Delivery Quadcopter

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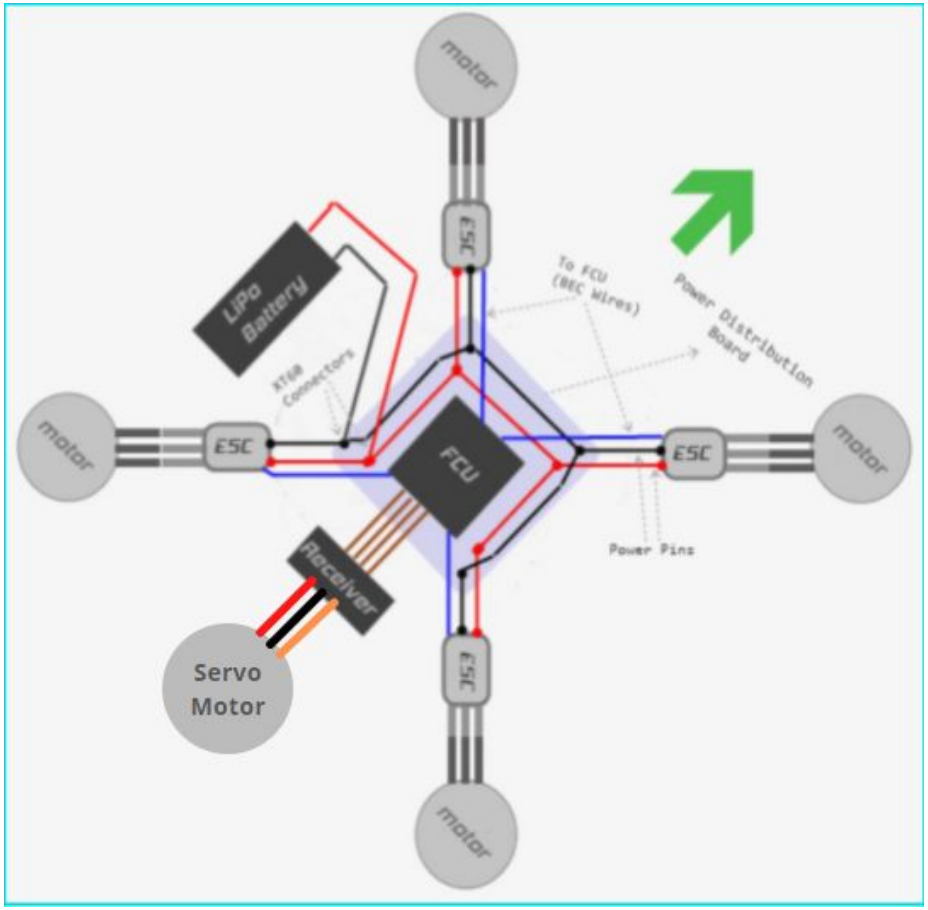
Agenda

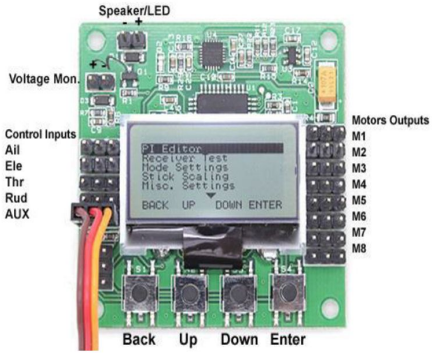
Scope of Project

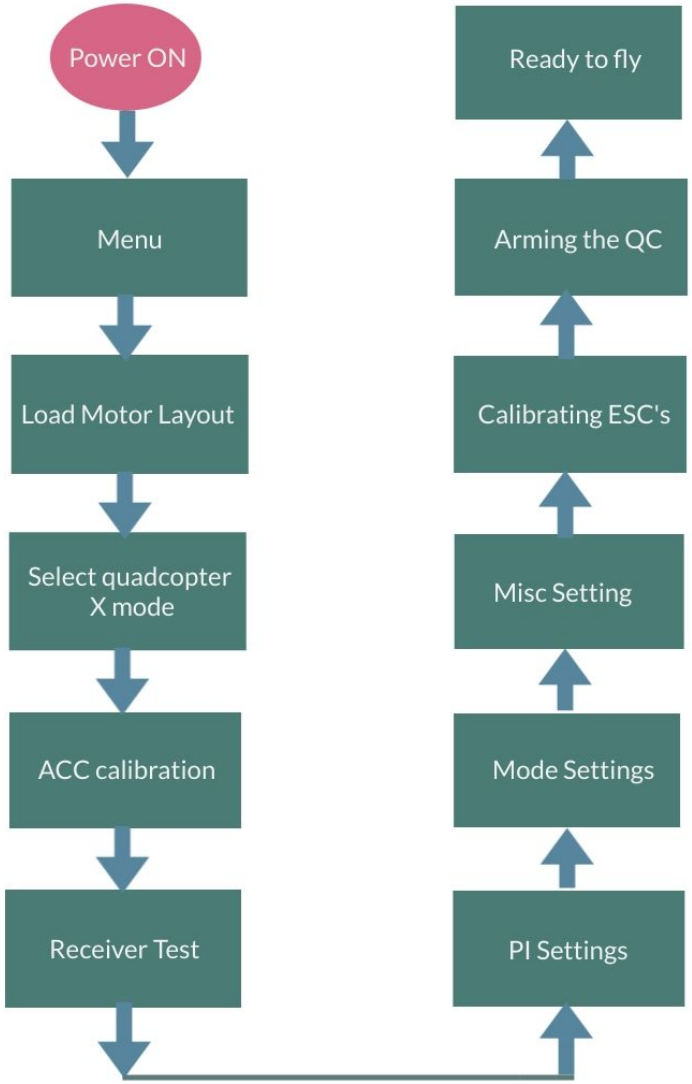
- Over the past few years, drones have become central to the functions of various businesses and governmental organizations and have managed to pierce through areas where certain industries were either stagnant or lagging behind.
- The introduction of delivery drones has stimulated discussion of what the technology can accomplish in terms of reduced vehicle travel.
- Delivery drones have the potential to change delivery economics for smaller and lighter packages.
- We chose to make delivery quadcopter with a larger aim of increasing work efficiency and productivity, decreasing workload and production costs, improving accuracy, refining services and customer relations, and resolving security issues in e-commerce companies.
- Our aim was to develop a drone that will be able to deliver products such as medicines and food supplies to remote areas at rush hours where man cannot reach in a timely and efficient manner.

Block Diagram/ Flow chart

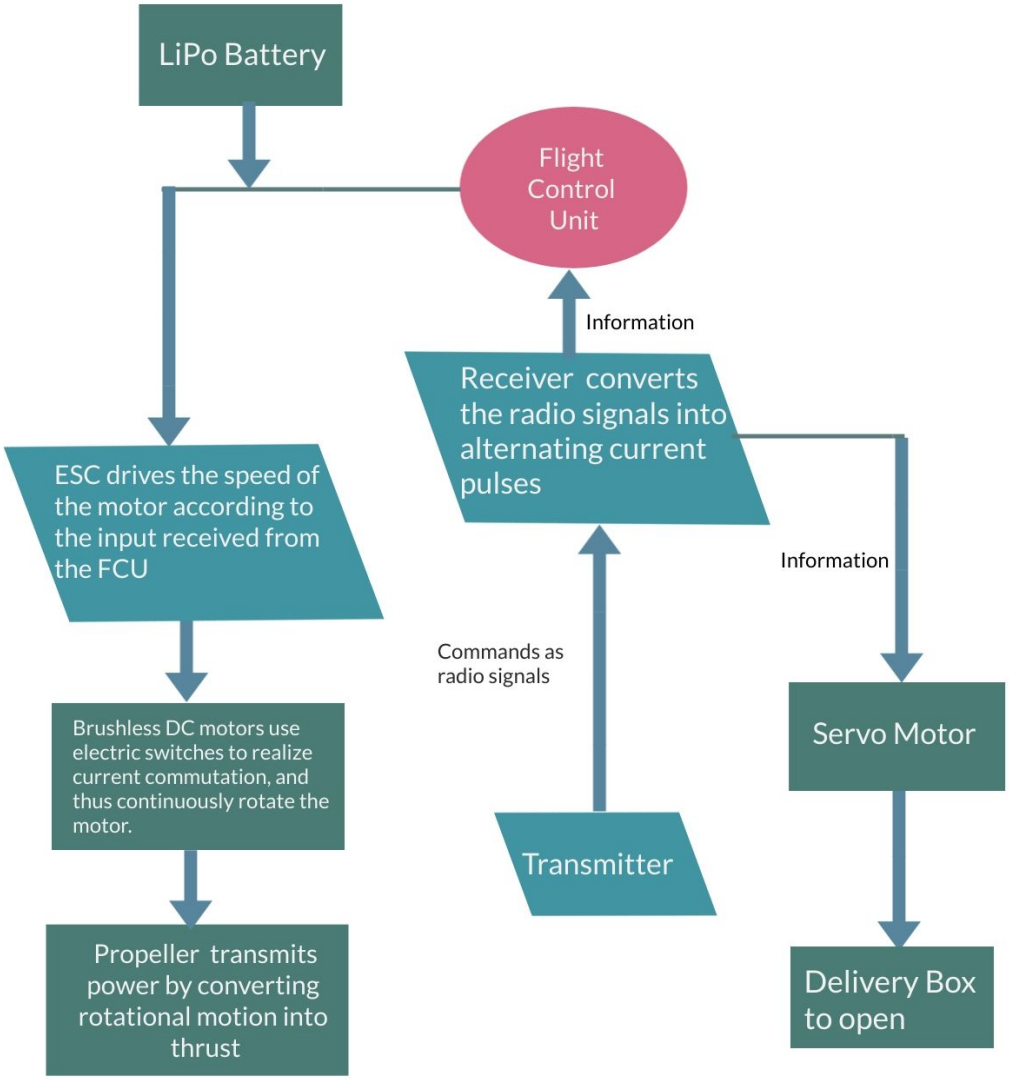


Circuit Diagram of Quadcopter





Setting up Flight Control Unit



Representation of working of the project

Methodology of Implementation

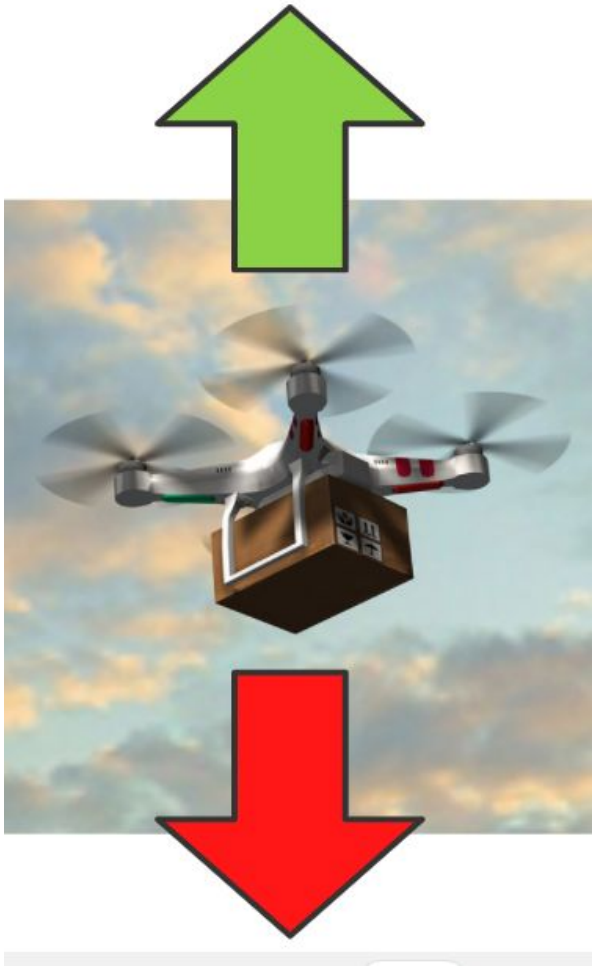
Thrust to Weight Ratio –
Also known as TWR or T/W. Thrust is defined as in drone application, thrust is the amount of mass that the motor/prop will be able to lift into the air.

TWR ratio is just the maximum thrust of a drone divide by the weight.

In our quadcopter we are producing a total thrust of 2600g and our drone total weight is 1300g, we will have a TWR ratio of 2:1 (2600/1300).

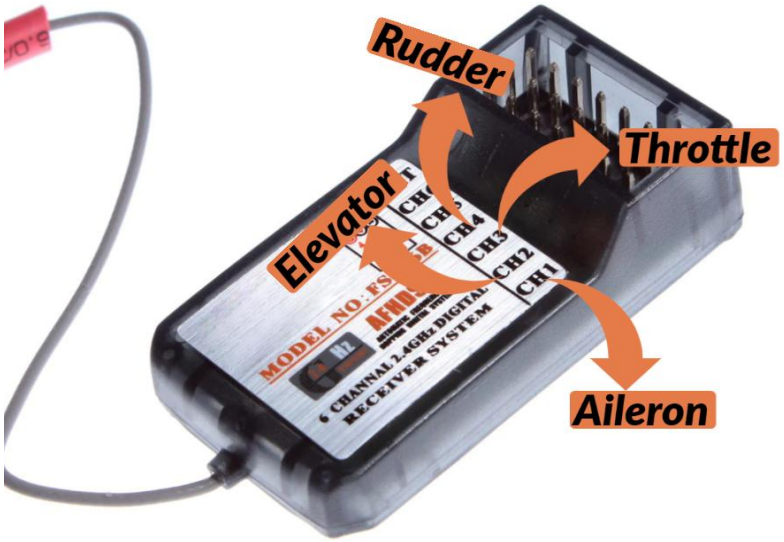
We must have more thrust than weight in order to fly.

TWR of 2:1 is a good number to aim for, we can still fly with a ratio of 1.5:1 but this leaves little room for additional payload.

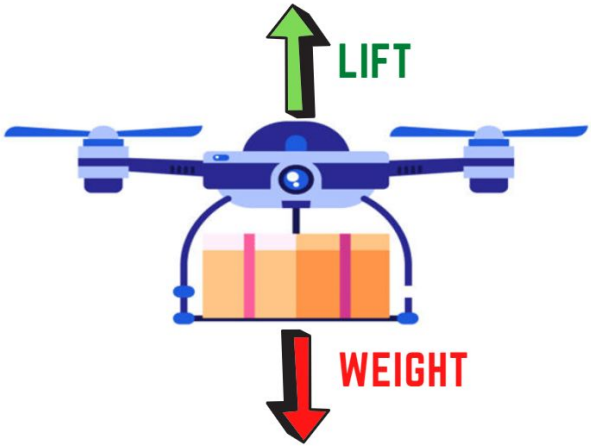


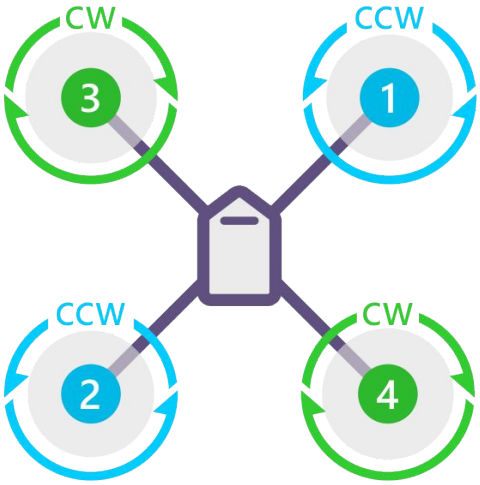
The four BLDC motors are mounted on the ends of the quad frame each connected to the flight control board via ESC. The 4 motors are connected in parallel to the supply battery. The ESCs are connected to their respective 4 pins M1, M2, M3, and M4 on the KK board.

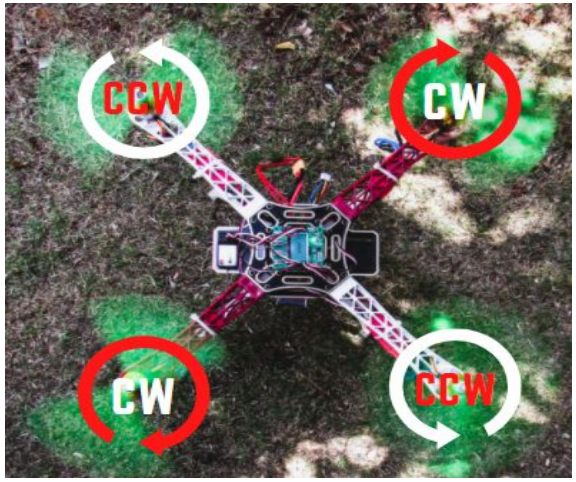
The receiver is then attached to the KK board. Four channels are used in the receiver for the four different movements and are connected to their respective pins namely the throttle, elevator, aileron, and rudder pins. Only one of the pin pairs is made in connection to the Vcc and Gnd pins and the remaining three are connected via signal pins. The KK board is an inbuilt microprocessor that gives out the desired output to the motors by receiving the signals for the different movements via the receiver.

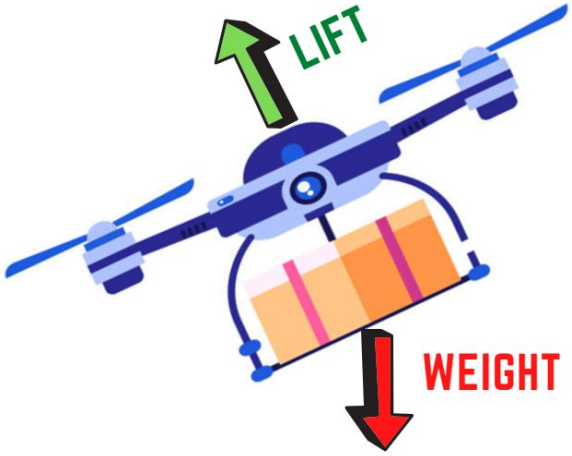


To make anything fly, we must balance its weight by generating an equivalent force (Lift) and balance moments of its Centre of Gravity (CG) by generating opposite moments.
A quad-copter generates these required moments and lift force using its four rotors. To fly stable in a particular orientation, net moment of the CG should always be zero or resultant of all the forces acting on the system should pass through its CG.
Also, to balance the angular momentum about the CG, two rotors are made to rotate clockwise and other two anti-clockwise.

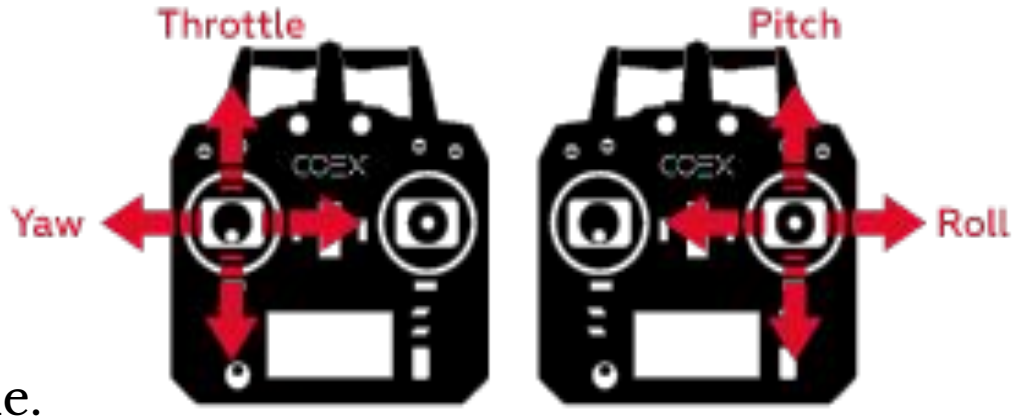








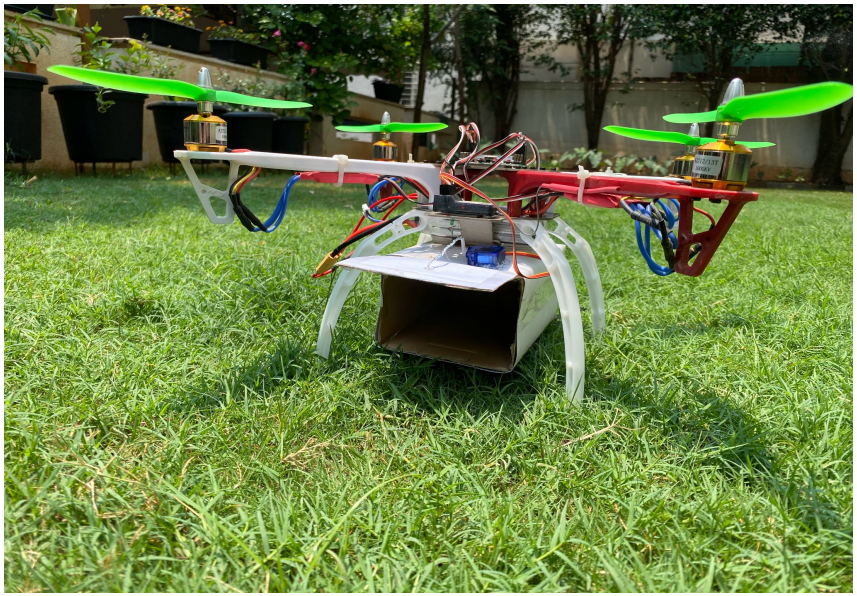
- The ‘throttle’ control tells the quadcopter to gain altitude or descend.
- The ‘pitch’ control tells the quadcopter whether to fly forward or backward.
- The ‘roll’ control tells the quadcopter to move side to side.
- The ‘yaw’ or ‘rudder’ is a rotation movement of the quadcopter.



Plan of Work

Goal 1: Getting the materials for the project					
Key Action Steps	**Timeline**	**Expected Outcome**	**Obstacles Faced**	**Solution**	**Comments**
1. Making a list of the materials and the quantity required and then placing the order.	*7.3.21 – 12.3.21*	*All materials available to us in working conditions.*	*Cost of some of those materials were really high and finding it at a cheaper rate from a trusted source was hard.*	*Through vigorous research the best option was buy it from a store where we could self-check the materials and get it at a cheaper rate.*	*The total cost of the project is Rs 9250/-.*
Goal 2: Setting up the frame of the model					
Key Action Steps	**Timeline**	**Expected Outcome**	**Obstacles Faced**	**Solution**	**Comments**
1. Mounting the BLDC motors on the ends of the quad frame. 2.Placing the flight control board 3. Connecting the motors to the flight control board through ESC's.	*15.3.21 – 19.3.21*	*When testing the circuits set up using the multimeter, current flow should be proper.*	*Most of the components were new to us thus connecting them properly was a challenge.*	*Referring properly to the pin out diagrams of the components.*	*The body of the Quadcopter was set.*
Goal 3: Setting up the flight controller					
Key Action Steps	**Timeline**	**Expected Outcome**	**Obstacles Faced**	**Solution**	**Comments**
1. Configuring the Gyroscope and Accelerometer in the Flight Control Unit KK 2.1.5. 2.Setting up the transmitter and receiver by tuning the transmitter.	*24.3.21 – 28.3.21*	*Quadcopter is flight ready.*	*After configuring the flight control unit we were not able to pass on the commands through the transmitter to the Quadcopter.*	*We set the channels of the transmitter individually by connecting it to the pc through the fly sky software.*	*We changed the 10x4cm propellers with 8x4cm because the drone was not stable with bigger ones.*
Goal 4: Setting up the delivery mechanism					
Key Action Steps	**Timeline**	**Expected Outcome**	**Obstacles Faced**	**Solution**	**Comments**
1. Setting up the channel left to the servo motor by tuning the transmitter. 2. Attaching a box for the materials to be transported which is controlled by the servo motor.	*1.4.21 – 8.4.21*	*Quadcopter to deliver materials safely.*	*During this timeline second lockdown was imposed which prevented us from meeting to work on the project.*	*We would meet up online and work on the project where one would physically handle the model and others would help by assisting virtually.*	*We got to experience a new way of working on a project.*

Experimental Results



Costing of Project

Sr. No.	Item	Quantity	Rate	Price
1	DJI F450 Quadcopter frame Kit	1	₹900.00	₹900.00
2	FlySky 6CH	1	₹2,700.00	₹2,700.00
3	KK2.1 Multi-rotor LCD Flight Control Board	1	₹1,400.00	₹1,400.00
4	30A 2-3S Brushless ESC For RC Model	4	₹325.00	₹1,300.00
5	0845 Propeller 8x4.5 For Drone Kit (AntiClockwise, Clockwise)	2	₹100.00	₹200.00
6	A2212 1000KV Brushless Motor For RC Airplane / Quadcopter	4	₹350.00	₹1,400.00
7	Battery	1	₹1,350.00	₹1,350.00
		Total Price		**₹9,250.00**

Conclusion

- Whether drones are controlled by a remote or accessed via a smartphone app, they possess the capability of reaching the most remote areas with little to no manpower needed and require the least amount of effort, time and energy.

- Along with the technological potential the drone holds, its uses will grow with time and we aim to expand our project in similar direction.

- By bringing real-life context and technology to the curriculum through a Project Based Learning approach, we were encouraged to not only become independent workers but also critical thinkers and learners.

- We learnt to overcome the fear of embarking on an unfamiliar process and handle all ups and downs together.

- We achieved our aim of together building a fully functional delivery quadcopter.

References

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