Fixed-Wing UAV and Launcher System

Description

This project presents a fixed-wing Unmanned Aerial Vehicle (UAV) and a custom ground launcher designed for payload transportation in disaster-response scenarios, developed for competition purposes. Disaster zones are often difficult or dangerous to access using ground vehicles, making UAV-based payload delivery a critical solution. The launcher plays an important role by providing sufficient initial thrust for takeoff, improving launch consistency, and significantly increasing operator safety compared to hand-launch methods.

Objectives

The main objectives of this project are To design and build a safe and reliable UAV launcher, To develop a competitive fixed-wing UAV capable of payload delivery, To ensure operational safety during UAV launch in competition environments

Technologies Used

- Pixhawk Flight Controller
- Servo Motors
- Propeller
- Carbon Fiber
- Resin
- Composite Materials
- Measuring Tools

System Workflow

1. Launcher Design The launcher was designed using Autodesk Inventor. The launch rail angle was calculated to optimize initial lift and ensure stable flight conditions immediately after takeoff.
2. Launcher Fabrication and Assembly Launcher components such as V-slot rails and gantry wheels were purchased and fabricated using a grinder according to the design specifications. All parts were assembled using bolts, allowing the launcher to be easily disassembled for transportation.
3. Aircraft Body Reinforcement The aircraft body was reinforced using two layers of composite material to improve structural strength and aerodynamic performance. Each composite layer was bonded using resin to

harden and strengthen the airframe. The aircraft was then repainted using team colors.

4. Flight and Launcher Testing The launcher system was assembled, including the sling mechanism. The aircraft was placed on the launcher, and all components—including propulsion, control surfaces, and electronics—were checked. The launch was executed by triggering the launcher mechanism.

Key Features

- Operational flight radius of up to 3 km
- Payload drop capability
- Ground-based launcher for safe and consistent takeoff

Challenges & Issues (Key Section)

- Very limited project budget
- Aircraft crash during testing
- Sling mechanism failure
- Tight development timeline before competition

Solutions & Technical Decisions

- Used personal savings to cover critical expenses
- Built a replacement aircraft using debris from the crashed plane within a short time frame
- Purchased a new sling component to replace the broken one
- Adopted highly efficient and intensive work schedules to meet deadlines

Results & Evaluation

Most of the implemented solutions were successful. However, the rebuilt aircraft did not receive sufficient test flights due to time limitations. As a result, the aircraft could not be safely flown, and the team was unable to proceed in the competition.

Lessons Learned

- Practical use of resin and composite materials
- Safe and effective operation of power tools such as grinders
- End-to-end process of designing and building a fixed-wing UAV
- The importance of adequate testing time in aerospace systems