Drowne

Problem Statement: An intervention to minimize and mitigate diverse forms of losses due to Drone Accidents.

Team Name: Drowne

Team Members: Parth Garg, Shagun Yadav, Tanmay Singhal

INDRAPRASTHA INSTITUTE *of*
INFORMATION TECHNOLOGY
DELHI

Problem [1-2 slide]

- The global drone market is worth $43 billion as of 2022 and is expected to reach growing at a CAGR of 21.5%.
- A recent survey found that a staggering 79% of online buyers would be willing to receive a delivery by drone.
- With the recent rise in use of drones for delivery purposes, there has been an increased cause of concern due to drone crashes:

1. Crashing drones pose a danger to civilian lives and property.
2. Loss of goods onboard which sometimes have critical life saving drugs onboard. E.g. blood components aboard from AIIMS Rishikesh.
3. Loss of the drone itself which is now rendered useless, they themselves cost lakhs to begin with.

Problem

- “A food delivery drone owned operated by a private organisation crashed into a two storey home while attempting an emergency landing damaging a dish antennae, a windowpane”
  - https://timesofindia.indiatimes.com/city/gurgaon/food-delivery-drone-crashes-in-south-city-2-operator-booked/articleshow/107767713.cms
- “A drone carrying a 2.5-kilogram payload (blood component) as part of the institute’s efforts to ensure quick delivery of medicines and samples from AIIMS Rishikesh crashed nearly 15 to 20 km short of its destination.”
  - https://www.hindustantimes.com/cities/dehradun-news/drone-carrying-blood-components-crashes-due-to-bad-weather-on-route-from-aiims-rishikesh-to-base-hospital-in-kotdwar-101691416177553.html
- “More than 400 large US military drones have crashed around the world in the past 13 years including collisions with homes, farms, runways, roads, waterways and even an air force transport plane in midair.”
  - https://www.theguardian.com/world/2014/jun/21/400-us-military-drones-crashed-13-years

Problem

- “A drone, flying over prohibited territory in Southern California, crashed in the middle of a nesting colony of elegant terns, frightening the seabirds and causing them to abandon 1,500 or more eggs.”
  - https://nanpa.org/2021/06/11/drone-crash-causes-birds-to-abandon-1500-eggs/

- “A military drone crashed during a test flight in northern Iran on Monday, wounding two people and damaging buildings.”
  - https://apnews.com/article/iran-military-drone-accident-5aa6327073216c0ca0441f904023a39b

Problem

- Drone technology is being rapidly integrated into our everyday lives finding its way into domains like military, delivery services, communication, delivery and many more. This advent comes with various threats, involving physical injuries, damage to private and public properties, while also raising commercial concerns for the drone service providers.

- Drone Crashes pose a risk of physical harm to individuals in its vicinity. Incorrect trajectories and debris falling can lead to injuries.

- Mid-air crashes with other flying objects like birds, planes, buildings, trees and even other drones.

- These crashes cause commercial losses - Majority of drones used today are used for commercial purposes carrying goods with economic value.

Problem

- Current developments around Drone Crashes/Accidents is majorly about **prevention:** Primarily involving use of sensors to prevent accidents. There has hardly been any development in the situation of when accidents have already happened. Is there any **curative** measure in place? No.

- What about cases where the Drone actually with the goods onboard? Do we simply let go of the entire shipment? - This is a huge commercial loss - first the goods, secondly the drone which is now rendered useless.

- Here, our solution comes in.

Literature Survey

We reviewed the following research papers that have already made contributions to this domain to inform our project development process.

- https://www.sciencedirect.com/science/article/abs/pii/S2214785322074752
- https://static1.squarespace.com/static/5a7d8aa2d55b419a5b531b85/t/604df9cad5db3e46790f9779/1615722988711/Development+of+a+Multirotor+Drone+Airbag+%28Cawthorne%2C+2016%29.pdf

Users

- Target users include:
  - Commercial drone operators like delivery services, and security and surveillance drones.
  - Drone enthusiasts who wanna ensure longevity of their personal drones.
  - Research organisations focusing on drone development and safety.

- End users would primarily be drone manufacturers integrating our technology into their products to mitigate crashes with the average drone costing over $2500 to the target users.

Proposed Solution

- Development of Nylon based Air Bags for Drones that help minimize the damage/loss in case of an accident.
- They will detect a crash on the basis of information from :
  - The Drone Gyroscope
  - Proximity Sensors
  - Cameras and RF analysers
- Once activated, the Airbags will protect the Drone and its contents from high impact collisions.
- The proposed airbags could be easily tethered to existing drones as extensions - no need to modify existing drone designs.
- These bags will be lightweight - to stay within weight constraints.

Proposed Solution

AirBag Design:

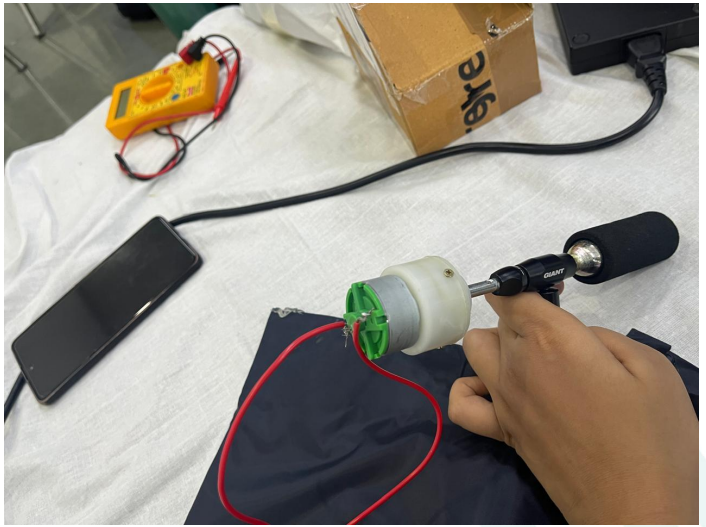
- Made from woven fabric, coated to be impermeable to gases and flame resistant. Nylon (polyamide) 6.6 to be used.
- Attached at the bottom of the Drone, designed to form an inflated structure protecting the drone from all 6 sides - taking into account a sideways or upside down fall.
- Latches to secure Airbags to existing drones.
- LightWeight : weighing around 680g, this will not affect the drone's weight constraints or restrict the drone's carrying capacity.

Proposed Solution

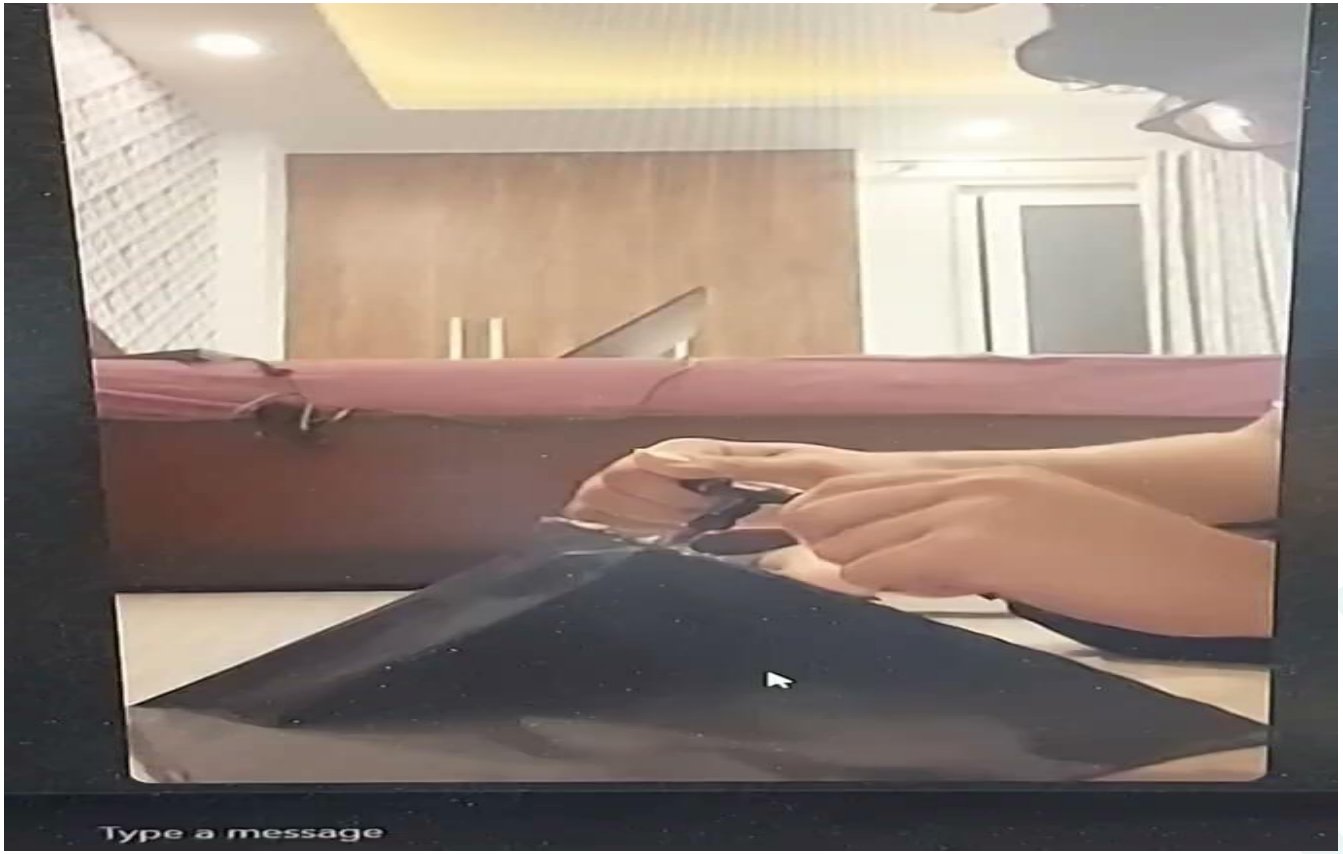
Detecting a crash:

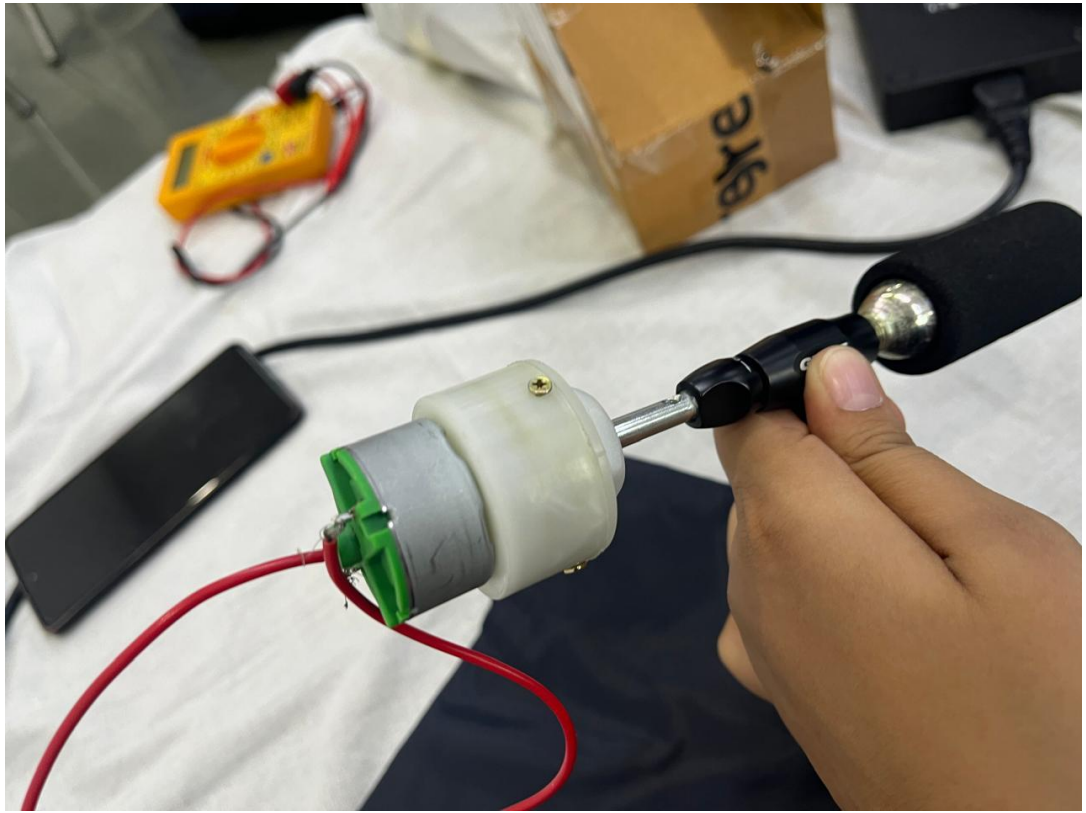
- Utilizing gyroscopes and accelerometers to measure sudden changes in drone's velocity and orientation that may indicate a collision.
- Employ altitude sensors to monitor for rapid descents or unexpected altitude drops which acts as a crucial early indicator for a crash.
- Implementing GPS tracking to monitor the drone's position for detection of any major deviation from the intended flight path.
- Incorporate sensors to detect rapid and erratic movements while been airborne informing about any potential issues.
- Implement a system to monitor the locking mechanism of payload to ensure its secure attachment during flight.

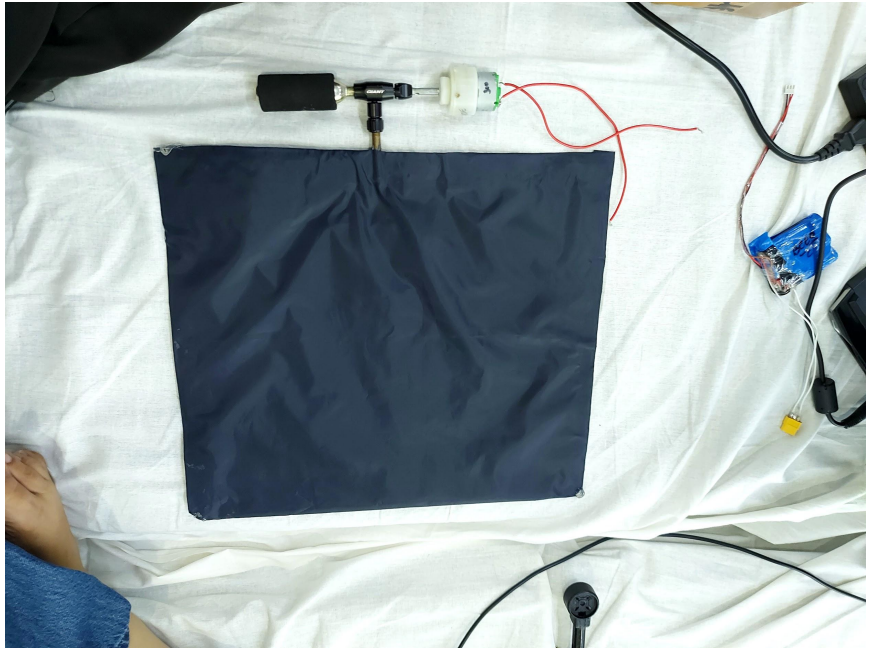
Prototyping

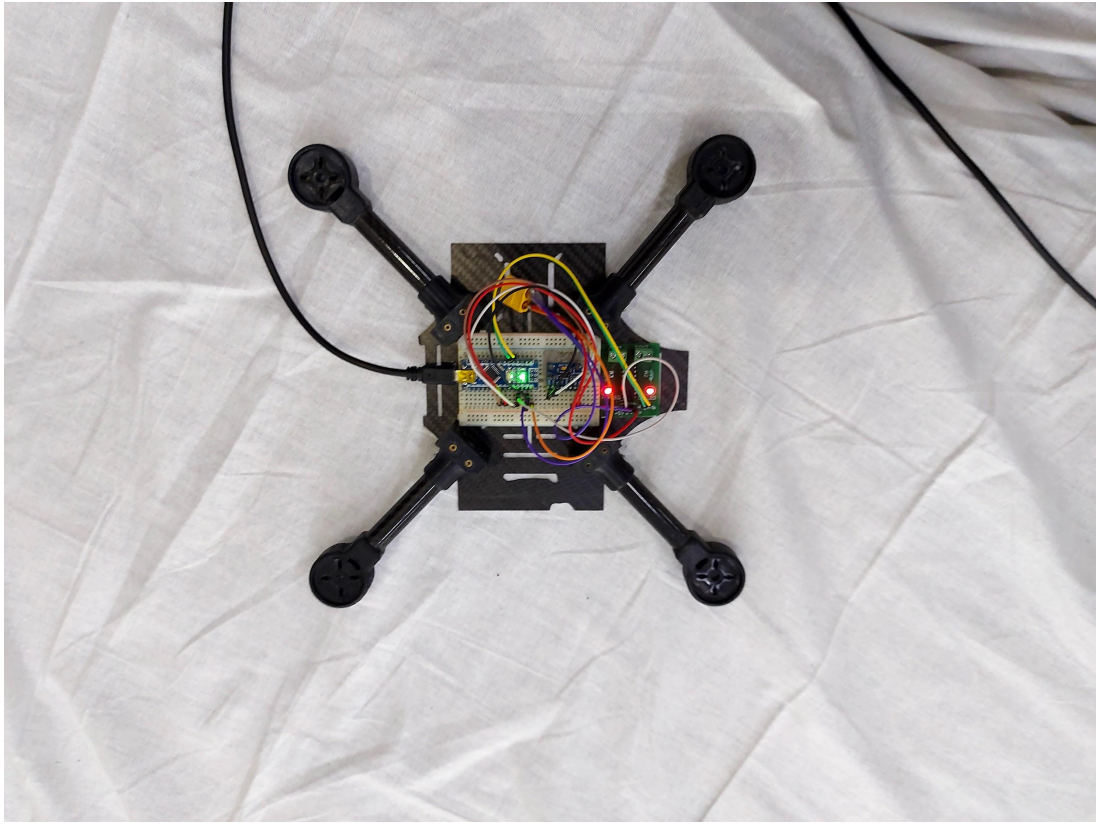


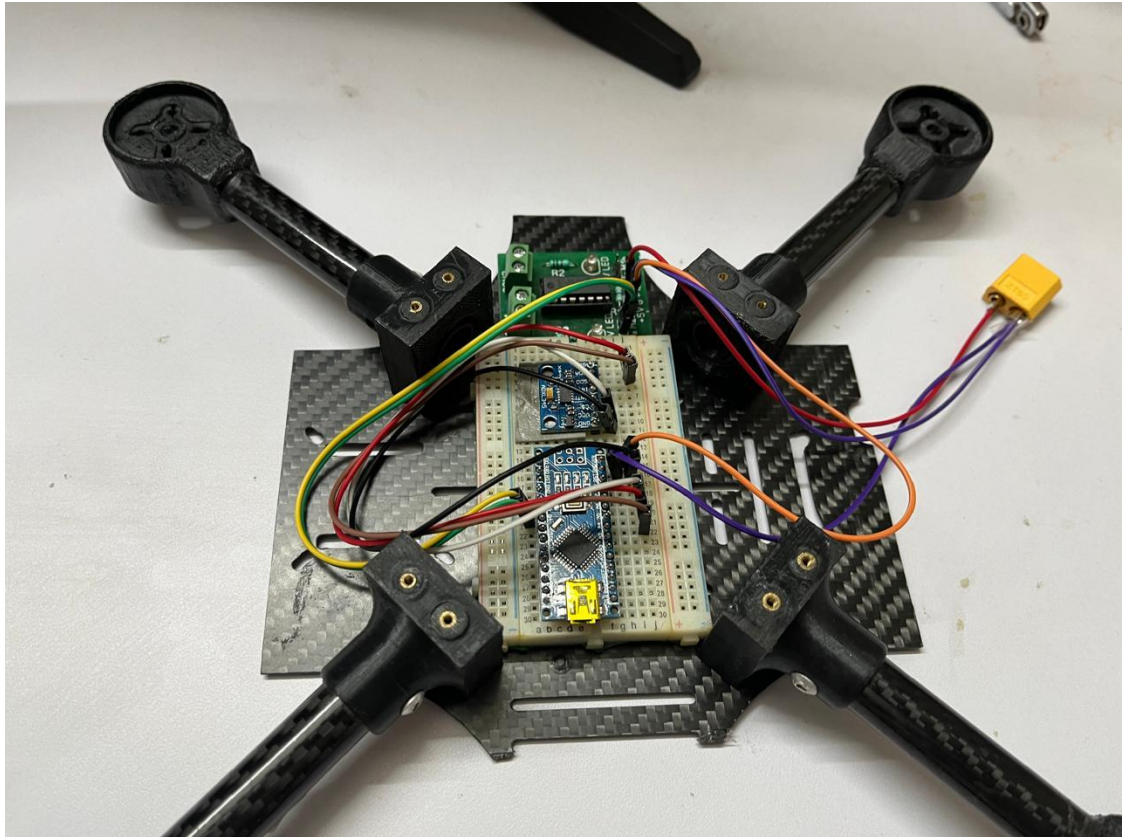

CONTROL BLAST O
GIANT
GIANT
1.
2.
3.
4.
5.
CLOSE
OPEN
CLOSE

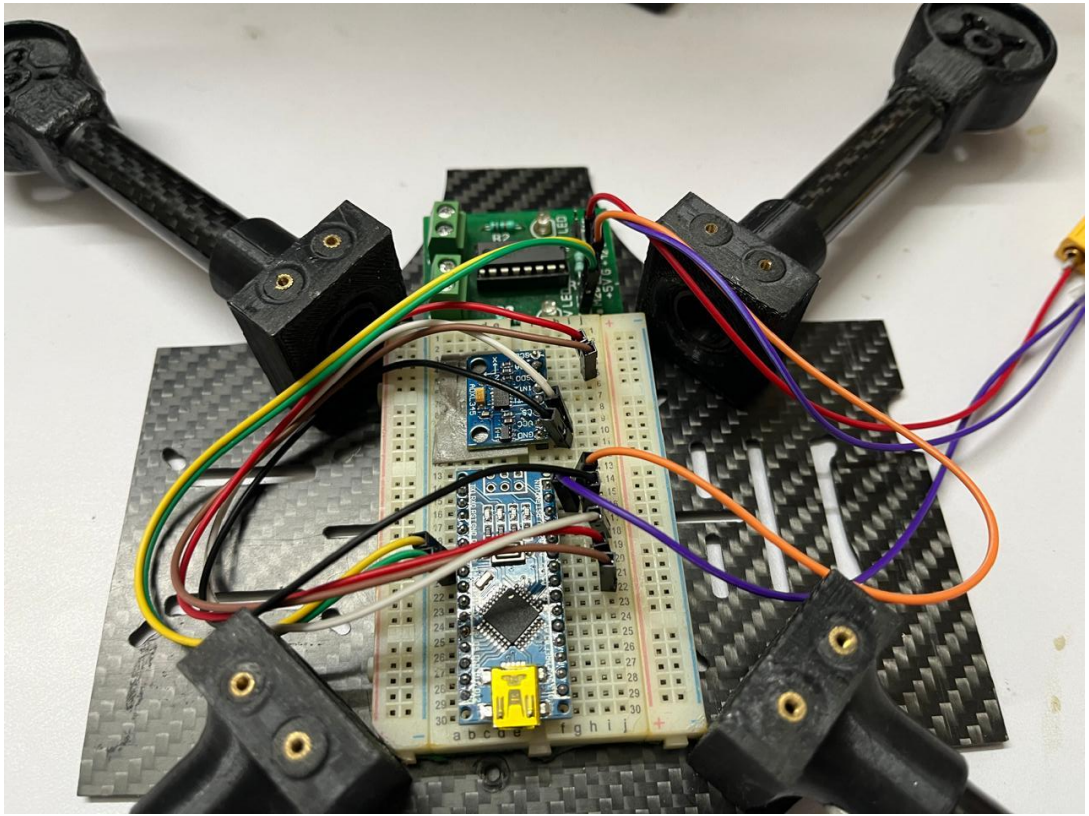

Type a message

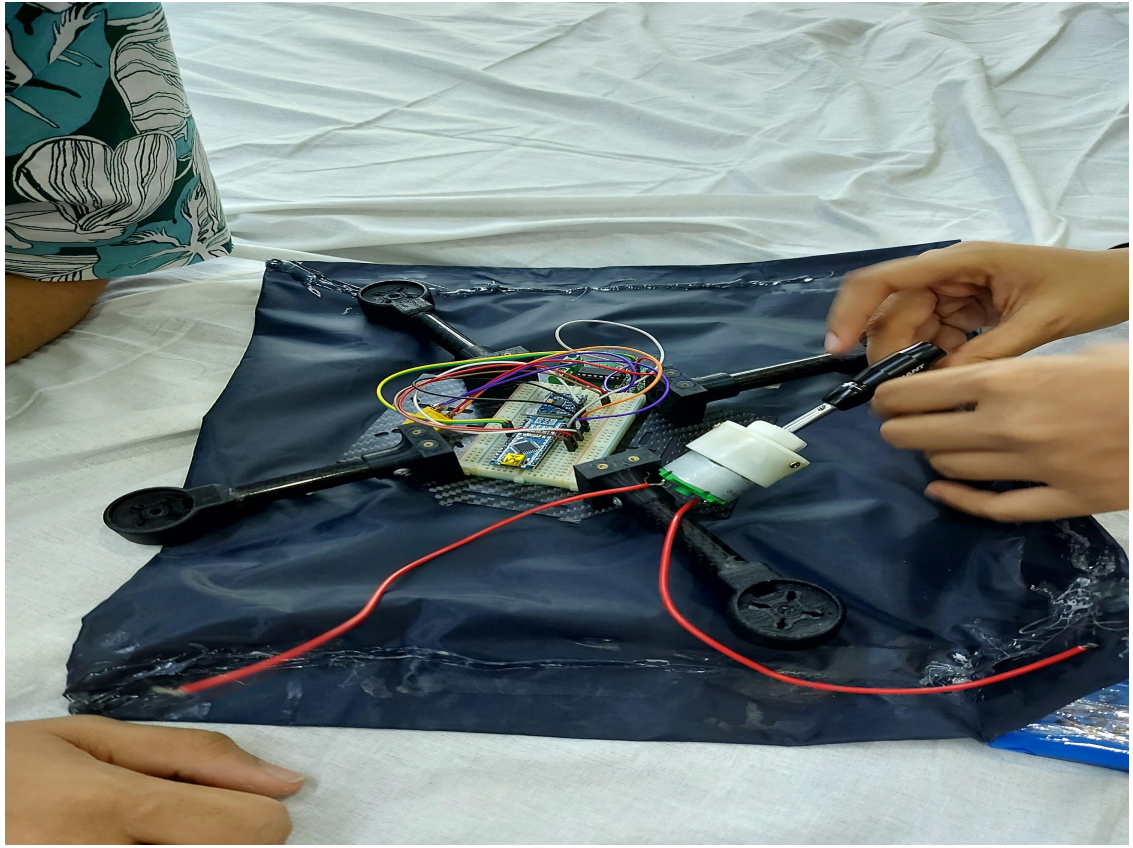


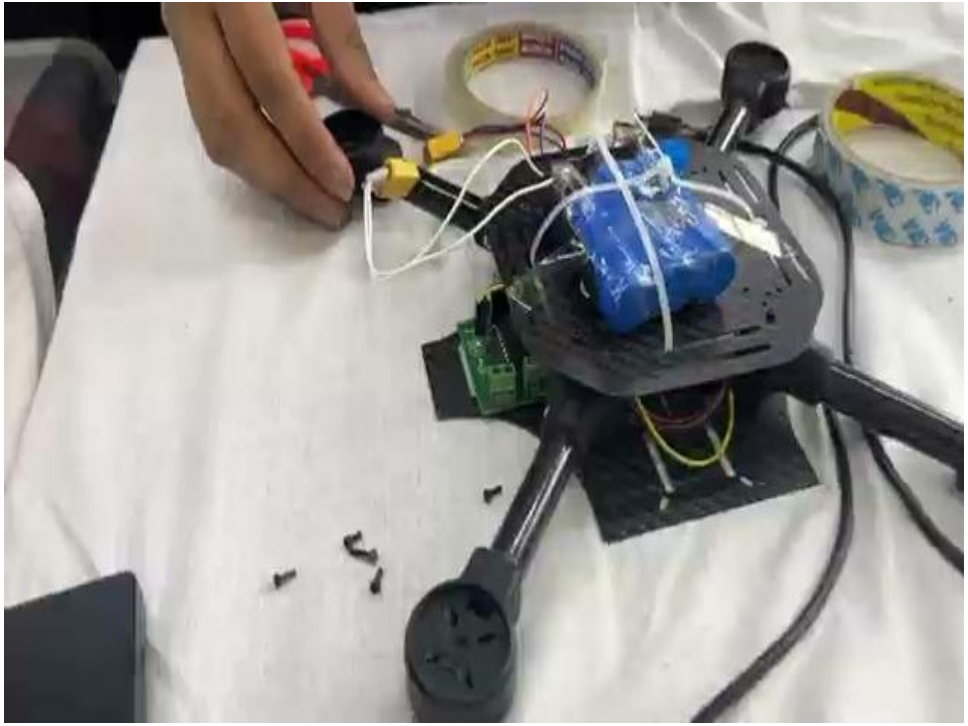


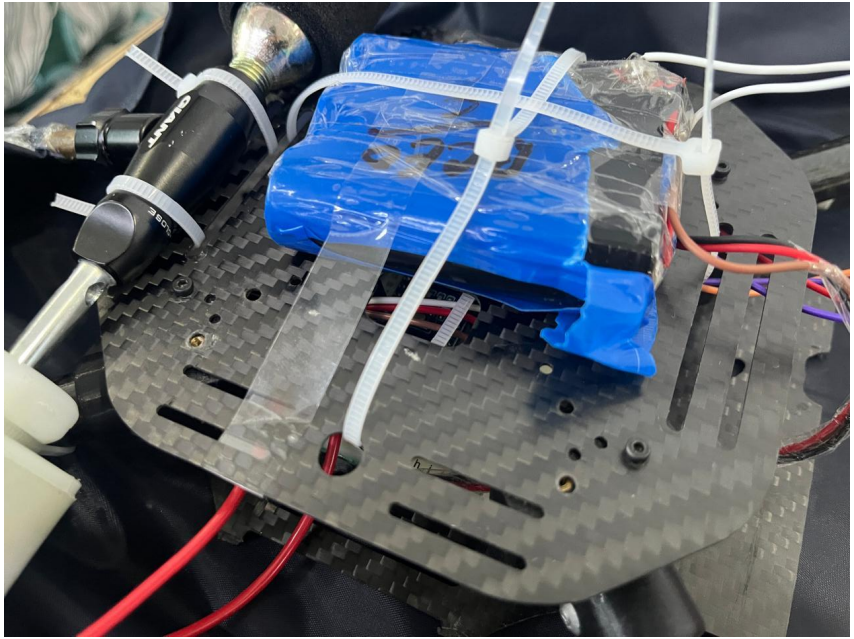


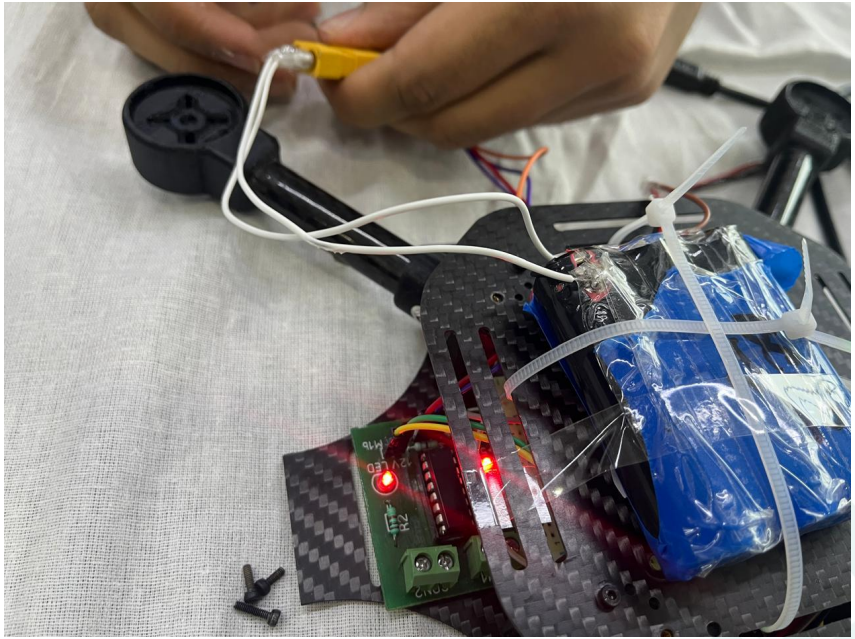




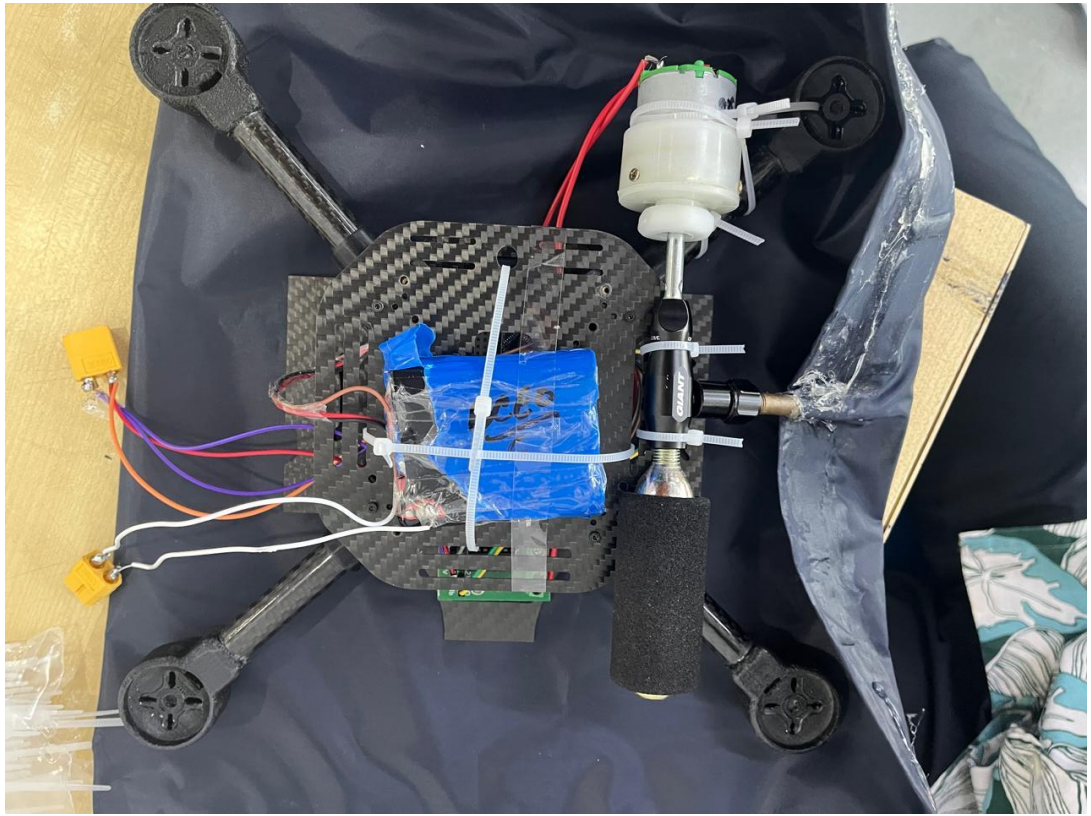









GIANT



Demo

Potential Impact

- Delivery Drones: The drone services market is expected to reach $63.3b by 2025. Delivery drones equipped with airbags ensure that losses during high impact collisions is minimized protecting both the contents (which could be fragile and expensive) and the drone itself.
- Military Drones: Military drones equipped with airbags will safeguard sensitive data and valuable equipments reducing the risk any collateral damage in case of a crash or emergency landing. Additionally it prevents unintentional detonation of explosives.
- Collisions: Airbags on drones will help with the impact during mid air collisions or crashes protecting both the drone and its adjacent airspace while keeping the cargo safe.
- Fragile Goods: Airbags play a vital role in the secure transportation of delicate and expensive goods by reducing the risk of breakage and damage in case of any crash.