Imperial Journal of Interdisciplinary Research (IJIR)
Vol-2, Issue-6, 2016
ISSN: 2454-1362, http://www.onlinejournal.in

Quadcopter - A Smarter Way of Pesticide Spraying

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Abstract: *Currently, Agricultural field facing some problem: - the lack of human labors. There are some reasons like it requires hard work which causes tiredness and some field workers are migrating from the farm to other fields in the industry which offer them more stable and more profitable jobs. In this scenario, it becomes necessary to introduce and develop agricultural automation and sensing technologies for increase agricultural productivity. In this system we introduce Quad-copter [QC] which is light weight and low cost. It is also known as UAV i.e. Unmanned Aerial Vehicle. More recently quad-copter design become popular in unmanned aerial vehicle (UAV) research. These vehicles use an electronic control system and electronic sensors which stabilize the aircraft. With their small size and agile maneuverability, these quad-copters can be flown indoors as well as outdoors. It is autonomous flight for fertilizer spraying, manure spreading by using android device. There is real time Bluetooth communication between quad-copter and android device. Here the quad-copter can be control through android phone for fertilizer spraying. So the hard-work, human efforts, number of human labors can be reduce by it .This system reduce the problem related to the agricultural field and also improve the agricultural productivity. This system reduce the health problems which are caused by manual spraying.*

Keywords: *Joystick, Wi-Fi, GSM, Quadcopter, Camera, Android phone.*

I. INTRODUCTION

India and other developing countries are facing many problems in agriculture field like shortage of labor, health issues. As per World Health Organization survey, there are 3 million or more cases of pesticide poisoning in each year. Asthma, Allergies and Hypersensitivity are the prospect effect on human health on exposure to pesticides. Children and new born babies are at great risk to exposure of pesticides because they are not having strong immune system.

Now a days each and every person uses computing device like Smartphone. This motivated us to use smart phone for interfacing mobile phone with electronic devices. Quadcopter is an Unmanned Aerial Vehicle (UAV) which is controlled by android application. QC is a rising UAV and it is lifted by four propellers with four rotors. The robotics applications are currently evolving. Use of this robots in agriculture fields is mostly very popular so many people try to do some robots which helps them in agriculture field.

A unique framework is offer by automated agriculture for robotic developments. Precision agriculture can be automated for primary and secondary agricultural tasks. The primary goal is to improve the agriculture production. The coupling between field workers and robots should be done in such a manner that humans should feel comfortable in the presence of robots. HRI system is introduced To face issues such as: regulations, safety and comfort. Flexible automation is focused in this work.

This paper introduce a quadcopter which is used for pesticide spraying in agriculture field is handle by android application. Here the quad-copter can be control through android phone for fertilizer spraying. This system reduces the problem related to the agricultural field and also improve the agricultural productivity.

II. RELATED WORK

UAV are very popular for monitoring, package delivery, search-and-rescue missions, target tracking, and various other applications.

Alex Waller [1] PARCov (Planner for Autonomous Risk-sensitive Coverage) This paper propose the system for surveillance purpose of risk-sensitive areas using a team of unmanned aerial vehicles (UAVs), which keeps the track of the areas that are already surveyed and time of the previous survey. PARCov is used for detection of risk by using quad copter in risk sensitive area which are under its coverage. It is able to cover more area and provide continuous surveillance. A nonlinear optimization formulation is also used in this paper to determine the optimal altitude for quadcopter flying with maximized data sensor quality and minimizing risk.

Miguel Torres-Torriti [2] paper HRI is introduce i.e. Human Robot Interaction, because of lack of human labour there is need to introduce as well as developed automation and sensing technologies for all tasks like harvesting, seeding, grove supervision etc. Fully Robotized farm are not yet possible therefore human labours are also needed to handle the robot or for the autonomous farming. In this paper they summarized the state of art of human robot interaction in agricultural field. There is guidelines and strategies for designing a human device/robot interaction in agricultural field.

III Principal of QC operation

After deciding to create the Quadcopter, we had to decide what electronics to use and which sensors we would incorporate into it. After a lot of research on the web, we found a couple forums that discussed open source electronic and software components suitable for making a Quadcopter. Also, very basic but highly customizable Quadcopter bodies were available that were suitable for us to use to create our baseline system.

We decided that we would use a commercial frame and then build around it with the electronics that we wanted. With the frame, we also got the motors and propellers. These components determined how much room I had for the electronics as well as how much weight I could put on the helicopter and still have lift. The next thing we chose was the microcontroller which was an open source Arduino board which allowed us to put our own software on it.

On the IMU Shield board there is a gyroscope, barometer, compass, and accelerometer which all need to work together to make sure the Quadcopter maintains stable flight while moving or hovering. Finally we purchased a Lithium-ion polymer (Lipo) battery because they have the best ratio of weight to power. The particular battery we chose has been sufficient to complete the design, assembly, and testing of the Quadcopter systems and our experiments have shown that since we have plenty of thrust we can chose a larger battery for our mission flights to improve the flight time.

The basic QC design consists of four complete rotor assemblies attached at equal distances from each other and a central hub. All the rotors are located within the same plane and oriented such that the thrust generated by each rotor is perpendicular to the vehicle as shown in Fig. 1. If the rotors are comprised of parts with the same specifications and expected performance, each will produce the same amount of thrust given a specific power input.

The angular momentum of any of the four rotors generates a torque about the inertial center of mass of the vehicle which can be effectively counter balanced by the torque created from the opposing rotor. This configuration requires that opposite rotors spin in the same direction while adjacent rotors spin in opposite directions. An immediate advantage to the quad rotor design is that, it is not necessary to implement additional equipment such as control moment gyroscopes with the sole purpose of negating extraneous torques on the vehicle.

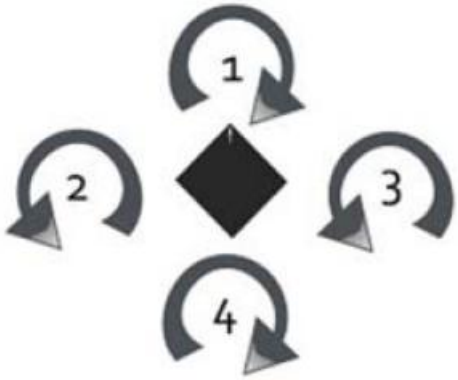

Fig. I - “+” configuration

In “+” configuration two motors of QC rotate clockwise and other two motors rotate anti-clockwise. And the opposite motor rotate in the same direction. QC operating motherboard’s front will be pointing rotor-1 shown in fig.

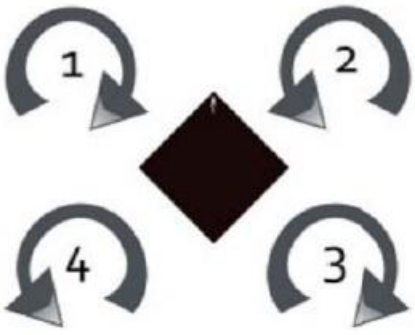

Fig. II - “X” configuration

In “x” configuration is almost same to “+” configuration. Only difference is QC operating motherboard’s front will be pointing to the direction between rotor-1 and rotot-2 shown in fig.

All the configuration requires the opposite rotors spin in the same direction while adjacent

rotors spin in opposite directions. An immediate advantage to the quad rotor design is that, it is not necessary to implement additional equipment such as control moment gyroscopes with the sole purpose of negating extraneous torques on the vehicle.

Fig. III – Quadcopter with their tools

We also had to provide a way to control the Quadcopter from the ground by using Android application. We decided to use an application for controlling quadcopter which is displayed in Figure below. We build the application which has all the functioning to control the quadcopter and runs at any android mobile. Currently we are using all functioning like up/down movement, pivot, left/right, spraying and finally forward/backwards. We also can program the other many functions such as ground speed, air speed, Climb rate, altitude, google map, takeoff command, battery percentage etc.

Fig. IV – GUI of Android application

Connectivity between android application and quadcopter is the first step of system start-up. The wireless device is connected to mobile phone through which commands are given to the quadcopter. This wireless device has a particular range so the quadcopter fly within that range. Using Google map or satellite view, we find the exact location of our farm and the area where we have to spray the pesticide. With the help of commands given through the android application to the quadcopter, it sprays pesticide precisely at desire location.

IV. LIMITATION AND SCOPE FOR FUTURE RESEARCH

The QC is unable to perform at long distance range due to limited amount of power supply from Lithium polymer battery. Increment of power source will increase the range.

V. CONCLUSION

This paper gives the solution to all problems like shortage of labour, health issues which are faced by farmers during pesticide spraying. In future, battery power will be replaced by solar system as a power source. We can implement this on large scale using multi-copter with increase tank capacity.

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