Project Deliverable E: **Project Plan and Cost Estimate**

GNG 1103 – Engineering Design

Faculty of Engineering – University of Ottawa

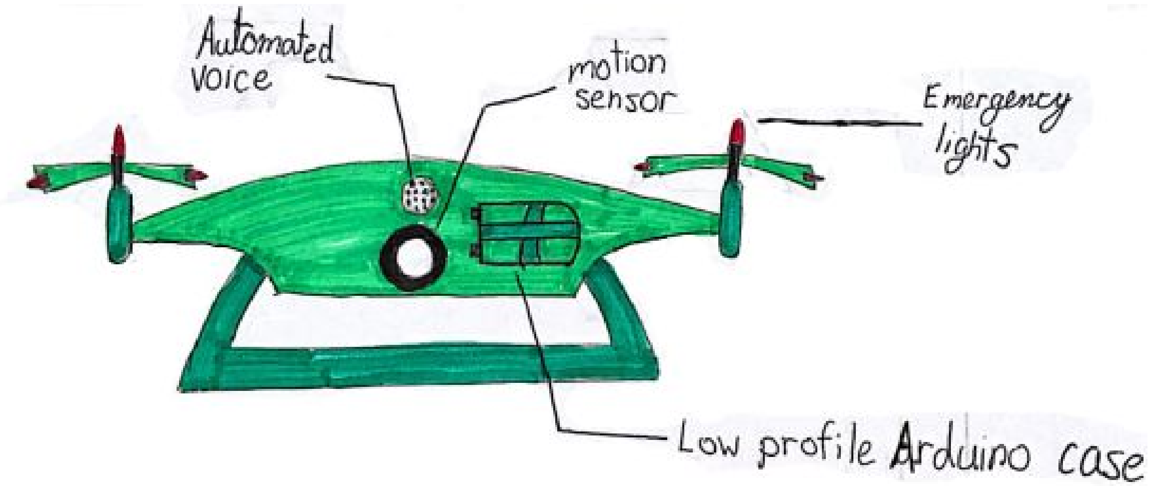
Group D2:
Andy Saber
Yusuf Hilal
Steven Huang
Zakkai Shlah
Geoffrey Hooton

February 28, 2021

Introduction:

JAMZ delivery, a newly created drone delivery company has requested help from students in the University of Ottawa's Faculty of Engineering students in helping them design various functional additions to their drone. Students from group D2 have decided to develop an anti-theft module that will dissuade potential thieves from stealing the JAMZ drones. The module will contain both lights and speakers to deter thieves (these will be activated via a motion sensor). The students in our group have already developed design specifications that will be the base of the module's design, along with an overall conceptual design to base the future prototypes on.

Students have been asked to create a comprehensive task plan and bill of materials for this deliverable. After being approved by JAMZ Drone Delivery, students must create a proper plan that will lay out the project's timeline, tasks, subtasks and the project's budget (below $100). Also, students are asked to provide a sketch of their current design.



Project Plan:

Prototype 1 (Proof of concept) - March 7th

Objectives

- Getting lights to work and calculate when to change light color
- Designing a protective cover for the Arduino
- Getting familiar with the motion sensor

#	Task	Brief Description	Duration	Team Member(s)
1	Light (LED)	Testing the LED's ability to turn on, on command	2 days	Yusuf and Geoffrey
2	Design the Arduino Case	In OnShape, we will design a 3D model of the case to be printed off later	2 days	Zakkai and Steven
3	Speaker	Model speaker	1 day	Steven
4	Motion Sensor	Test PIR motion sensor in tinkcad	2 days	Andy

Prototype 2 (Critical Systems/Parts) - March 14th

Objectives

- Getting the lights linked to the Ardiuno board and motion sensor
- Programming the speaker to warn people to stay away from downed drones.
- Get final prototype of case cover

#	Task	Brief Description	Duration	Team Member(s)
1	Attaching the lights to the motion sensor	Program the lights to change color depending on the situation.	3 days	Yusuf
2	Physical Calculations	Calculate the exact velocity of the drone to know when it's falling using the altitude.	2 days	Geoffrey and Zakkai
3	Programming the automated voice to activate when lights are red.	Someone will be speaking into the speaker and repeated the message of the automated voice	3 days	Andy
4	Printing Case on Cad and Physically	Printing the previously designed CAD Arduino case.	2 day	Steven and Zakkai

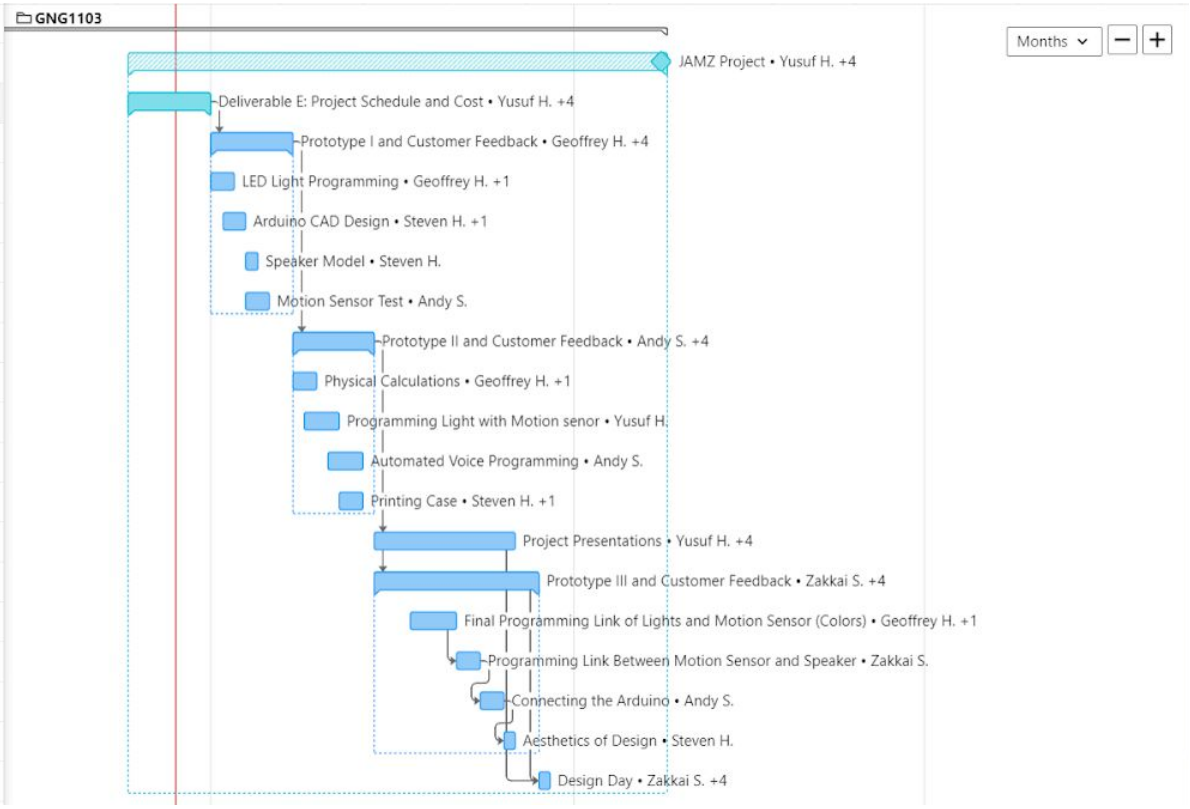
Prototype 3 (Fully Functional) - March 28th

Objectives

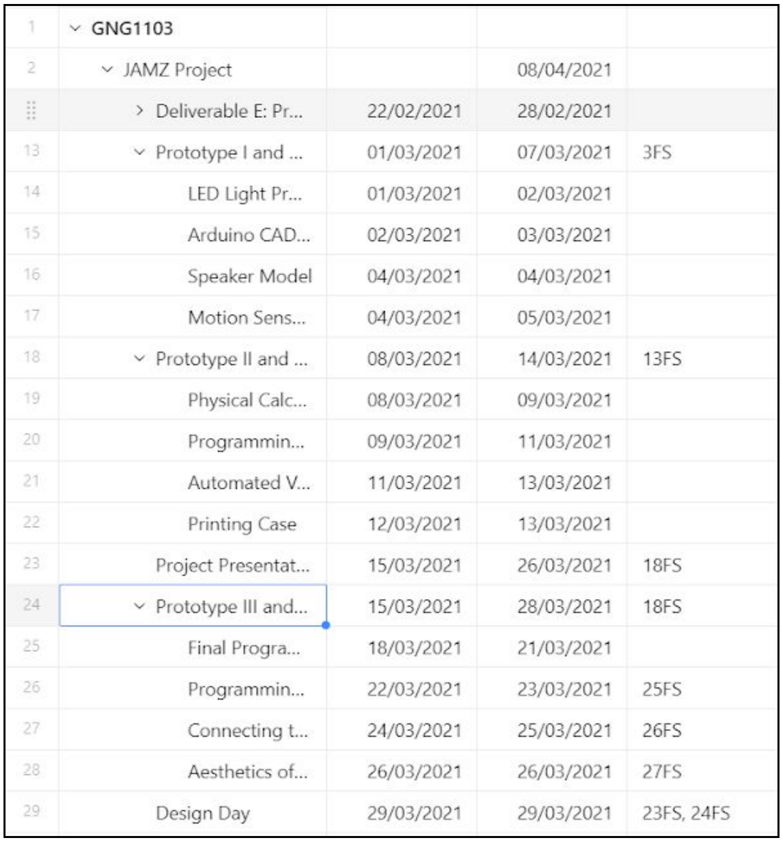
- Program the motion sensor calculate acceleration based on change in elevation
- Program speaker to turn on after the drone crashes and begins movement again
- Physically connecting the parts and makes sure the lights and the speakers work
- Preparing the prototype for presentation

#	Task	Brief Description	Duration	Team Member(s)
1	Link the lights, and motion sensor together	The lights must change based on the acceleration going from $-9.81 m/s^2$ to 0 indicating free fall and crashes. This will change light red. It will turn yellow if the velocity and acceleration are zero.	2 days	Yusif and Geoffrey
2	Putting the arduino board in the cover and connecting wires from motion sensor and speaker.	After 3D printing the arduino case, we will make sure it fits properly. Also wire management.	1 day	Andy
3	Linking the speaker and the motion sensor together	The speaker will be ready to turn on when the red light is on. If the acceleration increases from zero an automated message will be said warning whoever moved the drone. The warning will include telling the person that the drone is property of JAMZ and that it is being tracked.	2 days	Zakkai
4	Aesthetics	Coloring of the case and wire cleanliness.	1 day	Steven

Gantt Chart:



List of Tasks:



1	GNG1103			
2	JAMZ Project		08/04/2021	
	Deliverable E: Pr...	22/02/2021	28/02/2021	
13	Prototype I and ...	01/03/2021	07/03/2021	3FS
14	LED Light Pr...	01/03/2021	02/03/2021	
15	Arduino CAD...	02/03/2021	03/03/2021	
16	Speaker Model	04/03/2021	04/03/2021	
17	Motion Sens...	04/03/2021	05/03/2021	
18	Prototype II and ...	08/03/2021	14/03/2021	13FS
19	Physical Calc...	08/03/2021	09/03/2021	
20	Programmin...	09/03/2021	11/03/2021	
21	Automated V...	11/03/2021	13/03/2021	
22	Printing Case	12/03/2021	13/03/2021	
23	Project Presentat...	15/03/2021	26/03/2021	18FS
24	Prototype III and...	15/03/2021	28/03/2021	18FS
25	Final Progra...	18/03/2021	21/03/2021	
26	Programmin...	22/03/2021	23/03/2021	25FS
27	Connecting t...	24/03/2021	25/03/2021	26FS
28	Aesthetics of...	26/03/2021	26/03/2021	27FS
29	Design Day	29/03/2021	29/03/2021	23FS, 24FS

Project Risks

Risks/Uncertainties	Contingency Plan
Testing the motion sensor for free fall	Allow a range of accelerations to be accepted as the acceleration of gravity to avoid the light not turning on due to slight differences in acceleration values.
Getting speaker to only say the message when picked up by stranger	Alarm will be able to be turned off from a JAMZ office.
Arduino case might not fit on drone	Check measurements of the drone

Bill of Materials

Item no.	Item Name	Goal of Purchase	Estimated Cost	Purchase Link
1	Motion Sensor	Motion Sensor to detect drone acceleration	$5	[1]
2	Speaker	Speaker to play the automated voice message	$9	[2]
3	Green/Yellow/Red LEDs	LEDs to display the status of the drone, Green = Normal, Yellow = Loading, Red = In distress	$7	[3]
4	3D Printing	To 3D print the case	Free	One of our households
5	Motion Sensor Code that talks to speaker/LEDs	Code that will interpret the motion sensor data and control the speaker and LEDs using the data.	Free	N/A
6	9V Batteries	To power the prototypes (the actual drone will supply its own drone).	$6	[4]
7	SD card	For recording voice files	$6	[5]
8	SD reader	Reads the SD card	$12	[6]
9	Audio Amplifier	Connects the speaker to the arduino and amplifies the audio	$12	[7]
10	Male to female wires	To connect the SD reader to the arduino board	$9	[8]

11	9V Battery Clip Converter Power Cable	To power the arduino board	$9	[9]

** Links at the end of the document

Total Estimated Price: $75
Total Estimated Price With Tax: $84.75

Conclusion

In order to create a powerful, reliable anti-theft module for JAMZ delivery, students from group D2 developed the above project plan and cost estimate for the anti-theft module. The project plan was separated into numerous subtasks to make sure that the group will be able to complete each prototype punctually. These subtasks were assigned to specific group members so that the workload is distributed evenly across the members. A discussion was held to ensure that the members were designated a task that played to their strengths so that nobody is left doing a subtask that they do not understand. Finally, the subtasks were given reasonable time estimates for completion (these will be flexible depending on how many problems we encounter during the implementation period).

Additionally, a Bill of Materials was created to provide a cost estimate for the project. Since the project budget was $100, the group made sure that the total cost of the project was less than $100. For each purchasable item, an estimated cost, a short description of the component and a link was included. This is a purchase link to a product that will likely be used in the future prototypes (note that in the final product, the drone will already have red/green LEDs and will be able to provide power to the Arduino board).

Going forward, the group will follow the created project plan to design the 3 prototypes. Each member will work to complete their designated subtasks such that an exceptional final product is created

Purchase Links

1) Motion sensor
   https://www.amazon.ca/CANADUINO-InvenSense-MPU-6050-Accelerometer-Interface/dp/B07B2F2MB9/ref=cm_cr_arp_d_product_top?ie=UTF8
2) Speaker
   https://www.amazon.ca/Gikfun-Speaker-Diameter-Arduino-Speakers/dp/B07BFTYY6L/ref=pd_sbs_1?pd_rd_w=BMy7g&pf_rd_p=2e4406eb-8a85-4054-91ce-de4164472fa9&pf_rd_r=0K3A7371A0VW958M3XN8&pd_rd_r=55925ef6-60aa-4aad-98ae-5dea2a43b43b&pd_rd_wg=5UBD9&pd_rd_i=B07BFTYY6L&psc=1
3) Light
   https://www.amazon.ca/Gikfun-Assorted-Arduino-100pcs-EK8437/dp/B01ER728F6/ref=sr_1_5?dchild=1&keywords=small+led+lights+arduino+board&qid=1614304745&sr=8-5
4) 9V Batteries
   https://www.amazon.ca/Energizer-Ultimate-Lithium-Battery-Count/dp/B018N7YZL6/ref=sr_1_3?dchild=1&keywords=9v+battery&qid=1614366045&sr=8-3
5) SD card
   https://www.canadacomputers.com/product_info.php?cPath=11_171&item_id=050635
6) SD reader
   https://www.amazon.ca/Senmod-Adapter-Reader-Module-Arduino/dp/B01JYNEX56/ref=pd_bxgy_3/131-4841147-0281018?_encoding=UTF8&pd_rd_i=B01JYNEX56&pd_rd_r=87c368c4-af33-4066-b2b0-1347089ebc4c&pd_rd_w=tBTNn&pd_rd_wg=qBMbF&pf_rd_p=42339929-297e-4141-b7b2-fe55db70f4b7&pf_rd_r=6ARKA015NGNY9C5NSEXY&psc=1&refRID=6ARKA015NGNY9C5NSEXY
7) Audio amplifier
   https://www.amazon.ca/5V-12V-Amplifier-Module-Arduino-EK1236/dp/B01FDD3FYQ/ref=pd_bxgy_2/131-4841147-0281018?_encoding=UTF8&pd_rd_i=B01FDD3FYQ&pd_rd_r=87c368c4-af33-4066-b2b0-1347089ebc4c&pd_rd_w=tBTNn&pd_rd_wg=qBMbF&pf_rd_p=42339929-297e-4141-b7b2-fe55db70f4b7&pf_rd_r=6ARKA015NGNY9C5NSEXY&psc=1&refRID=6ARKA015NGNY9C5NSEXY
8) Male to female wire
   https://www.amazon.ca/Uxcell-a13040500ux0203-Female-Jumper-Cable/dp/B00D7SDDLU/ref=sr_1_7?crid=Q3IENUO827RS&dchild=1&keywords=female+to+male+jumper+wires&qid=1614366020&sprefix=female+to+male+%2Caps%2C257&sr=8-7
9) Power connector
   https://www.amazon.ca/Mr-Power-Battery-Converter-Connector-Guitar/dp/B07FCZZ5JF/ref=pd_vtp_2?pd_rd_w=S2jpM&pf_rd_p=d24b48d8-e9cd-4bb0-98bc-8c16948e998b&pf_rd_r=7X2XG6V5DA0MFBAZ996E&pd_rd_r=d5b98942-551f-4c8d-be0e-6e251dc753b3&pd_rd_wg=G6V1H&pd_rd_i=B07FCZZ5JF&psc=1