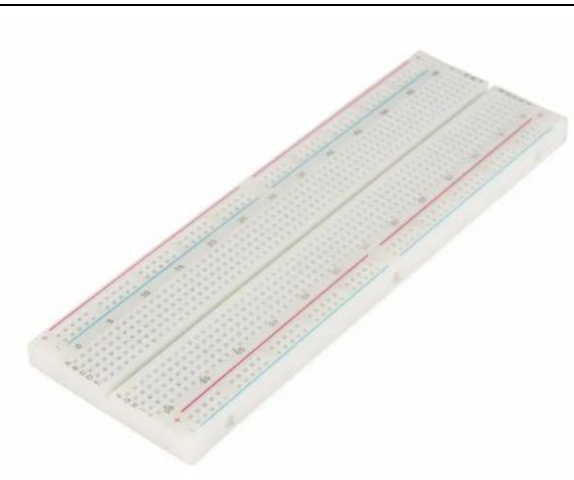


Figure 4 - Diagram of the Emergency Beacon

The diagram above is an aerial view of the overall system. The component sizes are proportional to their real dimensions listed in the table below. In the system the Arduino is adjacent to and connected to the breadboard which connects to all other components except for the GPS module (it will be directly connected to the Arduino). A large portion of the GPS will be under the Arduino and the breadboard to meet the size constraints given to us by JAMZ. The buck converters will be placed entirely on the breadboard and connected to the Arduino and the speakers. The speakers will only have a small portion mounted to the breadboard due to the size of the speakers and the limited space available on the breadboard. The LED lights will be mounted to the exterior of the overall case so they can be visible to civilians if the drone is downed. In order to communicate with the operator at JAMZ the entire system must be connected to the Raspberry pi onboard the drone. Since the communication with the Raspberry Pi has already been built by JAMZ it is not included in the diagram but will be wired externally in the prototypes.

Table 1 - Overall System Components and Dimensions

Component	Visual	Length (cm)	Width(cm)	Height(cm)
Arduino Uno R3		6.0	9.0	2.0
Breadboard		5.5	8.5	1.0
BMP180 Digital Barometric Pressure Sensor		0.36	0.38	0.93

BN-880 GPS Module		7.62	7.62	1.27
Buck Converters 3.2V-35V		4.3	2.1	1.4
40hm 3W Full Range Audio Speakers		5.08	5.08	3
LED Lights		0.9	0.4	0.2
Protective Case	Prototype made out of cardboard	13.5	12.8	5.0

Prototype I

Table 2 - Tasks Plan for Prototype I

Task	Member Responsible	Due date
Research	1. Arduino and sensor (Elsa) a. Electronic component and wiring b. Test plan (code) 2. Arduino and GPS (Sandeep) a. Electronic component and wiring b. Test plan (code) 3. Arduino and voice system (Karen) a. Electronic component and wiring b. Test plan (code) 4. Arduino and light system (Jacob) a. Electronic component and wiring b. Test plan (code) 5. All-around connections (Tri) a. Electronic component and wiring b. Test plan (code)	March 2nd, 2021
Assembly	1. Arduino and sensor (Elsa) a. Electronic component and wiring 2. Arduino and GPS (Sandeep) a. Electronic component and wiring 3. Arduino and voice system (Karen) a. Electronic component and wiring 4. Arduino and light system (Jacob) a. Electronic component and wiring 5. All-around connections (Tri) a. Make sure all components are connected	March 4th, 2021

Deliverable F	1. Prototyping test plan a. Test on Tinkercad first i. Location subsystem (Sandeep) a. i.Test it using code ii. Altitude subsystem (Elsa) a. i. Test it using code iii. Voice and light subsystem a. i. Test voice system using code (Karen) b. ii. Test light system using code (Jacob) iv. All-around connections (Tri) a. i. Test that it all works on the Arduino b. ii. Test that it will work with the raspberry pi 2. Formatting (Jacob) 3. Presentation (Sandeep) 4. Wrike update (Karen)	March 5th, 2021

The first task is to research the components of the different subsystems for the project. For the first task, the research, Elsa is responsible for the electronic component and wiring set up to go along with the code for the test plan or the Arduino and sensor. Meanwhile Karen will set up the electronic component and wiring for the Arduino and voice system; the test for the test plan is also needed. Sandeep will do the same with the Arduino and GPS and will do the set up for the electronic component and wiring. He will also test the code for the test plan and Jacob will do the same work but with the Arduino and the light system. After collecting all the research from four members, Tri will have to research a way to connect all subsystems together to make a complete system.

The second task is to make a virtual prototype and test it out to see if it works. For the second task, the assembly, Tri will use the four assembled systems of the other members and connect them all together and make sure that the whole system will work effectively. Tri will work on a prototype on TinkerCAD. Then we will have a test on TinkerCAD where Sandeep can test his location subsystem by using a code test. Following Elsa with her altitude subsystem and Karen and Jacob with their voice and light system respectively. After that Tri will again make the test if the complete system works on Arduino or Raspberry Pi.

Table 3 - Test Plan for Prototype I

Test ID	Member Responsible	Test Objective	Description of Prototype Used and of Basic Test Method	Descriptions of Results and How These Results Will Be Used	Estimated Test Duration and Planned Start Date
1	Elsa	To test the assembly of the electrical components and simulate the barometric pressure sensor.	The test method will be done on Tinkercad as the first prototype will be made on Tinkercad.	A screenshot and/or screen recording of the simulation and a copy of the test code used will be included in the deliverable. If it passes the test plan it will be deemed as functional.	March 4th, 2021 Test Duration approximately 5 minutes
2	Sandeep	To test the assembly of the electrical components and simulate the GPS.	The test method will be done on Tinkercad as the first prototype will be made on Tinkercad.	A screenshot and/or screen recording of the simulation and a copy of the test code used will be included in the deliverable. If it passes the test plan it will be deemed as functional.	March 4th, 2021 Test Duration approximately 5 minutes
3	Karen	To test the assembly of the electrical components and simulate the voice system.	The test method will be done on Tinkercad as the first prototype will be made on Tinkercad.	A screenshot and/or screen recording of the simulation and a copy of the test code used will be included in the deliverable. If it passes the test plan it will be deemed as functional.	March 4th, 2021 Test Duration approximately 5 minutes

4	Jacob	To test the assembly of the electrical components and simulate the light system.	The test method will be done on Tinkercad as the first prototype will be made on Tinkercad.	A screenshot and/or screen recording of the simulation and a copy of the test code used will be included in the deliverable. If it passes the test plan it will be deemed as functional.	March 4th, 2021 Test Duration approximately 5 minutes
5	Tri	To test the assembly of the electrical components and simulate the overall product.	The test method will be done on Tinkercad as the first prototype will be made on Tinkercad.	A screenshot and/or screen recording of the simulation and a copy of the test code used will be included in the deliverable. If it passes the test plan it will be deemed as functional.	March 4th, 2021 Test Duration approximately 5 minutes

Legend	Orange	Red
Probability	Unlikely.	Reasonably likely.

To analyze the risks, the legend above was used. The risks were either categorized by reasonably likely and unlikely and those that were reasonably likely were given an associated contingency plan.

Table 4 - Risks Assessment for Prototype I

Risk	Risks Analysis (Likelihood)
Late/non-delivery of material.	Reasonably likely
Inaccurate completion of task.	Unlikely.
Cost risk.	Unlikely.
Operational/technical failure.	Reasonably likely.
Inaccurate estimation of duration of tasks.	Reasonably likely.
Scope Creep.	Reasonably likely.
Unforeseen addition of workload.	Reasonably likely.

As our team plans to assemble the materials, if possible, the late delivery of any materials is a reasonably likely risk. Additionally, as the team is in the preliminary stages of the prototyping process, there still may be some confusion which would lead to the inaccurate completion of a task but this risk is unlikely. As we are testing the prototype, it is reasonably likely that a material may not work, integrate properly and other technical problems may arise. Furthermore, the team does not have the experience to know the exact duration of tasks so it is likely that the estimates are inaccurate. The team has attempted to account for all of the possible materials and tasks needed for this prototype but it is reasonably likely that some additions will have to be made after we attempt to create the prototype. Consequently, the addition of tasks because of the scope creep will result in the addition of workload.

Table 5 - Risk Management and Contingency Plan for Reasonably Likely Risks of Prototype I

Risk	Risk Management	Contingency plan
Late/non-delivery of material.	1. Order all the products and materials as soon as possible. 2. Choose products that will ship/arrive faster whenever possible.	1. If we are only able to receive some materials before the first prototype, we will put the materials we have together. 2. If no materials are received, we will stick with Tinkercad.
Operational failure.	1. If possible, prototypes will be tested first through Tinkercad.	1. More extensive research will be done if a certain aspect fails. 2. If needed, other group members may offer assistance in resolving the solution. 3. As a last resort, the project manager and the TAs will be asked for their help.
Inaccurate estimation of duration of tasks.	1. Some buffer time has been allocated in the schedule in case.	1. If possible, other team members will help the owner of the task to complete the task

	2. Tasks will be started as soon as possible to avoid their incompletion.	on time. 2. If needed, the project schedule would have to be updated (assuming we are too far behind schedule to catch up).
Scope Creep.	1. The design requirements have been clearly outlined by our team and communicated with our client. 2. To recognize scope creep, our group will test several components of our project.	1. If a team member believes a certain aspect/component of the product needs to be changed, all the other team members should agree. If possible the TAs's, project manager's and client's opinion should be asked for. 2. Consequently, the project schedule would need to be updated to accommodate this change and possible other documents such as the bill of materials.
Unforeseen addition of workload.	1. Effective planning has helped our team minimize the chances of scope creep.	1. The tasks will be delegated based on the team member with the least amount of work.

The reasonably likely tasks were given associated risk management and contingency plans. The risk management is to avoid or reduce the likelihood of the risk while the contingency plan is the steps the team will take if this risk were to occur.

Table 6 - List of Materials for Prototype I

List of Materials
None.

As the prototype will be a model on Tinkercad, there will be no physical materials for prototype I.

Prototype II

Table 7- Tasks Plan for Prototype II

Task	Member Responsible	Due date
Fixing of components	1. Location subsystem (Sandeep) 2. Altitude subsystem (Elsa) 3. Voice and light subsystem a. Voice system (Karen) b. Light system (Jacob) 4. All-around connections (Tri)	March 8th, 2021
Code creations and testing	1. Location subsystem (Sandeep) 2. Altitude subsystem (Elsa) 3. Voice and light subsystem a. Voice (Karen) b. Lights (Jacob) 4. All-around connections (Tri)	March 9th, 2021
Testing of the physical prototype	1. Test each subsystem (Elsa and Karen) a. Location subsystem b. Altitude subsystem c. Voice and light subsystem	March 10th, 2021
Deliverable G	1. Detailed analytic model and images (Sandeep) 2. Formatting (Jacob) 3. Summary of previous deliverable (Jacob) 4. Testing, results and improvement methods of the first prototype (Jacob) 5. Presentation (Tri) 6. Wrike update (Karen)	March 14th, 2021

For prototype II, it starts with the Fixing of components where each member will have to make changes based on the feedback of the customers. Sandeep will have to make changes for the location subsystem meanwhile Elsa will have her Altitude subsystem fixed, the voice and light subsystem can be fixed by both Karen and Jacob respectively. After all the changes have been fixed, Tri will make the proper changes to the complete prototype.

For the next task, Sandeep will create the code and test if it works for his location subsystem; similarly, Elsa will create a code and test it for the altitude subsystem. Karen and Jacob will do the same

with their voice and light system, respectively. Then Tri can test whether all the codes can work well together.

When the deliverable G, Sandeep will do the detailed analytical model and images. The formatting will be done by Jacob with stylistic elements, recap of the first prototype, testing and results and describe how it was an improvement of the last, summary of subsystems and problem statement. The google slides of the first prototypes will be Tri's responsibility to get it done for the presentation of the group. Finally, Karen will do the wrike update.

Table 8 - Test Plan for Prototype II

Test ID	Member Responsible	Test Objective	Description of Prototype Used and of Basic Test Method	Descriptions of Results and How These Results Will Be Used	Estimated Test Duration and Planned Start Date
1	Elsa and Karen	To test the assembly of the electrical components and simulate the barometric pressure sensor.	The subsystem will be tested to ensure that the subsystem is connected.	A picture and/or recording of the simulation and a copy of the test code used will be included in the deliverable. If it passes the test plan it will be deemed as functional.	March 10th, 2021 Test Duration approximately 5 minutes
2	Elsa and Karen	To test the assembly of the electrical components and simulate the GPS.	The subsystem will be tested to ensure that the subsystem is connected.	A picture and/or recording of the simulation and a copy of the test code used will be included in the deliverable. If it passes the test plan it will be deemed as functional.	March 10th, 2021 Test Duration approximately 5 minutes
3	Elsa and Karen	To test the assembly of the electrical components	The subsystem will be tested to ensure that the subsystem is	A picture and/or recording of the simulation	March 10th, 2021

		and simulate the voice system.	connected.	and a copy of the test code used will be included in the deliverable. If it passes the test plan it will be deemed as functional.	Test Duration approximately 5 minutes
4	Elsa and Karen	To test the assembly of the electrical components and simulate the light system.	The subsystem will be tested to ensure that the subsystem is connected.	A picture and/or recording of the simulation and a copy of the test code used will be included in the deliverable. If it passes the test plan it will be deemed as functional.	March 10th, 2021 Test Duration approximately 5 minutes
5	Elsa and Karen	To test the assembly of the electrical components and simulate the overall product.	The connection between the Arduino and raspberry pi will be tested.	A picture and/or recording of the simulation and a copy of the test code used will be included in the deliverable. If it passes the test plan it will be deemed as functional.	March 17th, 2021 Test Duration approximately 5 minutes

Table 9 - Risks Assessment for Prototype II

Risks	Risks Analysis (Likelihood)
Late/non-delivery of material.	Reasonably likely
Incompatibility of systems.	Reasonably likely.
Defective product.	Reasonably likely.

Operational/technical failure.	Reasonably likely.
Performance risk.	Reasonably likely.
Inability to solve a certain problem.	Unlikely.
Inaccurate estimation of duration of tasks.	Reasonably likely.

For this prototype, the materials will be tested, the late delivery of a material will impact the chances of properly testing the material for our product. As this prototype will have all of the materials in one integrated system, it is reasonably likely that it does integrate correctly. As we are testing, there is a possibility that a material is defective. Furthermore, there is risk of operational risks for this prototype as well. Similar to the operational failure, the performance risk would have a working product but it does not satisfy the design criteria. Consequently, there is the unlikely possibility that we will be unable to solve an operational or performance problem in our prototype. As we have never built a prototype, the tasks may take longer than expected.

Table 10 - Risk Management and Contingency Plan for Reasonably Likely Risks of Prototype II

Risk	Risk Management	Contingency plan
Late/non-delivery of material.	1. The receiving time of the materials should be tracked in case a material is arriving late for instance.	1. If a material has not been received by the estimated time, this prototype will not include it. 2. The project schedule will be updated to accommodate this event.
Defective product.	1. Reputable sellers have been chosen to avoid this problem.	1. If possible, a refund for the product will be received. 2. If the budget allows, a new product will be ordered in its place. 3. As the worst case scenario, the next best design concept will be used in its place and the project schedule will be updated.
Incompatibility of systems.	1. A fully integrated simulation of the product was first made and tested on Tinkercad before the creation of the second prototype.	1. The team will attempt to resolve this problem. If we cannot resolve the problem on our own, we will ask the TAs and project manager for their assistance. 2. If needed, the next best design concept will be chosen in its place.
Operational/technical	1. A simulation was done on	1. More extensive research will be done

failure.	Tinkercad with similar materials and code to avoid operational/technical failure.	if a certain aspect fails. 2. If needed, other group members may offer assistance in resolving the solution. 3. As a last resort, the project manager and the TAs will be asked for their help.
Inaccurate estimation of duration of tasks.	1. The estimated duration of tasks will be adjusted, if need be, after the first prototype to present a better representation.	1. If possible, other team members will help the owner of the task to complete the task on time. 2. If needed, the project schedule would have to be updated (assuming we are too far behind schedule to catch up).
Performance risk.	1. Effective prototype tests will be done on this prototype to catch any performance problems.	1. More extensive research will be done to resolve the problem. 2. If the team cannot resolve the problem on our own, we will ask the TAs and project manager for assistance.

The risks highlighted in red were given an associated risk management and contingency plan in the table above.

Table 11 - List of Materials for Prototype II

Materials
Arduino Uno R3
Breadboard
BMP180 Digital Barometric Pressure Sensor
BN-880 GPS Module
Buck Converters 3.2V-35V
40hm 3W Full Range Audio Speakers
Wires
LED Lights

All of the subsystems will be tested so all the materials in each subsystem are needed for each subsystem.

Prototype III

Table 12- Tasks Plan for Prototype III

Task	Member Responsible	Due date
Fixing of components	1. Location subsystem (Sandeep) 2. Altitude subsystem (Elsa) 3. Voice and light subsystem a. Voice (Karen) b. Lights (Jacob) 4. All-around connections (Tri)	March 15th, 2021
Testing of the physical prototype	1. Test each subsystem (Elsa and Karen) 2. Location subsystem 3. Altitude subsystem 4. Voice and light subsystem a. Voice b. Lights 5. All-around connections	March 17th, 2021
Deliverable H	1. Analytic model (Sandeep) 2. Formatting (Tri) 3. Summary of previous deliverable (Jacob) 4. Testing, results and improvement methods of the first prototype (Jacob) 5. Stylistic elements (Jacob) 6. Presentation (Tri) 7. Wrike update (Karen)	March 28th, 2021

For the prototype III, the subsystems will need to be fixed by the group again, Sandeep will do the location subsystem while Elsa is fixing her altitude subsystem. Karen and Jacob will need to have the voice and light system fixed if there were any errors with the systems. Then Tri will check all of them to guarantee that all the systems function together as one overall system and ensure they are able to communicate with the raspberry pi onboard the drone.

For the deliverable H, the formatting of the deliverable will be edited by Jacob; the deliverable will stylistic elements and summary of subsystems and problem statement. In addition, recap of the second prototype, test and describe how the results are an improvement of the latest version.

The google slides for the presentation of the group will be Tri's responsibility; then the whole group will do the presentation together where each member will present their parts. Finally, Karen will update wrike.

Table 13 - Test Plan for Prototype III

Test ID	Member Responsible	Test Objective	Description of Prototype Used and of Basic Test Method	Descriptions of Results and How These Results Will Be Used	Estimated Test Duration and Planned Start Date
1	Elsa and Karen	To test if the altitude subsystem satisfies the design criteria.	The subsystem will be simulated to check if it satisfies the design criteria.	A picture and/or recording of the simulation and a copy of the test code used will be included in the deliverable. If it passes the test plan it will be deemed as functional.	March 17th, 2021 Test Duration approximately 15 minutes
2	Elsa and Karen	To test if the location subsystem satisfies the design criteria.	The subsystem will be simulated to check if it satisfies the design criteria.	A picture and/or recording of the simulation and a copy of the test code used will be included in the deliverable. If it passes the test plan it will be deemed as functional.	March 17th, 2021 Test Duration approximately 15 minutes
3	Elsa and Karen	To test if the voice subsystem satisfies the design criteria.	The subsystem will be simulated to check if it satisfies the design criteria.	A picture and/or recording of the simulation and a copy of the test code used will be included in the	March 17th, 2021 Test Duration approximately 15 minutes

				deliverable. If it passes the test plan it will be deemed as functional.	
4	Elsa and Karen	To test if the light subsystem satisfies the design criteria.	The subsystem will be simulated to check if it satisfies the design criteria.	A picture and/or recording of the simulation and a copy of the test code used will be included in the deliverable. If it passes the test plan it will be deemed as functional.	March 17th, 2021 Test Duration approximately 15 minutes
5	Elsa and Karen	To test if the product satisfies all the design criteria.	The subsystem will be simulated to check if it satisfies the design criteria.	A picture and/or recording of the simulation and a copy of the test code used will be included in the deliverable. If it passes the test plan it will be deemed as functional.	March 17th, 2021 Test Duration approximately 15 minutes
6	Elsa and Karen	To test if the altitude subsystem satisfies the design criteria.	The subsystem will be simulated to check if it satisfies the design criteria.	A picture and/or recording of the simulation and a copy of the test code used will be included in the deliverable. If it passes the test plan it will be deemed as functional.	March 24th, 2021 Test Duration approximately 15 minutes
7	Elsa and Karen	To test if the location	The subsystem will be	A picture and/or	March 24th, 2021

		subsystem satisfies the design criteria.	simulated to check if it satisfies the design criteria.	recording of the simulation and a copy of the test code used will be included in the deliverable. If it passes the test plan it will be deemed as functional.	Test Duration approximately 15 minutes
8	Elsa and Karen	To test if the voice subsystem satisfies the design criteria.	The subsystem will be simulated to check if it satisfies the design criteria.	A picture and/or recording of the simulation and a copy of the test code used will be included in the deliverable. If it passes the test plan it will be deemed as functional.	March 24th, 2021 Test Duration approximately 15 minutes
9	Elsa and Karen	To test if the light subsystem satisfies the design criteria.	The subsystem will be simulated to check if it satisfies the design criteria.	A picture and/or recording of the simulation and a copy of the test code used will be included in the deliverable. If it passes the test plan it will be deemed as functional.	March 24th, 2021 Test Duration approximately 15 minutes
10	Elsa and Karen	To test if the product satisfies all the design criteria.	The subsystem will be simulated to check if it satisfies the design criteria.	A picture and/or recording of the simulation and a copy of the test code used will be included in the deliverable. If it passes the	March 24th, 2021 Test Duration approximately 15 minutes

				test plan it will be deemed as functional.	

Table 14 - Risks Assessment for Prototype III

Risks	Risks Analysis (Likelihood)
Non-delivery of material.	Reasonably likely
Operational/technical failure.	Reasonably likely.
Inaccurate estimation of duration of tasks.	Reasonably likely.
Scope Creep.	Reasonably likely.
Performance risk.	Reasonably likely.

As this is the last prototype, the expected delivery of a material may be after the submission date of our last prototype. As all of the subsystems will be tested, it is reasonably likely that there will be an operational or performance failure during testing. Consequently, scope creep may occur to resolve a performance or operation failure. As always, there may be an inaccurate estimation of the duration of tasks as there are subsystems we have never built before.

Table 15 - Risk Management and Contingency Plan for Reasonably Likely Risks of Prototype III

Risk	Risk Management	Contingency plan
Non-delivery of material.	1. The non-delivery of a material cannot be predicted, but if after a certain date a material has not been received, it will not be included in the final product.	1. The next best design concept (that does not include that material) will be used to satisfy the specified design requirement. 2. The project schedule will be updated to represent the change in design concept.
Operational/technical failure.	1. The previous prototype tests have been done to reduce the likelihood of operational failure by the third prototype.	1. If the problem cannot be resolved after exhausting all of our options, then the product will not include that aspect.
Inaccurate estimation of duration of tasks.	1. As there are two weeks for this prototype, some extra time has been allocated.	1. If possible, more time will be allocated to finish and catch up to the project schedule. 2. If that is not possible, the product will not include the aspect in the final product.

Scope Creep.	1. To minimize the likelihood of this risk, we will look for regular customer/client feedback as well as the project manager's and TAs' opinion.	1. If possible, the requirement will be integrated in the final product. 2. If the above is not possible, the final product will not include the aspect.
Performance risk.	1. Effective prototype tests will be done on this prototype to catch any performance problems.	1. If extensive research and help from the TAs and project manager does not resolve the problem, we will not include the aspect in the final product.

The risk management and contingency plan for the associated risk for prototype three are in the table above.

Table 16 - List of Materials for Prototype III

List of Materials
Arduino Uno R3
Breadboard
BMP180 Digital Barometric Pressure Sensor
BN-880 GPS Module
Buck Converters 3.2V-35V
40hm 3W Full Range Audio Speakers
Wires
LED Lights
Cardboard (Protective Case)

All of the subsystems will be tested so all the materials will be needed as well as cardboard for the protective casing.

Wrike update