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Long Range micro Drone with Stabilization

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Abstract - Unmanned Aerial Vehicles, UAVs, are becoming more and more available as Technology becomes cheaper. Applications that can be created today were just a thought ten years ago and now they are becoming a reality. There are many applications that are being researched and it is through this research we are able to come up with new and improved applications that saves lives. In the world of truly autonomous vehicles, UAVs should react on their own through some sort of external stimuli. It is through these external stimuli that the UAVs react and adjust their goal accordingly. These stimuli can be taken from various sensors on the craft but also can be given commands by a human.

In this we have discussed and covered all the points that are required and essential for the manufacturing of a drone with a long range. We have also discussed various applications in which these drone can be useful for human beings such as to perform various tasks like surveillance in night from a miles apart. We have increased flight time as we use 5000 mah battery pack. It is easy to use for workers and soldiers to discover new places, etc. And we have also discussed various improvements which are applicable to make the drone easy to use we are trying to minimize the sound and size.

1. INTRODUCTION

A drone, in technological terms, is an unmanned aircraft. Drones are more formally known as unmanned aerial vehicles (UAVs) or unmanned aircraft systems (UASes). Essentially, a drone is a flying robot that can be remotely controlled or fly autonomously through software-controlled flight plans in their embedded systems, working in conjunction with onboard sensors and GPS.

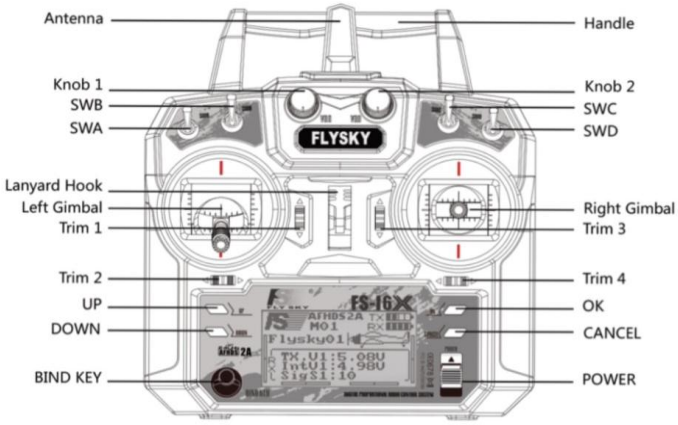
In the recent past, UAVs were most often associated with the military, where they were used initially for anti-aircraft target practice, intelligence gathering and then, more controversially, as weapons platforms. Drones are now also used in a wide range of civilian roles ranging from search and rescue, surveillance, traffic monitoring, weather monitoring and firefighting, to personal drones and business drone-based photography, as well as videography, agriculture and even delivery services.

In military or in intelligence department we need to look out new places without even getting noticed to anybody. We use a new chip which is naze 32 dof. In this we have added an additional barometer, gps, telemetry and magnetometer which can detect air pressure and magnetic intensity in a particular area on our map through gps. It has the range of approx. 3 to 4 kms with half battery charged. It has horizontal speed of about 40 to 50 km/h and takes off. Velocity of about 2 m/s. It have 2 kg of weight bearing capacity less the kv ratings of the motors more the thrust and since more the weight carrying capacity

2. CONSTRUCTION

Every drone build should have placed everything properly and also there should be no wire coming out of the body. Also there should be no wire hanging out of the body all the soldering of Esc's should be done properly. XT 60 connector is connected to the down side of the frame. Since the budget is quiet low we have a local frame for this. We added 1045 propeller set and also base stands to protect it from crashing while landing. We have placed gps at the trop for better connectivity and the naze 32 board in the middle so that it seems to be clean and tidy work. The battery is attached at the top of the frame for the ease of removal for charging the battery.

2.1 Transmitter module:-



We use 2.4 ghz radio transmitter and receiver module of flysky. It is fs-i6 to maintain budget we have chosen this version and this provides 6 channel transmissions. We can upgrade the transmitter module to 10 channels but for that it requires 10 channel receivers. Transmitter module has 2 channels in left gimbal stick and 2 channels in right gimbal. These channels can be transferred to each another through the inbuilt software. The 5th and 6th channels are by default in the knob1 and knob 2 respectively but they also can be transferrable in the switch 1 to switch 4. One can go to the settings to change and apply the settings which they want through the keys and display

2.2 Receiver module:-

This is the 6 channel receiver that has been used. In these channel 1 provides pwm output i.e. all the channels can be converted in on channel to connect to the board. The first socket is to bind the transmitter to the receiver. CH1 to CH6: used to connect the servos, power or other parts. B/VCC: used to connect the bind cable for binding and the power cable during normal operation.

Binding :- The transmitter and receiver have been pre-bound before delivery. If you are using another transmitter or receiver, follow the Binding The transmitter and receiver have been pre-bound before delivery. If you are using another transmitter or receiver, follow the steps below to bind the transmitter and receiver:

1. Connect the supplied bind cable to the B/VCC port on the receiver.

2. Insert power into any other port.

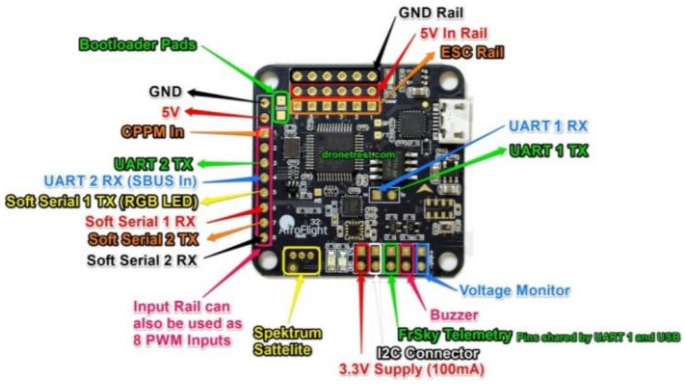
3. Hold the bind key while powering on the transmitter to enter bind mode.

4. Remove the power and bind cable from the receiver. Then connect the power cable to the B/VCC port.

5. Check the servos' operation. If anything does not work as expected, restart this procedure from the beginning.

2.3 Battery and Capacity:- The battery capacity is measured in amps / hour (ah) or milliamps/hour (mah). 5500 mah battery is used to deliver 11.1 volts and about 5 amps for 5 hours; it delivers charge of 25c. it charges very slowly for perfect discharge. If we increase the charging time the battery may get damaged.

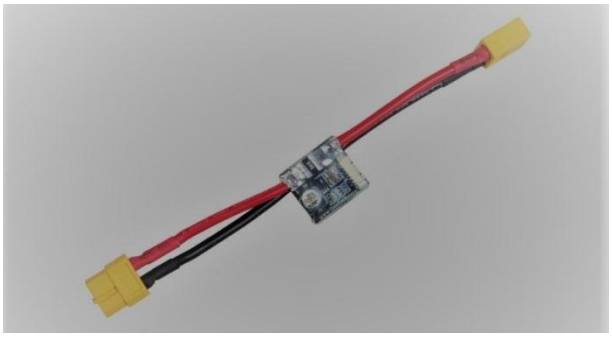
2.4 Naze 32 flight controller:- Naze 32 flight controller provides 8 pwm pinouts so we can make quadcopter to octacopter. It also supports SBUS connection and has two uart rx and tx ports we can add telemetry system in these through frsky telemetry which operates at 5v it supports spectrum satellite connection. We can load any firmware in these. We can use these to make drone or helicopter or rc car, tanks, hexacopter, robots etc. for small electronics that operate at 3.3v it has separate pinouts for it. We can upload any firmware through a Google application like cleanflight or beta flight etc.one can connect it via usb cable. This is how we can add and connect frsky radio telemetry for map navigation.



We have used local frame for our project because it is the prototype. We have used 1400kv BLDC motors with 10T and max current efficiency of 12amps. It is used with simonk 30 amps esc. These Esc's can carry max load of 30 amps. We have to use 5500mah battery for that which gives 11.1v output. We have used a power module to save the battery power when the motors are in the fly time.

Note: If anyone do not have ibus or sbus receiver output it just needed an extra component namely ppm encoder just connect the pwm pins to the board and receiver pins to the receiver.

2.5 3DR Power Module:-



The 3DR Power Module is a simple way of providing your control board with data of the current Consumption and voltage measurements of a LiPo battery so that the control board can estimate the Remaining flight durations according to the remaining and power capacity and the real time current Consumption calculated by the received data. This 3DR Power Module has the function of BES Which can provide stable power supply to the control board. Specifications:

• Max input voltage: 18V

• Min input voltage: 4.5 V

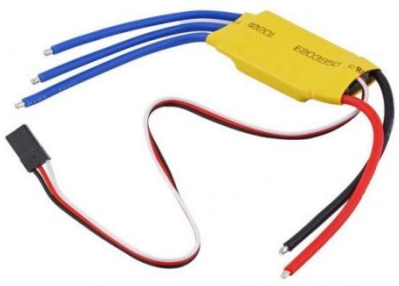
• Voltage and current measurement configured for 5V ADC

• 6-pos DF13 cable plugs directly to APM 2.5's 'PM' connector

Dimension: 23mm*22mm*10mm

Net weight: 19.2g

2.6 30A BLDC ESC

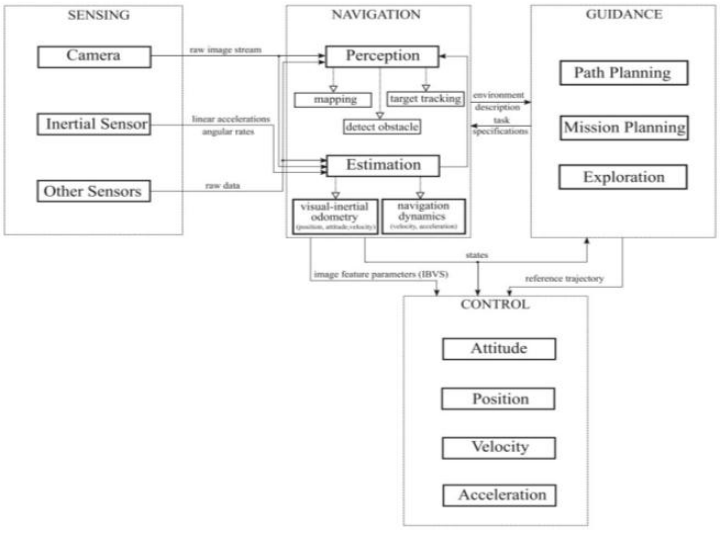


This is fully programmable 30A BLDC ESC with 5V, 3A BEC. Can drive motors with Continuous 30Amp load current. It has sturdy construction with 2 separate PCBs for Controller and ESC power MOSFETs. It can be powered with 2-4 lithium Polymer batteries Or 5-12 NiMH / NiCd batteries. It has separate voltage regulator

for the microcontroller for Providing good anti-jamming capability. It is most suitable for UAVs, Aircrafts and Helicopters.

3. Working

Firstly connect the servo pinouts to the naze 32 board. Remember the white wires are the signal wires properly connect them. When we load the quadcopter firmware we solder ublox to the uart (1) tx and rx pins and also solder vcc and 5v pins. Now add air module of the telemetry to the uart (2) Rx and Tx pins and also connect vcc and 5v pins The firmware should auto detect the gps module in the clean flight software. If not one have to download specific drivers for the gps and also for radio telemetry. After loading firmware set the bit rate to 115200 since this rate would be preferable for processing all the function in the naze32 board. After this go to the settings menu for the settings that you wanted to apply we still have one channel left for any purpose we want therefore we would use it for attaching gimbal to our camera. The four channel are for four motors and the 5th channel is for gps and the 6th channel is for the gimbal that we would attach it later. Now we have added the radio telemetry and also gps now our hardware procedure is done. First we have to install an application called Tower it has been developed by the website github.com and as a result it is much better than any other applications. We have to connect the ground module of the telemetry to the mobile phone via otg cable. The device would auto detect the telemetry just click connect via usb and then you are connected to the drone via telemetry.



4. ADVANTAGES:

4.1 Maintaining safe environment:

UAVs are utilized in numerous occurrences due to their advancement in safety. With their remote control abilities, Drones monitor locations, communicate possible hazards, and notify threatening conditions. such as oil and gas refineries, pipelines and flare stacks. Not only this, Drone Technology is employed in the military during high-risk periods as well. Their features allow them to obtain real-time data to create and preserve a safe environment.

4.2 Cost saving technology:

As drone's applicability becomes more extensive, their prices also drive towards being more pocket-friendly. People now acquire Drones not just for their industrial practices but also to fulfill their tech-savvy gadget's passion. UAVs are no longer equipped only for the military, law authorities, or the elite. Since UAVs take over several workforces, vehicles, and operation activities in commercial uses, many costs are preserved. For example, a Drone is more economical to buy, sustain, and fuel than airplanes for inspections. In addition you don't need to hire a ladder, aerial lifts, and other heavy equipment.

4.3 Quality of aerial imaging:

With their high-resolution cameras furnished with top-notch sensors, UAVs can take excellent Aerial Photographs, aerial videos and accumulate large volumes of accurate data. The data obtained is transformed into detailed 3D Maps and 3D Models for a complete analysis. 3D Mapping is particularly relevant to disclose cracks, damages, or other hazardous elements in disaster areas. Drones, when paired along with high-resolution images or 4K video abilities, is well-known for live streaming significant events such as entertainment, personal, political, and global affairs.

4.4 Precision:

UAVs appropriate GPS (the Global Positioning System) in their software, which is why they can be programmed and guided precisely to specific locations. For example, in Precision Agriculture, a Drone Aircraft is employed to perform many farming obligations like pesticide spraying, identification of weeds, monitoring crop health, crop damage, crop assessment, field soil analysis, Irrigation Monitoring etc. This feature of precision through the GPS conserves time and expenses for farmers.

4.5 Easy controllable or deploy able:

The regular advancement in drone-control technology allows operators to quickly deploy and operate drones even with a relatively minimal technical background. With an extensive range of low-cost drones available for several purposes, drones are open to a broad spectrum of operators. Unmanned aerial vehicles (UAVs) have a more comprehensive range of movement, fly lower in all directions, and can navigate effortlessly when contrasted to a crewed aircraft.

4.6 Security:

Another advantage that weighs out the pros and cons of a drone is the security centered around them. With relevant permissions and licenses, drone operators can utilize an Unmanned Aircraft System (UAS) to render safety and surveillance to private organizations, potential venues, and other expenses. Drones can also accumulate reliable information from natural catastrophes to support safety and recovery efforts.

4.7 Minimizes obvious danger and health risks:

With the support of a Drone, numerous dangers like elevation, wind, weather, and radiation that were earlier suffered by crew members have been replaced with more viable and safer alternatives. Drones facilitate straightforward and secure inspections of towering and complicated constructions like oil and gas refineries, flare stacks, and pipelines.

4.8 In-Depth and detail data inplace:

Many drone models are launched into the market with obstacle avoidance capacities. They can operate quite close to constructions, and this encourages them to seize precise data. They capture high-resolution images or 4K videos that explicitly reveal cracks, damages, displaced wires, and additional defects that we cannot detect through our naked eye. UAVs allow obtaining complete data without endangering inspection crew members of the company.

4.9 Flexibility for quick inspections:

Since Drones come with varied specifications, several can provide high or low altitude Inspections. The versatility of these characteristics empowers clients to customize the tools with ease for their projects. Drones are suitable for both regular and emergency scenarios, the Construction Industry abides by these advantages, especially building developers for Rooftop Inspections. Drones can carry out multiple roles, such as capturing high-quality photos, videos, thermal images, etc. This data is then transmitted and processed immediately, as opposed to the time-consuming conventional method.

4.10 Reach hazardous area:

UAVs make obtaining efficient data from hard-to-reach locations a cakewalk for industry professionals. It is the most suitable alternative to overcome limitations of traditional methods regarding worker's safety, especially in hazardous situations like radiation monitoring, inspecting high-voltage lines. Drones also allow a more cost-effective approach toward inspections of these locations.

5. DISADVANTAGES:

5.1 Privacy:

While drone's benefits are endless, drone technology has several downsides to it. UAVs can quickly fall prey to manipulation and trespass a group or individual's privacy. Though many desire to utilize drones for retaining safety, it could violate numerous individual liberties in the name of public security.

5.2 Software issues or malfunctions:

There have previously been many drones that have fired weapons to commoners, generating a significant amount of casualties, injuries, and damages due to malfunctions or software blunders. Drone mishaps strike other military personnel's safety as well. Drones are still in the process of improvement to limit accidents or hazards that can affect the health and safety of human lives.

5.3 Legislative uncertainty:

The use of Unmanned Aircraft Systems (UAS) has become widespread; however, the law is still developing, considering it is a novel technology in the industry. Specific practices installed for tiny drones also apply to commercial and recreational applications but are still vague in several dimensions. Rules for the regulation of drone movement and property protection from aerial trespassing are still in the making; thus, UAV technology functions in a judicial gray zone. There are numerous frictions between governmental regulations and any state or city laws to manage airspace property rights, because of which drone operators may violate rules they didn't know about.

5.4 Safety:

Safety is a fundamental element to prioritize when operating drone technology. UAVs outfitted with high-quality sensors recognize possible collisions and safely engineer their way around them, making them a significant trait. These drone capacities must resemble those of the manned aircraft navigators. It is commendable to hire professional drone service providers who can operate an aerial drone without crashing it. Drones operated in heavily-populated regions have an amplified risk of ground impact or damage, mainly due to system malfunction or hacking.

5.5 Vulnerable to wild animals:

Drones are susceptible to wild animal attacks and are sometimes also dangerous to nature. It is possible that when a drone operator is flying in a domain with a considerable number of wild animals, they crash against a

tree or possibly conflict with a vulnerable animal. Large flying birds like eagles are regularly attacking and even capturing drones operating in their space to obtain crucial data.

5.6 Spying:

Many offenders employ drones as a strategy to target their victims and to maintain a track on them. The blatant propeller noises are no longer a concern and are unnoticeable, enabling criminals to invade someone's privacy. Many drones furnished with thermal and night sensors identify life signs and efficiently target those currently of interest by the spy. Since UAVs can seize accurate data, they can register regular habits and recognize suspicious activities without permission.

5.7 Easy to hack:

One substantial downside to drone technology's growth is its vulnerability. Hackers can quickly attack a drone's central control system and become the drone's original controller. The primary control system includes significant knowledge crucial for hackers to evade without the initial operator's awareness. Hackers can acquire private information, corrupt or damage the files, and leak data to unauthorized third parties.

5.8 Weather dependent:

Drones are more vulnerable to weather conditions when contrasted to traditional aircraft. For example, if the climatic conditions are unfavorable, the UAV will not maneuver appropriately or gather reliable data or imagery. However, there are drones available that are more stable and can withstand gusts of wind successfully.

5.9 Knowledge and skill:

As discussed earlier, if one necessitates seizing accurate, high-quality data, they need to possess the demanded skillset. This specification would indicate that an average farmer would require comprehensive training or a third party drone service provider to capture, process, and analyze farming data. With expanding operators in the industry, drone costs and its accompanying resource expenses will gradually reduce.

5.11 Data transfer speed:

One of the cons in expanding drone technology in precision agriculture is its data transmission speed, which some suppose could be a week. If the time necessitated for data delivery results in a farmers' unproductivity and damage to fertilizers, crops, or pesticides, the operation of the drone would be a waste in the end. Thus, if data transfer speed is slow, suffering and damage can occur in that period, following all efforts going to waste.

Table -1: Cost Estimation

Battery	1800
Naze 32 Rev6	1090
Frame	750
Motor x4	1200
Esc's x4	1200
Propellors x4	160
Transceiver module	3800
XT 60 Power Module	120
Additional expense	180
Total	10300

6. Applications:

6.1 Military applications:

In Military we can use these quadcopter for surveillance as they follow map navigation these drones can stay long at a position if we add loiter mode in the software settings. We are also making small frames and adding small battery packages for camouflaging the drones.

6.2 Agriculture applications:

These drones can follow map navigation they can be used for agriculture purposes also in agriculture we have to setup the route in the app and just set the quadcopter to align the mission. We just need to add an equipment to sprinkle or spread seeds or fertilizers.

6.3 Video-graphy:

These can be used to shoot videos for earth and also the camera provides 24 MP camera lens of dfrobot which also provides zoom in and zooms out and also provides fish eye lenses.

6.4 Surveillance:

This drones can be highly use for surveillance purpose as they have 5 hour standby battery package and these also can be extended

7. FUTURE SCOPE OF THE PROJECT:

Since we live in an age where technology is constantly changing and improving, design modification could be made to greatly enhance the long range drone system.

Areas to consider for further improvements are:

- Rechargeable System
- Durable propellers
- Weight Minimization
- Small Frame
- Shall increase Range
- Disaster maintenance
- Camouflaging and also making frames for example like a bird.

7.1 Rechargeable BLDC System:

We are trying to make regenerative BLDC motors which can save more power by adding another propeller just over and opposite to it the propeller will rotate and hence generate electricity and that would be transferred to battery.

7.2 Noise Reduction:

We are trying to make balanced propellers which are more convenient and also have high strength which are more durable and have more strength since they get damaged easily.

7.3 Weight Minimization:

In order to make stable, accurate and precise drone the big question is weight. For this the battery package we use is very big and heavy too. So we are trying to use other types of batteries such as sodium-ion batteries or else thin aluminum batteries which are as thin as paper and also have very low weight.

7.4 Small Frame:

Since we are trying to make our drones shorter that they don't easily noticeable and also easy to use. If the size of drone is minimized their accuracy would also be increased.

This is the frame for micro drone of area about 25 $cm^{2.}$
The above drone contains a camera a gps and also night vision this was built by nasa in 2018 for INR 5000 per model we are trying to make the same models with more efficiency but with cheaper prices.

7.5 Increased bands in terms of range:

We are also trying to increase the range and also with less use of battery that can easily be operate through smartphones without using any remote controller.

7.6 Disaster Maintenance:

This is a new concept. When we minimize our drones of area approx. 50cm2 we just have to connect all the slave to one master and thus we would release numerous drones which are micro drones in a disaster prone zone where humans or local crones can't go because of big size. And collect all the data and come back to the base. Hence they are helpful in disaster prone areas. Those can be used for an emergency steps in disaster management.

For Example: When earthquake occurs many buildings gets into pieces many peoples get trapped in this for more days or even weeks too. In these situation if we release micro drones in search of people in these fragments of building. These drone can go into small gaps and find people through cameras and this all can be seen from the base.

8. Actual Photographs Of the Project:

9. CONCLUSIONS:

The cheap cost and the advancement of technology has allowed us to achieve things that were only dreams 10 years ago. It is our duty to use these to our advantage to save lives. UAVs have potential in the area of Search and Rescue. They provide a way to get more eyes in the sky but cost less and if completely autonomous will allow multiple agents to work with one person to achieve a goal. Accidents cause a schism in the safety of air travel, which will lead to the consumer second-guessing alternate forms of travel such as air travel. With UAVs we can eliminate these fears by providing a system that can quickly and accurately find what it's looking for. From our work we can conclude that the drone that we have built have many extra applications and can be used everywhere with adding some appliances or attachments. These can be used on large scales also. These can be operate by anyone through the remote.

10. REFERENCES:

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