PROJECT JATAYU

Vision

The vision of Project Jatayuis to design and develop Autonomous Unmanned Aerial Vehicles, that use the most recent advances in technology to create applications for the real world and society at large.

Mission

The mission of Project Jatayu is to fulfill the vision by undertaking research and development in various fields encompassed, and to demonstrate their utility by participating in various competitions and events at the national and international levels.

Perspective

Project Jatayu, the student autonomous UAV team of RVCE was the brainchild of 6 Electronics and communication students of RVCE. Started in 2009 it was one of the first teams of its kind in the country. The motto of the team was to create drones which were autonomous, self thinking drones that perform numerous tasks without human intervention.

The team was started with an intention of participating in the autonomy based international event Australian Outback to be held in Australia.

Later the flagship event of Project Jatayu became the Society of Unamnned Aerial Systems (SUAS) organised by Association of Unmanned Vehicle Systems International (AUVSI)

The team is multi-disciplinary and has a well organized team structure with members from different branches like Mechanical Engineering, Computer Science, Information Science, Electronics and Communication, Electrical Engineering, Telecommunication Engineering, Aerospace Engineering, Civil Engineering, Electronics andIndustrial Engineering, etc. all performing tasks related to their respective branches. The final drones is a result of the integration of work of all these departments.

Principle

Subsystems

Project Jatayuhas 7 major subsystems to performparallel processing of tasks to reduce time and improve efficiency of the team.

AERODYNAMICS:

This system analysis the mission requirements of events by going through rulebooks released by the event organizers. They decide on the design , dimensions and drones parameters keeping in mind the constraints imposed by the organizers. Having hence decided they begin designing the drone on dedicated software and perform aerodynamic analysis to determine the various parameters. Based on similar iterative processes, they refine and modify the preliminary design repeatedly and finally provide the final design

when all satisfactory values of aerodynamic parameters are obtained. Software like SolidWorks, ANSYS, XFLR5, are used.

STRUCTURE

This team converts the final design given by the Aerodynamics team into models needed for machining operations and also design the internal structure of the fuselage and wing for fabrication to obtain the desired model. They model every part individually as it will be assembled to create the final model. They use software like SolidWorks, SolidEdge and Corel Draw.

PROPULSION AND CONTROL SURFACES.

This team is involved in the selection of propulsion systems for the designed drone. The team selects motors from a wide range of DC brushless motors that are best suited for the drone performance with minimum weight. This ensures optimum performance.

Control surfaces help maneuver the drone in the desired direction which is the essential criterion for a controlled aircraft. This is seen in fixed wing aircraft for performing maneuvering in the three rotational axes pitch, yaw and roll along the coordinate axes of the aircraft. These are electrically controlled gear servo motors.

COMPUTER VISION (IMAGE PROCESSING) SYSTEMS

The CV and IP subsystem creates the distinction between Project Jatayu and other UAV teams and makes it truly multi-disciplinary. The CV and IP subsystem deals with imagery from the onboard camera, its processing and extraction of useful information from therein. It focuses on application of computing to the analysis of visual data, to the ends of detection of various objects, surveying, surveillance, and so on. The CV and IP team is an integral component in making the drones crafted by the team able to carry out functional tasks based on visual data

COMPUTING SYSTEMS AND INFRASTRUCTURE

Another computing based subsystem which takes care of the computing infrastructure on board the craft, including the setting up and configuration of the onboard computer, the networking between the drone and ground station, the transmission of image data between craft and the ground station, and also integration with the autopilot

AUTONOMY

This subsystem deals with the setting up, configuration and development of the autonomy system, which allows a plane to perform tasks without constant human supervision. This subsystem is the one that sets us apart from normal remote control UAVs. The subsystems is involved in making the UAVs self thinking. Autonomy is accomplished by means of control boards like PixHwak and KK series board.

TECHNOLOGY UPGRADES

Mechanical

The initial years of Project Jatayu did not see any developments in the mechanical field as the main focus was on autonomy . Hence the models were purchased from vendors as Ready to Fly (RTF) kits. The manufactured plane was assembled and required autonomy components were added. With the increase in involvement of mechanical engineering

members, the team started fabricating designs from pre-existing designs. Later by 2012-2013 the team was designing and fabricating planes according to its own requirement.

Materials initially ventured were Depron (polyurethane) foam boards for its light weight, moderate strength and flexibility. Later Polycarbonate sheets were used for there strength but was avoided for its high weight and poor manufacturability. The material that was later looked into was Balsa wood. This material had light weight, good strength and appreciable manufacturability. This has been the material that has been used since 3 years. Additional composite structures like carbon fiber rods andplates are also used for reinforcements. Aluminum is also used for structures like manning gears.

Manufacturing methods have also seen numerous changes. Initially manual cutting and inaestheticbonding methods. But with the use of balsa, the team has started using laser cutting using low intensity CO2 laser for cutting intricate profiles on balsa sheets of all thicknesses. We have also began covering the structure surfaces with plastic monokote sheets for aesthetic look with increased strength.

Electronics

The major electronic component used on UAVsare the propulsion systems, the motors. The Electronic subsystems choose motors and Electronic Speed Controllers (ESC) by testing them on motor test rig manufactured in the workshop to check current drawn, voltage applied, thrust generated and speed of the motor. They also select Servos for various control surface actions on the plane.Control boards initially used were Arduopilot and then were updated to pixhawk. Onboard computing is done using OdroidU3.

Practice

Events And Accomplishments

- **2009: Australian Outback**

Australian Outback Challenge was the event for which the team was established. In the very first attempt the team performed brilliantly bagging the third place. Project Jatayu was also awarded the title of “Never say die” Award for its extraordinary performance as debutants. Project Jatayu prevailed against not only other student teams, but also professionals as the event is open for student teams as well as professionals and companies. The plane used was called Paparazzi, a balsa RTF plane

- **2012 SUAS**

  This event is the flagship event of Project Jatayu. This event takes place in the naval base of Maryland, USA. This is also an Autonomy based event emphasizing on Computer Vision. So Project Jatayu ventured into Image Processing and Image transmission fields. The event has a large area which have several stationary targets and some emerging targets. The stationary targets are shapes with an alphabet or a number at its center and emerging targets are human figures. The task is to perform an autonomous take off and the move through preset way points and detect the shape colour and alphabetor number on stationary targets. The GPS locations of these have to be sent simultaneously to the ground station. The processing has to be done onboard and all telemetry details and processing details have to be transmitted to the base. The event is challenging and attract student teams from colleges all around the globe. Being the first time in 2014, the team still performed very well and was awarded the “Best Debutant” award. We also received a prize barrel of $2000.

- **BITS Goa's "Tail Spin"**

This was another national level event at BITS Goa. We secured a table top finish in the Bits Goa “Tail Spin” event.

- **2013**: **IIT- Kharagpur’s Boeing Aerospace Event**

We secured a table top finish in IIT- Kharagpur “Boeing aerospace” event, held at IIT-Kharagpur.

- **2014 SUAS**

We participated again in SUAS in 2014 and performed all tasks. We secured prize barrel worth 50,000INR. The plane that was used was a ready to fly plane called Ranger.

- **2016SUAS**

Project Jatayu , In 2016, participated again and completed the SUAS 2016 tasks. We won four prize barrels worth $1200 (USD). We were ranked 18 out of 54 teams from all across the globe. This was the first event for which a completely designed and fabricated plane was used. The plane used was Vayu.

Work till now

1) Paparazzi : A balsa RTF plane with a span of 3m. This was procured from a vendor and alterations were done to accommodate the autonomy components and camera for live feed.
2) Sampathi : Another RTF foam plane. This was high wing configuration used for testing. It had a span of 1.5m
3) Ranger : This was the RTF Foam plane that was in operation in Jatayu for the longest duration. It was used in two consecutive SUAS events. Extensive testing were done on this. It had a span of 2m. It was jjsed for Autonomy, Image processing and Image transmission
4) Boka: This was the first self assembled quadcopter in Project Jatayu. This was used for testing Autonomy, Image processing and Image transmission.
5) Sentinel : This is the Octacopter of Project Jatayu with a heavy payload capacity of 500grams.it is well suited for Image Processing and Image transmission.
6) Vayu : This is currently our flagship plane. This was the first self fabricated plane of this size to be tested completely for Autonomy, Image processing and Image transmission. This was used at the SUAS 2016 and performed excellently. This has a span of 2.5 m and a payload capacity of 1.5kg. It has a compartment for dropping water bottle or any package of weight of around 50 grams. This was designed for search and rescue applications.
7) Airavatha: This was the plane that was fabricated first at Project Jatayu. This was a small plane of span 1m and was used in a national level event at VIT, Vellore called “graVITas”.
8) Silver surfer : This is another fixed wing plane that was designed and fabricated at Project Jatayu. It was designed for reconnaissance applications.

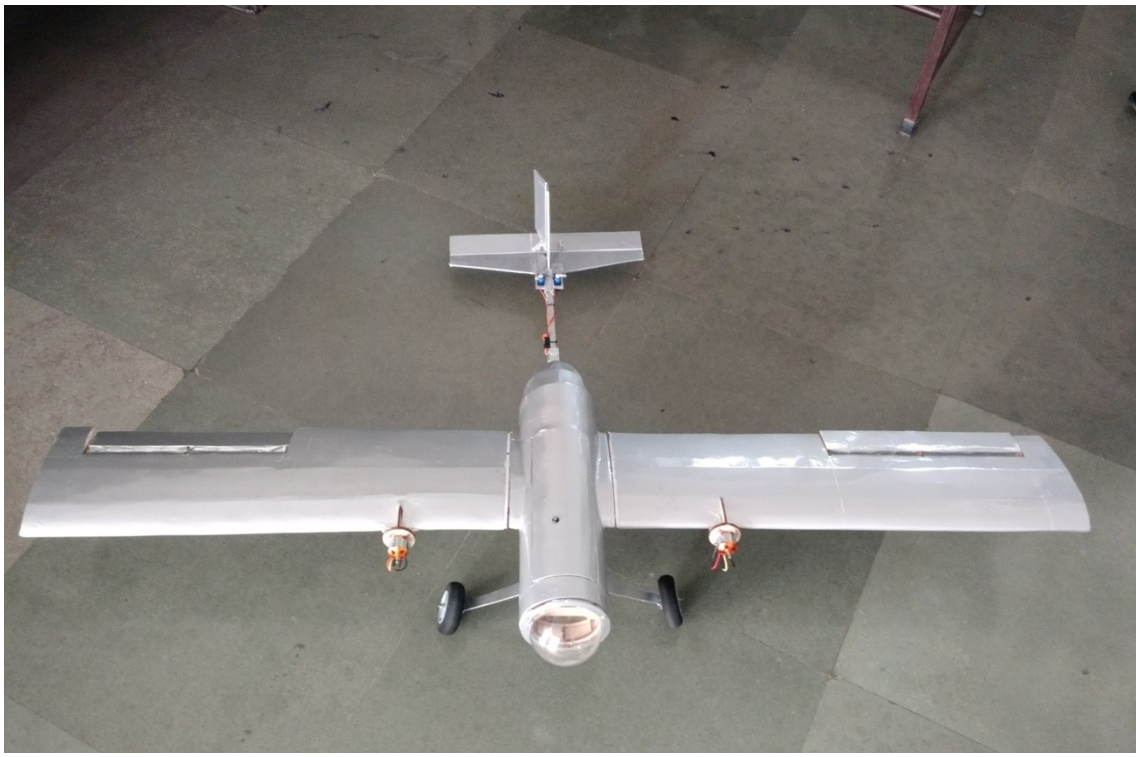
Applications:

1) Surveillance
2) Reconnaissance
3) Search and rescue

4) Agriculture – pesticide application

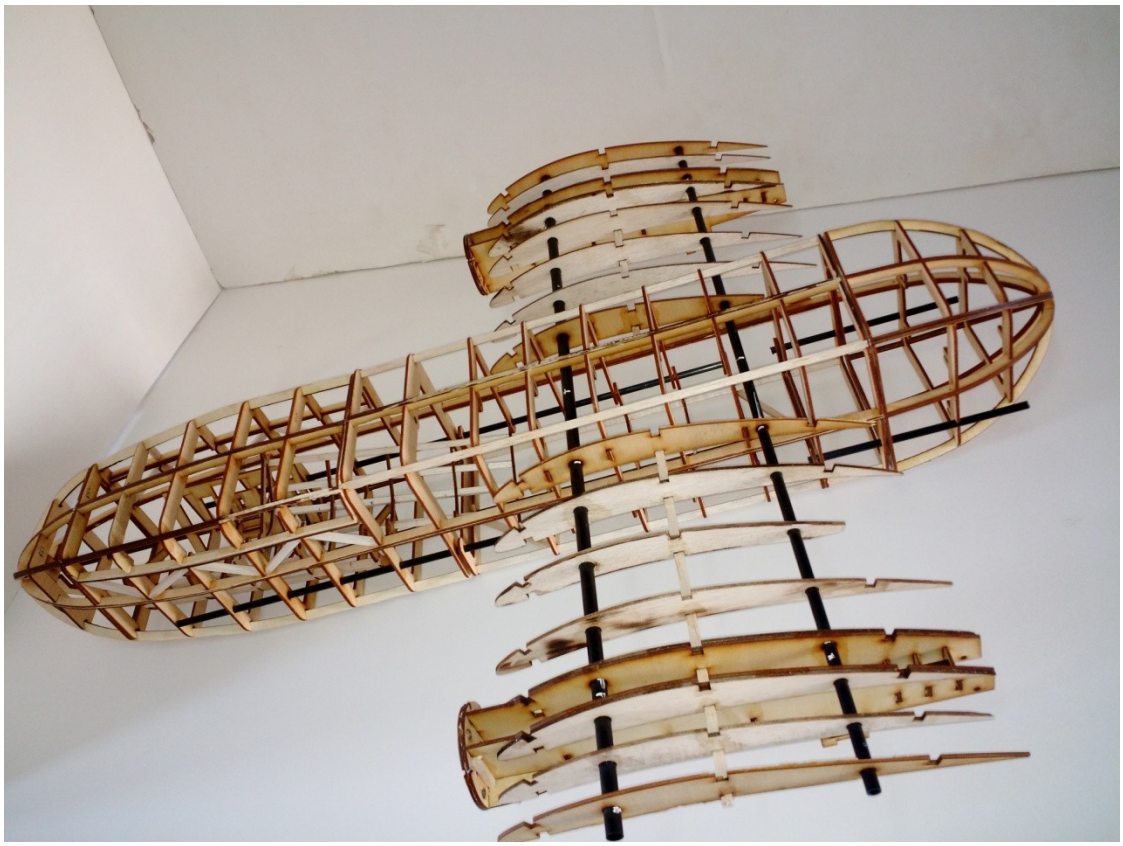
2016-2017 batch of Project Jatayu

Octacopter Sentinel



Silver surfer, the reconnaissance plane

Vayu, the flagship search and rescue drone



The balsa structure of Vayu done using laser cutting technique.

Project Jatayu at SUAS 2016 event, Maryland, USA