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Quadcopter controlled using Hand Gestures

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Abstract: One of the most exciting developments in the last few years is the development of quadcopters. Quadcopters has its uses across all domains, some of them are medical services, security services, tourism, wildlife photography and etc. Harnessing the power of Quadcopter would enable the photographer to capture a majestic landscape or an award winning photography of wildlife. This does not require an elevated position such as conveniently situated mountain or renting a helicopter, neither which are guaranteed to be available and incurs a large wad of cash. Traditionally when photographing from a helicopter, photographer flies at a height of 1000 feet above the terrain and this aerial photography often faced daunting technological challenges and if wildlife is involved would ran the risk of spooking the very subject for which the photographer took to the skies to capture. When a Quadcopter is piloted by a skilled photographer he can create incredible sceneries, photos and videos with relatively lower risk and at a cost of battery charge.

I. INTRODUCTION

Wildlife photography is a kind of art which focuses on capturing various wildlife in their habitat. Providing images of animals in their respective environment are essential to education, science and numerous other domains. Wildlife photography falls into that class of hobbies which requires a lot of patience and the ability to work in uncertain and dynamic conditions to achieve success. Since a century there is increase in the use of unmanned aircraft vehicles (UAV) in diverse applications ranging from optical surveying of architectural buildings to wildlife telemetry tracking, surveying, inspection, mining and public safety. Quadcopters come under these unmanned aircraft vehicles (UAV) which have gained high popularity. Quadcopters consists of 4 arms having motors mounted with propellers. The propellers rotated with sufficient power provides the necessary thrust to gain lift. The speed of the motors are controlled by Electronic Speed Controllers (ESC) which are powered by a battery. Generally quadcopters are controlled using remote control which consists of a transmitter transmitting signals to the receiver present in the quadcopter. An alternative means to control them are by using hand gestures. Gesture recognition is the mathematical interpretation of a human motion by a computing device. Being a significant part in non-verbal communication hand gestures play an important role in our daily lives by providing a simplified means of communication with the computers. Hand gesture technology can be combined with the quadcopters in controlling them. This approach leads to an easier way of controlling when compared with the traditional transmitter control.

II. LITERATURE SURVEY

An extensive survey has been made on quadcopters hand gestures, different techniques of implementing hand gestures towards quadcopter control.

A. *Using WebCam / Camera*
1) Quadcopters can also be controlled by gestures and voice commands. Image processing algorithms play a vital role in these controlling techniques. Smooth cooperative environment between human and the Quadcopter is achieved by using the natural communication technique like manual remote control. The results show reduced Transmission loss and time delay while coordinating voice and visual information. [1]
2) Quadcopters can also be controlled Quadcopter with the help of hand Gestures make it more user friendly as the user would not have to learn about different instructions to control different parameters of a Quadcopter, because these parameters will be controlled and adjusted with the help of algorithm interfaced to the hand gesture inputs. This approach consists of
a) A real time capturing of hand gestures
b) Feature extraction
c) Pattern matching for gesture recognition
d) Command determination corresponding to show gestures and performing actions respectively. [2]
3) Quadcopters can also be controlled by Virtual Mouse using Hand Gesture and Color Detection in which that it is possible to move the mouse cursor on the screen without using hardware which is performed using Webcam and Hand Gloves where

different colors are painted on different fingers which makes a clear distinction in colors and make the system faster and easier for the algorithm, this technique can be extracted and made use in Quadcopter control design.[3

4) Quadcopters can also be controlled by Real Time FPGA Implementation of Hand Gesture Recognizer System in which hand tracking system includes the image preprocessing state and feature extraction state that consists of bounding box and Center-Of-Mass based computation. Through the features extraction state, the object's Center-Of-Mass and bounding box attributes are extracted to be applied for gesture sign classification. [

5) Quadcopters can also be controlled by controlled robots using image processing as the central theme for controlling. This robot is built using PIC18 Microcontroller, MRF24WG0MA microchip and L293D motor driver. The bot/robot is operated through signals generated by hand gestures of the user captured by the web cam which acts upon the base station to control the robot. Halide, a programming language to write codes for efficient image processing techniques is used .The PIC18 microcontroller is used to interface with the chosen wifi-module. The MRF module connects to a specified number of microcontrollers via a 4-wire SPI interface which provides a solution for low-power and low-data Wifi networks. This module combined with MIC allows access to run the TCP/IP stack to deploy IEEE standard 802.11 and IP services .The motor driver takes the digital signal generated from the gestures as input and gives digital output to the DC motor which facilitates the navigation of the robot. Unless the gesture is changed the robot moves in the previous direction. Power supply is maintained by rechargeable batteries. [5]

B. Using Kinect Sensor

1) Quadcopters can also be controlled by Dual hand Gesture in which a new simplified scheme based on Kinect sensor is designed and extended to carry out the task of grasping / obtaining the 3D video stream data by Kinect, noise pre-processing on the depth image to extract the stable skeleton node data is performed. The obtained skeleton data is used to establish the control signal reference coordinate system and a dual – hand gesture information is mapped into the control information and the mechanical claw of the Quadcopter. [6]

2) Quadcopters can also be controlled by ROS based UAV Control Using Hand Gesture Recognition in which the design of different Hand gestures corresponding to different UAV commands and developing a stable algorithm to distinguish these gestures is the very first step towards the natural interaction between human and multi-UAV system . Asus Xtion Pro Live Camera is used to obtain the position information and color information, thus multi –user recognition by hand gestures is achieved. [7]

3) Quadcopters can also be controlled using Depth Map concept from Microsoft Kinect Sensor which states that the Microsoft Kinect Camera is a revolutionary and useful depth camera giving a completely new user experience of interactive gaming on the Xbox platform through gesture or motion detection and this Kinect Sensor includes a color (RGB) camera , an infrared depth sensor , an accelerometer , four microphones and a motor to adjust the tilt can be harnessed to process the live video stream of various Hand Gestures and this approach is feasible to control the Quadcopter.[8]

C. Using Leap Motion Controller

1) Quadcopters can also be controlled using a Motion Controller in which a Leap Motion Controller, an eight by three centimeter unit comprises of two stereo cameras and three infrared LEDs, the two stereo cameras as well as the three infrared LEDs perform the function of tacking the infrared light and this recognizes the Hand gestures and relays it on to the ground Station. The ground station runs Robot Operating system (ROS) in Linux platform. Python programming language is used for the interaction with the AR. Drone in order to convey simple hand Gestures. [9]

2) Quadcopters can also be controlled by Robotic Buggy using LEAP Motion Controller and hand Gestures states that Leap Motion Controller is a gesture recognition device using an advanced and robust algorithm for Hand Gesture recognition. Stereoscopy allows the Leap to minimize the errors and to provide up to point precision while tracking Hand and Finger gestures. Then using LEAP SDK (Software Development kit) unique task is going to be assigned to each unique hand-gestures. [10]

D. Accelerometer Techniques

1) Quadcopters can also be controlled remotely. This quadcopter is controlled by a 6-channel transmitter. The signals from microcontroller goes to ESC's which in turn control the directions and speed of the quad copter. This quad copter is built using 3 cell 1000 mAH Lipo rechargeable battery. 4 brushless motors with micro bearings acts as the propellers which has low noise

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Nylatron gears for 8.625 propeller shafts. It consists of water resistant electronic motor controller with fully reprogrammability along with 380g outdoor hull and 420g indoor hull. This quad copter could also be used in carrying weights of approximately 400 grams. [11

2) Quadcopters can also be controlled using raspberry pi using computer signals. This quadcopter was built with intention of using it in military grounds mainly used at border to detect the intruders. Here quadcopter is instilled along with raspberry pi which controls the movements and speed of the quadcopter according to the signals sent by a computer system. This system involved a pi cam to take high definition videos as well as still photographs. Ultra Sonic Sensor was used for the measurement of height of the quadcopter from the ground. GPS antenna which is magnetic has been stacked to the top of the structure. Sensors like LIDAR had been used to avoid collisions. [12]

III. CONCLUSION

When compared to the three techniques under Image processing approach Accelerometer/Gyrosc

ope approach looks feasible due to the fact that Accelometer/Gyroscope based approach is wearable on arm and easy to carry around(Mobility), there is no constraint of camera clarity(High resolution pixels) as it is based on electrical muscle activity and it is not limited / affected by varying light conditions. The cost involved in Accelerometer/Gyroscope is very much less when compared to the other techniques and the efficiency is high compared to other techniques. Hence we propose Accelerometer/gyroscope based technique of controlling the Quadcoptor, which turns out to be feasible and could be completed within the stipulated deadline (time).

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