**Title of Project**:  
**SKYNAVIGATOR DRONE**: AUTONOMOUS DRONE SYSTEM FOR NAVIGATION, DELIVERY, RESCUE OPERATION

**Objectives**:

* To design and develop an autonomous drone system capable of performing high-precision navigation in complex environments while maintaining a total weight of apporx.1kg
* To integrate the drone with advanced GPS, computer vision, and real-time path planning for efficient navigation in rescue operations and deliveries, enabling the drone to carry payloads ranging upto 1kg
* To build a reliable payload delivery system that can transport medical supplies, food, or emergency equipment weighing up to 1kg to remote or disaster-affected areas.
* To enhance the safety and efficiency of drone operations by incorporating obstacle detection, collision avoidance, and autonomous decision-making capabilities ensuring safe operation even while carrying payload of 1kg
* To develop a real-time communication system for tracking drone status, position, and monitoring during operations, **Security Monitoring, Wildlife Observation, Parcel Delivery, Medical Deliveries, Locating Missing Persons, Commercial Photography**
* **Security Monitoring**: Drones will be equipped with high-definition cameras, infrared sensors, and other monitoring technologies for perimeter security, especially in urban areas, industrial sites, and borders. These drones will autonomously patrol designated areas and send back live video feeds, allowing security teams to monitor events remotely.
* **Wildlife Observation**: For wildlife conservation efforts, drones can provide valuable insights without disturbing natural habitats. Equipped with thermal imaging, GPS, and zoom cameras, drones can track animal movement patterns, monitor poaching activities, and record ecological data.
* **Parcel Delivery**: Drones will be optimized for delivering lightweight packages, food, medicines, or small supplies to homes, offices, or remote locations. The ability to navigate autonomously to a predefined destination and return safely to the base will be a key feature.
* **Medical Deliveries**: Drones will also be deployed for the transport of critical medical supplies such as blood samples, vaccines, and urgent medicines to hospitals or remote clinics, particularly where traditional delivery methods are slow or unfeasible
* **Locating Missing Persons**: Drones equipped with thermal cameras will be able to identify heat signatures from lost individuals, helping rescue teams to quickly locate people who may be trapped in wilderness areas or affected by natural disasters.
* **Commercial Photography**: Drones will be equipped with high-resolution cameras (such as 4K video cameras or advanced mirrorless cameras) for commercial applications in real

**Novelty/Innovativeness**:

* The “SKYNAVIGATOR” drone will integrate several advanced technologies, including autonomous navigation, real-time obstacle detection, and AI-based decision-making for dynamic environments(future)
* A unique feature of this drone system is its dual-purpose capability for both delivery and rescue operations, equipped with specialized payload systems for medical supplies and rescue equipment.
* The drone will feature robust collision avoidance algorithms that work in real-time, allowing for the safe navigation of urban or disaster-stricken areas.
* The system will also utilize advanced communication tools, ensuring remote tracking and control during critical missions, such as natural disasters or emergency medical situations.

**Expected Outcomes**:

* Creation of a functional, autonomous drone capable of carrying out precise navigation and delivering payloads in both structured and unstructured environments.
* Successful testing of the drone’s performance in emergency and disaster scenarios, with successful delivery of medical supplies or rescue equipment.
* Reduced response times in rescue operations and disaster relief efforts, improving overall safety and efficiency.
* Real-time tracking of drone operations to ensure continuous monitoring during critical missions.
* A prototype ready for scaling and integration into larger logistics and rescue frameworks, offering potential commercial applications.

**Budget Estimate**:

|  |  |  |  |
| --- | --- | --- | --- |
| **Equipment name** | **No of piece** | **Amount of equipment** | **Total amount** |
| S500 Carbon Fiber Quadcopter Drone Frame Kit (self made) | 1 | ₹ 3,355.00 | ₹ 3,355.00 |
| Ready to sky 2212 920KV CCW Self-Locking Brushless Motor For Drone & RC Plane | 2 | ₹ 665.00 | ₹ 1,330.00 |
| Ready to sky 2212 920KV CW Self-Locking Brushless Motor For Drone & RC Plane | 2 | ₹ 665.00 | ₹ 1,330.00 |
| 9450 Self Locking Propeller For Drone 1CW+1CCW - (1Pair) - Original | 2 | Rs. 449.00 | Rs 898.00 |
| Favorite Little Bee 30A-S OPTO ESC For Drone | 4 | ₹ 1,366.00 | ₹ 5,464.00 |
| Radio link Cross Flight Flight Controller | 1 | ₹ 4,948.00 | ₹ 4,948.00 |
| Anti-Vibration Shock Absorber for APM PixHawk | 1 | ₹ 199.00 | ₹ 199.00 |
| NEO 7M GPS With Compass for APM 2.6/2.8 and Pixhawk 2.4.6/2.4.8 | 1 | ₹ 1,658.00 | ₹ 1,658.00 |
| GPS Folding Metal Stand For APM & PIXHAWK | 1 | ₹ 271.00 | ₹ 271.00 |
| XT60 Male Connector With 9cm 14AWG Silicon Wire |  | 119.00 | 119.00 |
| Fly Sky FS-i6 2.4G 6CH Radio Transmitter With FS-iA6b Receiver | 1 | 4,809.00 | 4,809.00 |
| 1/3″ CMOS 1500TVL Mini FPV Camera 2.1mm Lens PAL / NTSC With OSD | 1 | 1,269.00 | 1,269.00 |

|  |  |  |  |
| --- | --- | --- | --- |
| EWRF TS5823 600mW Wireless Video Transmitter | 1 | 1434.00 | 1434.00 |
| 5.8G UVC OTG Android AV Phone Receiver | 1 | 1434.00 | 2434.00 |
| **Total amount with frame** |  |  | Rs .34495 |
| **Total amount without frame:** |  |  | Rs. 31140 |
| **Accessories/Tools:**  1.XT60 Male Connector With 9cm 14AWG Silicon Wire  2. 20cm Lipo Battery Strap Belt For Drone  3. 1× 150mm Self Locking Adjustable Nylon Cable Ties | Zip Ties (White) 12pcs  4. 1× Allen Key 2mm  5 .1× Allen Key 2.5mm  6. 1× High-Quality Ultra  Flexible 20AWG Silicone Wire 1m – Black  7.1× Heat Shrink Sleeve 2mm Black 1meter  8. 25W 230V Soldering Iron (Rajshri).  9.Solder Wire 27gm.  10.Wire Cutter/Stripper 150mm - Taparia. |  |  | RS.1000 |
|  |  |  |  |

**Month 1: Preparation, Assembly, and Initial Power Setup**

**Research and Component Understanding**

* **Objective:** Familiarize with each component's specifications and assembly requirements.
* **Tasks:**
  + Review manuals and datasheets for each component (frame, motors, ESCs, flight controller, etc.).
  + Ensure you have all tools and accessories needed for assembly.
  + Watch tutorials or read guides on assembling drones (especially focusing on your specific components like 2212 920KV motors, Pixhawk).

**Assemble the Frame, Motors, and ESCs**

* **Objective:** Assemble the drone frame, motors, and ESCs.
* **Tasks:**
  + Assemble the S500 frame (mount arms, landing gear, etc.).
  + Mount the 2212 920KV CCW Self Locking Brushless Motors and 1045 propellers.
  + Verify motor rotation directions.
  + Solder ESCs to motors, ensuring proper placement under arms for balanc **Install Flight Controller, GPS, and Wiring**
* **Objective:** Install flight controller and GPS.
* **Tasks:**
  + Mount the Pixhawk flight controller and GPS module, ensuring correct positioning and wiring.
  + Connect the flight controller to the ESCs and GPS.
  + Secure and tidy up wiring to avoid interference and ensure safety.

**Battery Setup, Power Testing, and Firmware Installation**

* **Objective:** Test power connections and configure the flight controller.
* **Tasks:**
  + Connect the 5500mAh LiPo battery and test power connections.
  + Ensure correct voltage and polarity before powering up.
  + Install necessary drivers and software (Mission Planner for Pixhawk).
  + Update flight controller firmware and calibrate accelerometer, gyroscope, and compass.

**Month 2: Remote Control, Basic Flight Setup, and Calibration**

**RC Transmitter and Receiver Setup**

* **Objective:** Set up the Fly Sky FS-i6 transmitter and receiver.
* **Tasks:**
  + Install and connect the FS-iA6B receiver to the Pixhawk.
  + Pair the FS-i6 transmitter and receiver.
  + Test basic controls for throttle, yaw, pitch, and roll.

**Initial Bench Testing (Without Propellers)**

* **Objective:** Test basic controls and flight controller functions.
* **Tasks:**
  + Remove propellers and perform ground tests with motors running.
  + Test throttle, yaw, pitch, and roll to verify the flight controller is responding correctly.
  + Ensure all components are functioning (motors spinning, ESCs responding).

**Month 3: First Flight Trials and Controller Tuning**

**Attach Propellers and Test Lift-off**

* **Objective:** Perform low-altitude hover tests.
* **Tasks:**
  + Reattach propellers and perform a hover test in a safe, open area.
  + Test basic stability and responsiveness to control inputs.
  + Monitor battery levels and motor temperatures during the flight.

**Flight Controller Tuning and Stability Testing**

* **Objective:** Optimize flight control settings.
* **Tasks:**
  + Adjust PID values in the flight controller software (Mission Planner or Ground Control).
  + Test quick control inputs for stability (ensure no wobble).
  + Fine-tune GPS settings for autonomous flight modes like Return-to-Home.

**Month 4: Autonomous Flight Testing and Final Optimization**

**Test Autonomous Flight Features**

* **Objective:** Test GPS-based autonomous flight modes.
* **Tasks:**
  + Set up a waypoint mission and test autonomous modes like Return-to-Home and Altitude Hold.
  + Perform flights at different altitudes to test GPS stability and autonomous behaviors.

**Performance and Battery Optimization Testing**

* **Objective:** Assess performance under various conditions.
* **Tasks:**
  + Test flight time and range with different battery configurations.
  + Perform distance tests (ensure drone stays within line-of-sight).
  + Monitor for signs of instability, loss of GPS lock, or performance degradation.
  + Optimize battery usage, test recharging times, and ensure low-voltage alerts are set up.

**Long-Duration and Weather Testing**

* **Objective:** Test endurance and stability under long-duration flights and different weather conditions.
* **Tasks:**
  + Perform long-duration tests (5-10 minutes or more), focusing on battery and motor performance.
  + Test stability in moderate wind and different weather conditions.
  + Evaluate GPS and flight controller behavior in varying environmental conditions.

**Final Adjustments and Documentation**

* **Objective:** Perform final tweaks and document results.
* **Tasks:**
  + Perform final calibration and ensure all systems are functioning optimally.
  + Prepare a pre-flight checklist to check battery, propeller condition, and settings before every flight.
  + Document flight data, performance, and any issues encountered during testing.
  + Write up a final report with recommendations for any future upgrades or improvement