International Scientific Journal of Engineering and Management
Volume: 03 Issue: 04 | April – 2024
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata
ISSN: 2583-6129
DOI: 10.55041/ISJEM01527

Design and Analysis of Drone Landing Gear for Agriculture

Dr.Anoopkumar Shukla[1], Pachange Lakhan[2], Shilamkoti Sai Vilas[3] Medhi Sachin[4] MD Pasha[5]

[1]*Mechanical Engineering Department & JBIET College*

[2]*Mechanical Engineering Department & JBIET College*

[3]*Mechanical Engineering Department & JBIET College*

[4]*Mechanical Engineering Department & JBIET College*

[5]*Mechanical Engineering Department & JBIET College*

Abstract -This study aim to design and analysis of drone landing gear with spring suspension for agriculture. A literature review was conducted to examine the existing research on the topic of agricultural drone and it's landing gear. Then testing present landing gear has been done and also the designing and analysis of new landing gear with suspension has been done. The result show that the drones landing gear without suspension break easily. This also shows that the landing gear with suspension have more life time then the landing gear without suspensions system.

***Key Words*:**agricultural, drone, spring suspension, landing gear

1. INTRODUCTION

The agricultural drone has become an integral part of modern farming. While agricultural drone has many benefits, it has also associated with the failure of landing gear due to the irregular land forms and also due to rough landing of the pilots. This study aim to design and analysis of drone landing gear with spring suspension for agriculture.

2. PRESENT WORK

Assembling a drone typically involves several steps, and the specifics can vary depending on the model you have. Here's a general guide to assembling a basic quadcopter drone:

- **Read the Manual:** Always start by reading the instruction manual provided with your drone kit. It will contain specific instructions and safety guidelines.

- **Prepare Your Workspace:** Make sure you have a clean, well-lit area to work in. Gather all the parts and tools you'll need.

- **Frame Assembly:** Begin by assembling the frame of the drone. This usually involves attaching the arms to the main body frame. Follow the instructions carefully and use any included hardware (screws, nuts, etc.) to secure the frame components together.

- **Mount Motors:** Mount the motors onto the arms of the frame. Each motor should come with screws for attaching it to the frame. Make sure the motors are securely attached and facing the correct direction (propeller rotation direction).

- **Attach Electronic Speed Controllers (ESCs):** Connect the ESCs to the motors. The ESCs regulate the speed of the motors and are usually mounted near the base of each arm. Follow the wiring diagram provided in the manual to ensure correct connections.

- **Install Flight Controller:** Mount the flight controller board onto the frame. This is the "brain" of the drone, which controls its stability and flight behavior. Secure it firmly, usually in the center of the frame.

- **Connect Components:** Connect the ESCs, motors, and flight controller according to the wiring diagram

ISSN: 2583-6129
DOI: 10.55041/ISJEM01527

provided. Double-check all connections to ensure they are correct and secure.

- **Attach Propellers:** Attach the propellers to the motors. Most drones have two clockwise (CW) and two counterclockwise (CCW) rotating propellers. Make sure to match the propellers to the corresponding motors.

- **Install Power Distribution Board (PDB):** If your drone kit includes a power distribution board, install it according to the instructions. The PDB distributes power from the battery to the various components of the drone.

- **Add Additional Components:** Depending on your drone's features, you may need to install additional

components such as a camera, GPS module, or gimbal. Follow the instructions provided for each component.

- **Check Connections and Wiring:** Double-check all connections and wiring to ensure everything is properly connected and secure. Inspect for any loose wires or components that may cause problems during flight.

- Test Flight: Before flying your drone, perform a thorough pre-flight check. Test each motor and propeller to ensure they're spinning correctly. Check the responsiveness of the flight controller and make any necessary adjustments to the settings. Once everything looks good, you're ready for a test flight!

- Remember, safety is paramount when assembling and flying a drone. Always follow the manufacturer's instructions and guidelines, and be sure to adhere to any local regulations regarding drone use

ASSEMBLING OF SPRING SUSPENSION LANDING GEAR

Assembling a spring suspension landing gear typically involves several steps, Here's a general guide to assemble a spring suspension landing gear is as follow,

Components:

i. **PVC pipe**
ii. **Springs**

➢ **PVC pipe**

1-inch PVC pipe is a versatile and widely used material in various plumbing and construction projects. PVC stands for Polyvinyl Chloride, a type of plastic that is lightweight, durable, and resistant to corrosion and chemical erosion. Here are some key details and common uses of 1-inch PVC pipes:

Characteristics

- **Diameter:** The "1-inch" designation typically refers to the nominal inside diameter (ID) of the pipe. For 1-inch schedule 40 PVC pipe, the actual outer diameter (OD) is about 1.315 inches (33.4 mm), and the inner diameter is about 1.029 inches (26.1 mm).

- **Wall Thickness:** This depends on the pipe's "schedule," which relates to the thickness of the pipe walls. Common schedules include Schedule 40 and Schedule 80, with Schedule 80 having thicker walls and therefore a smaller internal diameter but higher pressure handling capabilities.

- **Color:** Most commonly found in white, but can also come in other colors like gray or black, which often indicates UV resistance or other specific properties.

- **Length:** Typically sold in lengths of 10 or 20 feet but can be cut to size as needed.

Properties

- **Durability:** PVC is known for its strength and ability to resist corrosion, which makes it a lasting option for plumbing.

- **Chemical Resistance:** It is resistant to many acids, bases, salts, and organic compounds, making it suitable for chemical plumbing systems.

- **Non-Conductive:** PVC does not conduct electricity, making it safe to use in applications where electricity is present.

International Scientific Journal of Engineering and Management
Volume: 03 Issue: 04 | April – 2024
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata
ISSN: 2583-6129
DOI: 10.55041/ISJEM01527

• **Temperature Limits:** PVC pipes are generally suitable for temperatures up to 140°F (60°C). Above this temperature, the material may become softer and lose some of its mechanical strength.

Considerations

• **UV Sensitivity:** Standard PVC can degrade when exposed to prolonged sunlight, so for outdoor applications, it's important to use UV-stabilized PVC or protect it with paint or another form of coverage.

• **Environmental Impact:** PVC is not biodegradable and can release harmful compounds if burned. Recycling or properly disposing of PVC is important for environmental protection.

➢ **Spring**

A 12mm diameter compression spring with a height of 80mm is a mechanical device commonly used to provide resistance to compressive forces or to store energy. The diameter of the spring refers to the outer diameter of the coils, and in this case, it is 12mm. The 80mm height (or length) of the spring indicates its uncompressed size from end to end. Such springs are typically made from various grades of steel depending on the required strength and durability. The specific characteristics of the spring, like the wire diameter, number of coils, and material type, determine its load capacity, stiffness, and how much it can be compressed. Compression springs of this size are often

used in automotive, manufacturing, and engineering applications where moderate to heavy loads are expected. They are crucial components in mechanisms requiring a return force or maintaining a pressure between two surfaces, such as valve operations, shock absorbers, and clamping fixtures.

Assemble of the components:

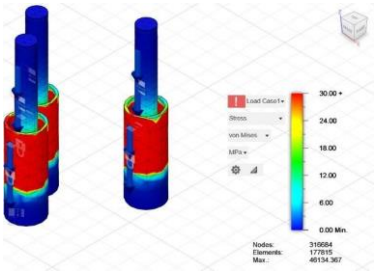
To make the landing gear the one end of the 1inch PVC pipe is closed and the spring is place inside the pipe, then the PVC pipe of diameter ½inch is taken and its one end is also closed with a round sheet of 1 inch diameter. Then the pipe with ½inh is place inside the 1inh pipe and close with another round sheet with the hole on the top. Prepare 4 of such legs for the drone and then attach them to the drone.

Figure (1) drone with the spring suspension system

ISSN: 2583-6129
DOI: 10.55041/ISJEM01527

Table(1) properties of the material used in landing gear

Properties	Spring	pvc pipe
Density	7.850E-06kg/mm^3	1.400E-06kg/mm^3
Yield strength	207.00mpa	46.53mpa
Young's modules	210.00gpa	3.40gpa
Poisson's ration	0.30	0.40
Ultimate tensile strength	345.00mpa	52.36mpa



3. Result and discussion

The design and modelling of drone landing gear for agriculture is been successfully done using the software's AutoCAD, Fusion360 under the various load conditions.

The analysis shows that the maximum stress developed are 30mpa, yield strength 50mpa, and the factor of safety1.67. The study's findings suggest that regular landing gear without suspension use has a great impact on the life of the drone. The study highlights the need for use of landing gear with suspension.

ISSN: 2583-6129
DOI: 10.55041/ISJEM01527

4. Conclusion:

The designing and modeling of the landing gear is done with the AutoCAD. further the structural analysis is carried out using fusion 360 application software. The load applied 30N in the structural analysis. The maximum stresses developed are 30mpa. The yield strength of the material is 50mpa, and the factor of safety-1.67 under the applied load of 30N.

References

1. **Prof .S. Ahirwar , Prof . R . Swarnkar, Prof. S. Bhukya and Prof .G .Namwade**titled as application of agricultural drone, nt.J.Curr.Microbiol.App.Sci.2019.8(1): 2500-2505 2.

2. **Prof .S .Meivel and Prof .S .Maheswari** , titled as Remote Sensing Analysis of Agricultural Drone , journal of the Indian society of remote sensing. 2020/11/24 VL49.

3. **Prof. Spoorthi S, Prof. B. Shadaksharappa, Prof. Suraj S, Prof . V.K. Manasa** titled as Freyr Drone: Pesticide/fertilizers spraying drone – an agricultural approach, IEEE 2017

4. **Prof. Sourav Biswas, Prof. Raviraj Pandey, Prof. Emon Barua, Dr. I. Daniel Lawrence** titled as Advancements in precision agriculture: pesticide spraying drones, IRJETS OCT 2023, VL 05

5. **Prof. Matheus Hentschke, Prof . Edison Pingeton de Freitas, Prof. Carlos Henrique Henning and prof. Igor Caike Girardi da Veiga.** Titled as Evaluation of Altitude sensors for a crop spraying Drone. PORTO ALEGRE, DEC 22/2

ISSN: 2583-6129
DOI: 10.55041/ISJEM01527

ISSN: 2583-6129
DOI: 10.55041/ISJEM01527