A SMART COCONUT AND PALM CUTTING DRONE

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ABSTRACT:
This Fruit plucking during harvesting period involves labor intensive and time consuming steps.Automatic fruit plucking drones has to be developed to avoid the scarcity of laborand to consume less time.In order to make drones automatic, fruits have to be detected and classified properly. Drone need to be stabilized during flight and remotely controlled by theuser. Robotic arm with gripper needs to be interfaced with the drone to pluck and hold thefruit. There is a rising shortage of skilled labors for climbing because these works are not considered a respectable job by people, although the wages are very high. It is highly challenge to grab the fruits from high altitude tress such as coconut tree and palm etc. Grabbing the fruits of trees in hilly region and mountains are also very difficult. Project can beimplemented to harvestvarious kinds offruitsin orchards likeapple, banana,guava and citrus etc.

Key Words: Drone, Electric Motor, Slider crank mechanism, Cutting blade, Fruit identification.

I. INTRODUCTION

The skilled farm labour in the agriculture is one of the most cost demanding factors. This isdue to the rising values of supplies such as migration of large population from rural to urban areas, power, water irrigation, agrochemicals and so on. This puts the farming to be underpressure with small profit margins. Under these challenges food production and harvesting stillneedstomeetthe growing demandsofanever-growing worldpopulationandthisproblemhas to beovercome. India is a biggest agriculture country in the production of coconut and palm. Manual climbing on the trees is the major setback due to the shortage of skilled manpower (trained climbers) and accidents. It is directly affects the productivity and economics. During the cultivation process in the coconut and palm trees, the accidents are happened to the humans. To avoid this we would come with a new technology called A Smart Coconut and Palm Cutting Drone.

II.LITERATURE SURVEY

[Ruggiero, 2018][1]Multicopters are gaining more interest in many aerial applications. Multicopters include helicopter, tricopter, quadcopter, hexacopter and octacopters. When one or two of the motors are damaged or not functioning properly due to unpredictable environmental issues or mechanical failures, multirotors can still maintain stable flying. For heavy lift applications hexacopter is preferable than the quadcopter because they give more stability to drone, provide higher durability and larger payload. Octocopter also has the ability as hexacopter but it cost more price due to increase in number of motors.

[Suprapto,2017][2] Hexacopter has been designed, rotation of rotors has two direction i.e. three on counter clockwise and three on clockwise. Thrust was calculated based on the total weight has to lift. Batteries plays important role in flight time, therefore current should be more than motor current. As weight on hexacopter increases flight duration also decreases.

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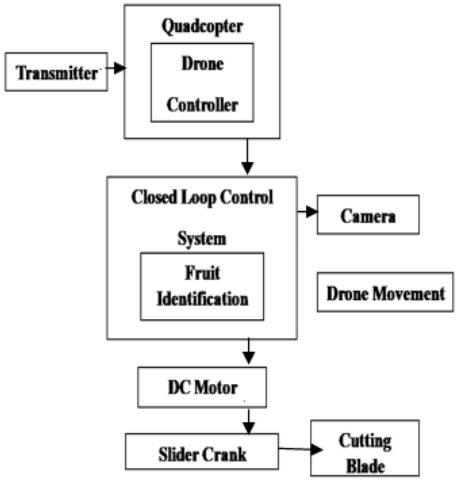
[Liu, 2019][3] To pluck fruit, drone has to distinguish the fruits based on the image captured by camera. Binocular stereo vision camera is being used to acquire three dimensional images of the fruit. It also converts the image into hue, saturation, value components of colour model. Different image processing techniques are implemented to remove noise and filter the image acquired. Otsu algorithm is used to segment the pixels of image and least square fitting method is applied to find centre and radius of fruit.

[Rahul, 2018][4] Image is acquired using digital colour Charged Couple Device (CCD) through which training data set is prepared. Colour image of fruits is converted into grayscale to obtain features of the fruits. K-means algorithm is used to segment an image and polygon fitting method is implemented to define boundaries in case of overlying fruits.

III. BLOCK DIAGRAM



IV. COMPONENT

a. BLDC Motor

Figure 1: BLDC Motor

There I have an out runner BLDC motor with the following specifications: it has a KV rating of 1000, it can be powered using 2S, 3S or 4S Li-Po battery and it requires 30A ESC. The KV rating on a brushless motor defines the RPM of the motor per volt with noload

b. Propellar Blades

Figure 2: Propellars

Specification:

Material : Plastic

NOS: 4

A propeller blade progresses through the air along an approximate helical path as a result of its forward and rotational velocity components. To rotate the propeller blade, the engine exerts torque. Due to the rotational forces reacting on the air, a rotational velocity remains in the propeller wake with the same rotational direction as the propeller. This rotational velocity times the mass of the air is proportional to the power input. The sum of all the lift and drag components of the blade sections in

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the direction of flight are equal to the thrust produced. A propeller blade must be designed to withstand very high centrifugal forces. The blade must also withstand the thrust force produced plus any vibratory forces generated, such as those caused by unevenflowfields.

c. Cutting Blades

Figure 3: Blade

Specification:

Material : Stainless steel

Grade : 304

Wood is one of the most precious and difficult engineering materials of the mankind. Although it is light, it is a material that has a high resistance to various effects, easily processed and consumes less energy during machining. There are many kinds of these in terms of the number of teeth, tooth form and material . For this reason, it can be stated that the choice of saw blade is so important in terms of Capacity, efficiency and end-product quality. We are using the stainless steel of grade 304. Due to the rotary movement of the crank the cutting tool reciprocates front and back and it cuts the stalk of the fruit. The material used in the cutting tool is 16 and 24 percent chromium and up to 35 percent nickel as well as small amount of carbon and manganese. The most common form of 304 stainless steel is 18-8(18/8) stainless steel which contains 18 percent chrominum and 8 percent nickel. 304 stainless steel is the most common form of stainless used around the world due to excellent corrosion resistance and value.

V. WORKING PRINCIPLE

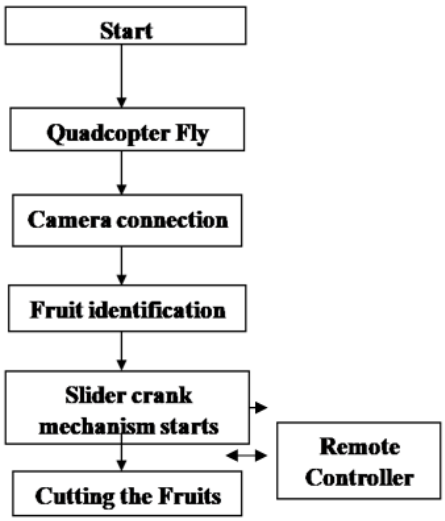

Figure 4: Flow Chart

This smart drone has been worked on basis of quadcopter flight principle. There are four rotors used in the quadcopter frame structure and it propelled by BLDC motor. Alongside, the cutting operation works under the principle of slider crank mechanism and operate by DC motor coupled with it. A stainless steel (SS 304) cutting tool is connected with slider link. The slider link will reciprocate the cutting tool when crank rotates by motor actuation. Both, the quadcopter rotors and auxiliary DC motor could be controlled by transmitter (F6-i6). A camera is placed in front side of drone structure which used to visualize the objects. By this working process the fruits of 'Cocos' species (coconut/palm) trees. It is a product in which hardware and software is embedded in it. This smart drone system enabled by the technology ADAIES(Artificial Intelligence, Data Analytics, IoT and Embedded System). The ADAIES system control and operate the drone and cutter.

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Figure 5: Drone

The smart drone operated and controlled by manually. The circular motion is converted into reciprocating motion by using slider crank mechanism. The mechanism is run by a separate electric motor. The Cutting Blade is connected to the slider of the mechanism. The smart drone reaches the proper position then the cutter is released by manually using button in the controller. The cutting blade in the mechanism goes front and back, the blade hits the stalk of the fruit chopped and collected.

VI. COST ESTIMATION

S.No	Description	Cost (Rs.)
1	Drone	5000.00
2	Cutting Blades	100.00
3	DC Motor	400.00
4	Battery	1000.00
5	Mechanical Joints	400.00
6	Wire and Accessories	500.00
7	Plastics	200.00
9	Miscellaneous	500.00
8	Total (Rs.)	8100.00

VII. RESULTS AND DISCUSSION

- We have described a new way of plucking the fruits with the help of a smart coconut and palm cutting drone by reducing the human effort.
- The smart drone will be applicable for plucking of fruits from high altitude or trees in mountain regions.

VIII.CONCLUSIONS

This The project proposes an efficient fruit harvesting system by providing vision system andslider crank mechanism for quadcopter can lift a payload of 1kg. The camera interfaced to copter providesinformation of the fruit by undergoing image identification and it is seen by drone controller monitor. The cutting action is done manually by using the remote controller. The slider crank mechanism with cutting blade is being designed to facilitate for cutting the fruit andblades are provided at the top for easy detachment of fruit from tree.Finally, the cutting blade will harvest the fruit shuffle identified by the user.A significant amountof manual work can be reduced along with number of labors which benefits the agriculturistsbysavingtime and money.

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