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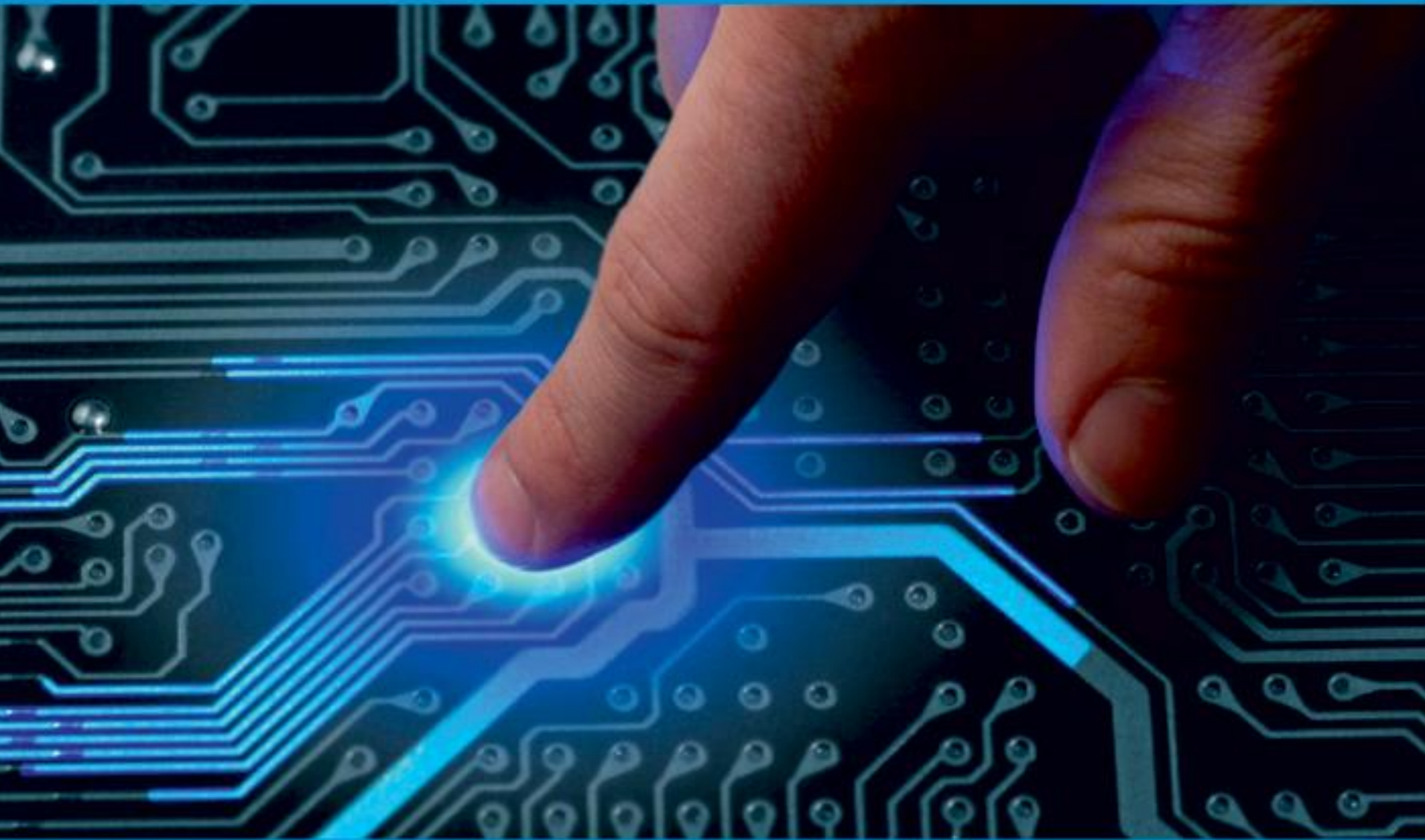

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# Design and Fabrication of Controlling the Flying Drone with Pick and Place Robotic Arm

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**ABSTRACT**: The concept presented involves a combination of a quadcopter drone and an end-effector arm, which is designed with the capability of lifting and picking fruits from an elevated position. The inspiration for this concept was obtained from the swarm robots which have an effector arm to pick small cubes, cans to even collecting experimental samples as in case of space exploration. The system as per preliminary analysis would contain two physically separate components, but linked with a common algorithm which includes controlling of the drone's positions along with the movement of the arm.But we here using separate controlling system for the initial prototype like for the arm we are using wifi module to control and for the drone is separate.In this project, a robotic arm with minimum actuation is designed and analyzed. This design is part of an advanced grasping system for Unmanned Aerial Vehicles (UAVs) and includes a foldable arm, case, novel gripper, and vision system.

**KEYWORDS**: **Drone, end effector, autonomous, payload**.

## I. INTRODUCTION

A robot is a machine that is programmable and capable of carryingout a series of complex actions automatically. Robots can be guidedby an external control device or the control may be embedded within. Robots may be constructed to take on a human form, but most robots are machines designed to perform a task with little regard to how they look. Robots can be autonomous or semi- autonomous such as Honda's Advanced Step in Innovative Mobility, also known as ASIMO, and TOSY's Ping Pong Playing Robot (TOPIO) which are marvels in the field of robotics. In addition to this there is considerable progress seen in area of industrial robots, medical robots, patent assisting robots, human rehabilitation, athletic training robots, and a whole set of more applications. In addition to land-based robots there is also developments in the bots used for aerospace and marine applications. By mimicking a lifelike appearance or automating movements, a robot may convey a sense of intelligence or thoughtof its own.

An unmanned aerial vehicle (UAV), commonly known as a drone, is an aircraft without a human pilot aboard. UAVs are a componentof an unmanned aircraft system (UAS) which include a UAV, a ground-based controller, and a system of communications betweenthe two. The flight of UAVs may operate with various degrees of autonomy either under remote control by a human operator, or fullyor intermittently autonomously by on-board computers. For example, the widely-used predator drone for military purposes is the MQ-1 by General Atomics which is remote controlled, UAVs typically fall into one of six functional categories (i.e. target and decoy, reconnaissance, combat, logistics, R&D, civil and commercial).

With the advent of aerial robotics technology, UAVs became more sophisticated and led to development of quadcopters which gainedpopularity as mini-helicopters. A quadcopter, also known as a quadrotor helicopter, is lifted by means of four rotors. In operation,the quadcopters generally use two pairs of identical fixed pitched propellers; two clockwise (CW) and two counterclockwise (CCW).They use independent variation of the speed of each rotor to achieve control. By varying the speed of each rotor, it is possible to specifically generate a desired total thrust, to locate for the center of thrust both laterally and longitudinally, and to create a desire total torque or turning force. In addition to this development, quadcopters were designed to adopt an end effector. In robotics, anend effector is the device at the end of a robotic arm designed to interact with the environment. The exact nature of this device depends on the application of the robot.

In the strictest definition, which originates from serial robotic manipulators, the end effector is the last link (end) of the robot. In a wider sense, an end effector is the part of a robot that interacts with the work environment. This does not refer to the wheels of a mobile robot nor the feet of a humanoid robot which are not end-effectorsbecause they are part of the robot's mobility.

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End effectors may consist of a gripper or a tool. When referring to robotic end-effectors, there are four broad categories of robot grippers. These are (a) Impactive – jaws or claws which physically grasp by direct impact upon the object, (b) Ingressive – pins, needles or hackles which physically penetrate the surface of the object (used in textile, carbon and glass fiber handling), (c) Astrictive – suction forces applied to the objects surface (whether by vacuum, magneto- or electro adhesion) and (d) Contigutive – requiring direct contact for adhesion to take place (such as glue, surface tension or freezing).

## II. LITERATURE SURVEY

[1] introduced a conceptual design which involved using multiple quadrotors programmed to make use of the yaw movement, linked to each other using a bar containing end effectors as seen in Figure 1. This paper aimed to introduce and spread an extensive mathematical formality that is used to build a new kind of UAV manipulator. The main contribution of this paper was to introduce the possibility of linkages that could be created between two systems.A parallel manipulator with robustly maintained precise end effector position stowed below a quadrotor UAV used for lifting oflight weight mass was developed by Danko et al.

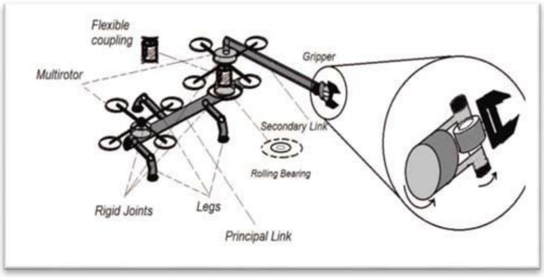


**Figure 1. Air-arm and end-effector**

[2] They also proposed, constructing a six degree of freedom parallel manipulator which is used to robustly maintain precise end effector positions despite post-UAV perturbations. The parallel manipulator allows for very little moving mass and is easily stored below a quad rotor UAV as can be visualized from Figures 2 and 3.

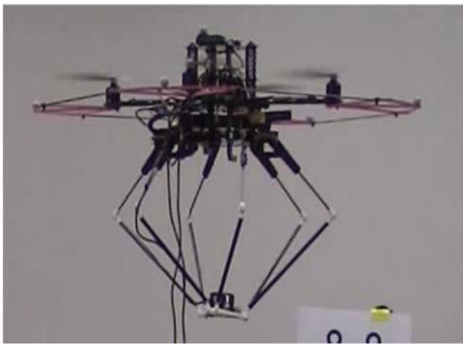

**Figure 2. Parallel manipulator extended**

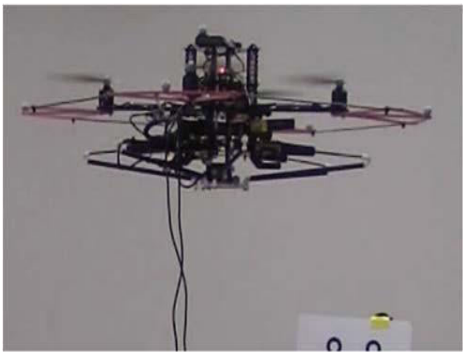

**Figure 3. Parallel manipulator stowed**

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[3] introduced the concept of a hyper-redundant manipulator as seen in Figure 4 to be used for the mobile manipulating UAVs. The flexibility of the links was observed by authors when the arm was programmed in MATLAB for moving in the shape of eight as seen in Figure 5 for testing the controllers.

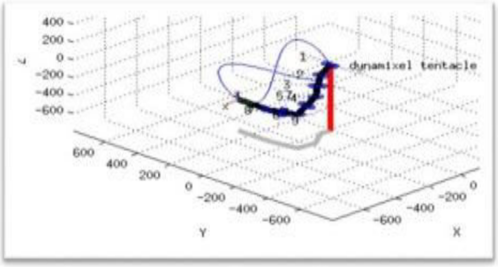


**Figure 4. Hyper redundant arm**

It can be controlled in such a way that links is moved within the arm's free space to help reduce negative impacts on the host platform's stability and the end effector to track environmental objects smoothly despite host platform motions. The hyper redundant manipulator does not include a spherical wrist, even though through preliminary reachability analysis, the manipulator had an improved reachable arm volume by over 20 %.

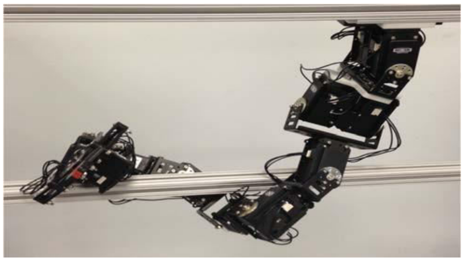

**Figure 5. Hyper-redundant arm sweeping in the shape of "8"**

[4] discussed about an approach allowing independent control of position and orientation of a UAV, whereby an arbitrarystable attitude controller could be used. The main contribution of this literature was to propose a new control approach for the entiresystem composed of Vertical Take and Landing (VTOL) UAV anda manipulator. The advantage of the presented approach is that theinteraction forces between robots and UAV were considered explicitly and that a Lyapunov stability proof for the UAV subsystem could be derived directly. This approach extends the classical Cartesian impedance controller to account for the UAV'srigid body dynamics.

[5] proposed a robotic hand which is efficient ingrasping a series of everyday life objects, is general purpose, and is validated using series of experimental paradigms. This approach further improves the design of conventional grippers that are commonly used for grasping, both in industry and research due to its low complexity and relatively low cost. The authors introduceda new end effector system capable of lifting heavy weights and withgrippers varying from two fingers to four fingers with a weight of 0.088 lb. to 0.53 lb. respectively as seen in Figure 6.

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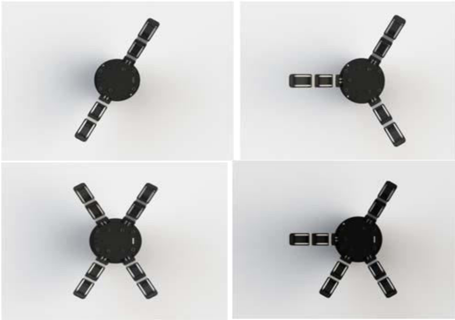

**Figure 6. Different robot hands created using identical modular fingers and the modular fingers basis**

[6] studied the kinematic and dynamic behavior of humans lifting heavy weights and applied it to a robotic arm which was made to lift heavy weights as a part of dynamic task. The authors discussed the kinematic and dynamic behavior of the robot with experimental results. The results showed that the arm could lift 20 kg mass with the links having kinematics like that of human muscle. This approach uses a new methodology that is dynamic motion control. This technology is applicable not only for lifting but for pulling, peeling and destroying tasks.

[7] gives an overall review of robot application employed over a period. The paper also provides information on the type of end effector used for fruit picking with pictorial representation as shown in Figure 7.

The robot mentioned in this paper deals with applications such as spraying and motorized weed control, fruit selection and inspecting the farms day and night for an efficient result which in turn reduces the farmer's effort. One of the advantages of the smaller machines employed in agriculture is that they are more satisfactory to the non-farm population.

**Figure 7. Fruit picking robot**

[8] discusses the technological improvements over the past decade related to fruit picking and the way robots have been programmed to locate the fruit in specified area without any damage to the fruit. The author developed an end effector with six degrees of freedom, having three rotational joints connecting neighboring links to cover the defined workspace. The author has made use of the Puma 560 robot arm which has forward and reverse kinematics whose controls are programmed through MATLAB Robotic Tool Box. The joint angles, velocities and torques of the robot arm were studied during example pick cycles which span the work space of representative peach and orange trees.

[9] who discussed the specific application of cucumber picking robots and the efficiency of the end effector. The manipulator was designed with seven degrees of freedom. The robot is equipped with computer vision system which could detect more than 95% of cucumbers in a green house. The ripeness of the cucumbers was determined based on the geometric models.

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**Figure 8. Vegetable harvest robot in the greenhouse**

## III. METHODOLOGY

The methodology for a Drone with a pick and place robot arm this system involves both hardware and software components.

## IV. EXISTING SYSTEM

- Unmanned aerial vehicle made by American-based Pepsi for commercial purposes has the ability to receive an object vertically. This unmanned aerial vehicle, whose specifications are not shared, has designed toreceive a ball.

- USA based e-commerce company, Amazon, launched a project in 2013 that target delivery of a product within 30 minutes of the customer's order placement . After the ordered product is placed in the box, it will be brought under the storage area under the UAV system with the rail system and the vehicle will be released for delivery.

- "Matternet M2" unmanned aerial vehicle, developed by Matternet company in partnership with Mercedes, is planned to be inserted in cargo vehicles. Therefore, when the cargo vehicle goes to the nearest delivery area, the range and charge limitations of the UAV will no longer be limited.

- Another international cargo company, UPS, has built its own unmanned aerial vehicle for product distribution. UAV named, as "UPS HorseFly" will be loaded by the operator into the cage below the UAV.

## V. PROPOSED SYSTEM

OBJECTIVE OF PROPOSED SYSTEM:

1. To help the physically handicapped person pick an object of necessity (Water bottle, food items, fruits etc.) from a far-off distance and bring it to his/her vicinity.
2. To help farmers in harvesting the fruits and vegetables therebyreducing the distance of travel in long fields and on a minor scale help develop automated farming.
3. Along with this the drone can be used to spray fertilizers and pesticides over the crops, thereby reducing health hazards of farmers.
4. For all kind of deliveries to possible with fast and safe.And all these are should be affordable to do all people for all needs.

## VI. CONCLUSION

The function of the robot is defined in the simplest of way which enables the UAV to perform a specific task. The materials and partsselection have been considered based on detailed evaluation of drones available in the market along with the mass of payload to becarried. The end-effector is modeled such that it is equipped with suction cups which give a better grip to the object help by the arm also the arm is stationary with the links being adjusted manually. The drone model presented here is controlled by means of a remote, where further developments can be pursued to have a complete autonomous system with capabilities of self-positioning, tracking and voice control of the drone.

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