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Parachute Recovery System for 10-12 Kg Drone at an Altitude Of 90-150 Meter

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Abstract – UAV & drone market is having rapid growth & will have huge impact in future ahead. With development of technology and machine, it is important that safety of the machine & its expensive & high-end components is ensured. We here in this paper describe about development of parachute recovery system to ensure safe landing of drone or UAV after inflight malfunction or failure of the system. we have integrated mechanical, electrical & electronics components together in this system. A comparative study of different materials that can be used for parachute making. The housing for all the components was designed such that it has minimal effect on the system aerodynamics. We created a prototype and are carried out tests, to ensure that system is reliable and works properly in different environmental conditions and technical situations.

***Key Words*:** UAV- Unmanned Aerial Vehicle

1.INTRODUCTION

As the evolution of drone technology continues, its battery capacity and the range of the fight increase, therefore also increasing the range and scope of tasks drones can be assigned to perform. Statistics of accidents during the operation of an Unmanned Aerial Vehicle (UAV) exhibits a significantly higher accident rate compared to piloted aircrafts [1]. The drones are made for different purposes such as photography, surveillance, filmography, military, civil applications & many more. The drones carry expensive components for the carry out high end task, these components are mainly sensitive to slighter high impact force. the damage caused to these components can cause financial loss as these components are very expensive. For example, the cameras used in drone are nearly add up to half the cost of drone. when the drone suffers a malfunction or a failure midair, it starts to lose altitude quickly and accelerates very fast towards the earth surface due to gravity, its descents velocity increases rapidly. It hits the surface with greater force which damages the components of the drone and it also causes harm to impact surface. If it lands on a living being, it can lead to fatal injuries.

To avoid such accidents, we need to reduce the descent velocity of the drone by creating a drag in opposite direction, equal or greater than Drone weight. We can create this drag attaching a parachute to the drone which comes into action in emergency situations.

2. Parachute Fabrics

According to the online version of Encyclopedia Britannica, the parachute is “a device that slows the vertical descent of a body falling through the atmosphere or the velocity of a body moving horizontally”. The word "parachute" is a combination of two French words: para (protect or shield) and chute (the fall). Thus, it literally means fall protection. From all these definitions, parachute can be defined as a “device protecting oneself when falling from a height due to earth’s gravity” [2][3].

While selecting the parachute material factors such tear strength, weight, permeability, temperature range, elasticity, & weaving pattern of the fabric.

Fabrics for use in the manufacturing of parachutes are predominately nylon. The major differences include the weave, weight, and finish. The various types of materials include canopy fabric, pack cloths, mesh, elastic fabrics, stiffener materials, and foams [4].

After considering different types of material for the parachute and their different properties, we saw ripstop nylon as best suited material for our parachute as it extremely resistant to the tears, as it does not allow a tear to spread all over the parachute, it is light weight which is better as more weight on the drone even in gram affects its endurance.it also has suitable strength-to-weight ratio.it is also available in different thickness and sizes. The nylon ripstop material is also extremely durable as it is woven using reinforced and tightly woven crosshatch. Ripstop nylon is non-porous, which means it is weather-resistant. The fabric cannot be penetrated by air or water.

3.Prototype and Testing

The figure below displays the prototype that used for testing purposes. the tests we conducted consist of dropping the system with help of drone which holds the system below with help of mechanical jaws, which expand and release the system when command is given. the system is attached to a payload, the system dropped from different altitude to record the reaction time of system, descent velocity and the landing radius.

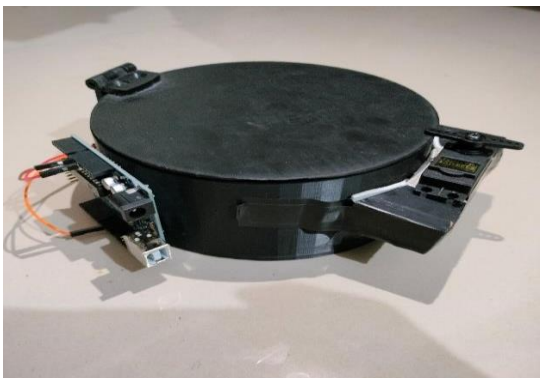

Fig. Prototype of the recovery system

Other components that we used for making of the prototype were 3d printed housing, a servomotor, a Arduino UNO , helical compression spring ,etc.

4. CONCLUSIONS

Here we can now conclude that the descent velocity of the drone or UAV increases as we reduce the altitude i.e., if the system actuates at low altitude the descent velocity will slightly greater than that of, when it actuates at higher altitude.

The system will take time up to 3.5 sec to come into action and produce drag to slow down the falling drone or UAV as, the unfolding of parachute takes 1-2 sec, whereas the actuation of the system takes about 1-1.5 seconds.

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