Volume 1, Issue 4 (2021)
Article No. X
PP XX-XX

VIVA Institute of Technology
9th National Conference on Role of Engineers in Nation Building – 2021 (NCRENB-2021)

VIVA-TECH IJRI
ANNUAL RESEARCH JOURNAL

VIVA-TECH INTERNATIONAL JOURNAL FOR RESEARCH AND INNOVATION

ANNUAL RESEARCH JOURNAL
ISSN(ONLINE): 2581-7280

Self-Controlled Drone.

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Abstract : *We all have seen drone at some point of our life. Drones are unmanned vehicles. For layman drones are usually „Quad-copters" .Quad-copter is more like a small helicopter with four rotors attach to it. In this project we will be using a similar Quad-copter. You will be surprised to know that first manual quad-copter was invented in 1920 by Etienne Omnichen. And now the quad-copters or drone works on remote control. And in recent years due to the increase in artificial intelligence and machine learning era there are drone which fly on their own without much involvement of human. These types of drone are known as autonomous drone. But the problem with these type of traditional autonomous drone are that they work using ultrasonic sensors. The use of ultrasonic sensor in these drones increases the reaction time to react to an obstacle which simultaneously decreases the latency of the drone. So it is not a good option to use these drones in public places. To tackle such problems we are proposing our project which is „Self-Controlled Drone". In this project we try to make an autonomous drone which will be using a camera sensor instead of an ultrasonic sensor. Use of various machine learning and artificial intelligence algorithms as well as image processing programs will make the drone work autonomously by taking input from the camera sensor, processing on the input and react accordingly. The use of the camera sensor in the drone will increase the latency of the drone and decrease the reaction timing. Another thing is that to travel the drone from one place to another we will be using a GPS module, which will guide the drone. The making of this drone will bring a change in the drone culture and will help to make the drone more safer and efficient to use in public spaces.*

Keywords - *Algorithms ,Artificial Intelligence, Autonomous, Drone, Machine Learning, Microcontroller, Obstacle Detection, Programming ,Quad-Copter, Sensors.*

I. INTRODUCTION

. We are living in the era of technology. We are surrounded by technology and it has very much affected various aspects of life. From small scale to large scale in almost every industry technology has changed their way. Another great thing in this era is the „Artificial intelligence". Artificial intelligence which is currently in its initial stage has brought significant changes in the use of technology. Until now the machine used to be operated manually, but after the introduction of the artificial intelligence and machine learning those same machine has got the ability to work on their own without any much human interference. Smart phones camera, Facial recognition, Self driving Cars, Autonomous Drones are well known example in which artificial intelligence and machine learning is used. Similarly our project Self-Controlled drone which will be using aspects of artificial intelligence and machine learning to make the drone which is autonomous, safe and efficient to use.

1.1 IMPORTANCE OF SELF-CONTROLLED DRONE

Drones are unmanned vehicles. The Quad-copter which is usually referred as „drone" by layman is a small helicopter with 4 rotors. The type of drone which normal people encounter is shown in the Fig1. Now the whole idea is to create a Self-Controlled is to make drone autonomous which work on itself without and human interference. To make it Autonomous we will be using computer programming in which aspects of artificial intelligence and machine learning is to be applied. One of the main purpose of this drone is to use it safely in public places.

Fig.1 Drone.

While working with a drone which is autonomous and to use it in public area safety is an important and major issue. Another thing is to use this drone is to make it work at lower altitude just few inches above the ground because by taking the drone at higher altitude will consume more power and will work for very less time, as power consumption is another major aspect while working with the drone. While making an autonomous drone, another major issue is the avoidance of obstacles. A collision avoidance system which will be the main part of this project to detect obstacles or objects coming the pathway and deviating its path and dodging the obstacle, to make drone more safer to use in public spaces.

1.2 MOTIVATION OF MAKING SELF-CONTROLLED DRONE

Autonomous drone are made by many companies and are sold in the market for use, but the problem with the traditional autonomous drones is that they uses ultrasonic sensors in the drone. Ultrasonic sensors are those sensors which emits ultrasonic waves which in results reflects back from the object and falls on the sensor. The time between emission and receiving the wave is calculated and the depth is estimated to detect the obstacle. This process is very time consuming and not a good option to using in a drone which will be flying at lower altitudes. The use of ultrasonic sensors is not very efficient to use as it increases the reaction time of the drone and decreases it latency. Decrease in reaction time will result is slow detection of objects, leading to collision with fast moving objects. To make the drone to detect obstacle we will be using a camera sensor instead of ultrasonic sensor. Camera of the drone will be programmed in such a way that as soon as any obstacle is detected in the camera it will deviate its path. Artificial intelligence and machine learning will be the most important aspects in this project to detect obstacles and avoid it.

II. DESIGN AND METHODOLOGY

This chapter will tell us about how we will make this project? What will be our approach? And how far we can reach with the amount of resources we have. Let us go through the block diagram to get the basic understanding of the approach.

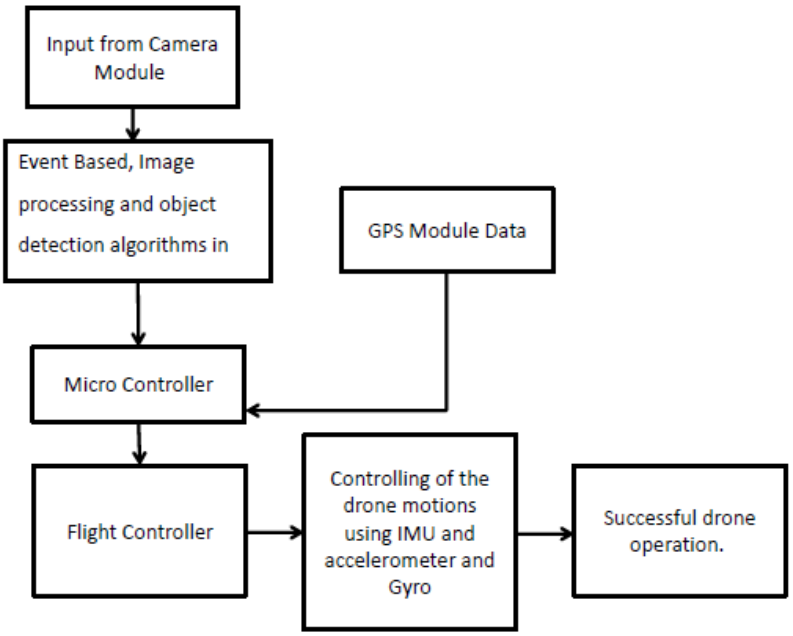

Fig.2 Block diagram

The block diagram which is shown previously summarizes everything we will be going to perform while making this project. The further and detailed description of the approach of this project is explained below.

2.2 STEPS TO ACHIEVE THE GOAL

2.2.1 GETTING INPUT FROM THE CAMERA

As we know the usage of camera is better than the use of ultrasonic sensors while working with autonomous drone. The reason ultrasonic sensor fails is due to the decreased latency of the drone by using it. On the other hand camera gives us the proper estimation of about where and how far the object is by using various algorithms such as real time image processing. So the input is taken from the camera and the data is sent to the microcontroller for further operation. In this the camera plays very important role of getting data from the surrounding and sending it for further process.

2.2.2 APPLICATIONS OF VARIOUS ALGORITHMS

The input is taken from the camera is in the form of continuous frames of image or what we usually say in the form of a „video". With the help of the simple video the drone will not be able to recognize what is the depth or what are objects and where are empty spaces, the video is a simple combination of many frames. To make this work we have to work on each particular frame. Each frame consists of pixels on which our real work is. First to lower the pixel resolution we will be using image processing algorithm so that the processing is faster and easy. After we get a lower resolution image now we will be applying various machine learning algorithms to make this work. While using machine learning on a machine first the machine has to be trained with an artificial dataset so that algorithms make the algorithms ready for working in the real life. Without training the model with the artificial data the and directly send it to the actual surrounding will cause harm to the model as well as the surrounding , because the machine didn't know what is objects and how to dodge it. After training the model with the artificial dataset the work is not over yet. The model is tested in artificial environment. In that environment the model algorithms will learn more and more so 14 that it may work better in real environment. Some of the algorithms we will be using in this project are listed down below: 1. Video to event Conversion. 2. Object Detection. 3. Gesture recognition. 4. Monocular and probabilistic dense reconstruction in real time.

2.2.3 THE ROLE OF GPS

Making the drone only work on its own is not completed here until when the drone is travelled from one place to another. So to travel the drone from one place to another GPS module is used. GPS is Global Positioning System which is used in our cars, smart phones and other object which is travelling from one location to another. Using GPS in our system will help us in guiding drone to a particular location.

2.2.4 MICROCONTROLLERS

Microcontroller is the brain of this whole project. Microcontroller works as the main component by storing data, algorithms and programs. Microcontroller consists of memory, processor, arithmetic and logic units and various ports to connect different types of I/O devices. Microcontroller also helps us processing information which comes from camera and GPS module. The data is processed inside microcontroller and further sent to the flight controller. In our project the microcontroller will be used is arduino and raspberry pi. The reason of using these microcontroller is that these controller are easy to program and its flexible to use it. The data is processed and further sent to flight controller.

2.2.5 WORKING OF FLIGHT CONTROLLER AND OTHER PARTS OF THE DRONE

Almost all flying robot consist of flight controller. Flight Controller is the basic part of the drone which makes the drone fly, change its direction and perform operation from the given input. All the basic functions of the drone depend on flight controller. Flight controller is also a type of microcontroller specifically made for drone. The FC is controls rotors of the drone to make the drone fly as desired by the pilot. Like other microcontrollers FCs also consists of small memory, processor and different I/O ports to attach various devices. 15 There are many types of FCs available in the market, but the one we will be using is the APM flight controller which is programmable and has all the facility that can be used in our project. The flight controller thus can be programmed as desired to make this project successful.

2.5.6 USE OF IMU , ACCELEROMETER AND GYRO

IMU (inertial motion unit), Accelerometer and Gyroscope are all in one embedded in the chip called MPU 6050. The chip collects the data of co-ordinates, acceleration and gyroscopic info, and send it to flight controller which helps in stability and smooth motion of the drone. It will help us to collect data of the co-ordinates of the which will help us to control the drone trajectory when it is flying. As well as it will also help us to control the acceleration of the drone while performing an various operations.

2.5.7 THE FINAL RESULT

All process mention above is the basic and crucial steps to make self-controlled drone. The outcome of this whole process will be a drone which is autonomous, safe for the people while flying at lower altitudes and to dodge obstacles. The success of this project will help us in various fields such as delivery at lower levels, military expedition, search and found operations and the places where human can't reach such jungles, caves, etc.

III. CONCLUSION

In this world, where the technology is continuously increasing, machine are becoming more and more advanced, this project will be a step to achieve the goal to meet today's standard. Self- Controlled Drone will not only bring change in the world of Drones but also start a new journey of making autonomous drones safer and more efficient then it now.

By using the aspects of artificial intelligence and machine learning this drone will be self-driven and can be used in public places as well. This drone can be used in ample of area where humans are not easy to reach such as jungle, caves, damaged area due to natural disaster where people are struck, in defence and military operations, search and found operations. This drone will hover at lower altitude safely which will also help in less power consumption by the drone, and will help the drone to travel longer distances compared to today‟s drone.

REFERENCES

1. Davide Falanga, Suseong Kim, and Davide Scaramuzza "How Fast is Too Fast? The Role of Perception Latency in High-Speed Sense and Avoid",IEEE,2019
2. Tobi Delbruck, Yuhuang Hu and Zhe He, "V2E: From video frames to realistic DVS event camera streams", IEEE,2008.
3. Anton Mitrokhin, Cornelia Ferm¨uller, Chethan Parameshwara, Yiannis Aloimonos , "Event-based Moving Object Detection and Tracking", Department of Computer Science, Institute for Advanced Computer Studies, and Neuroscience and Cognitive Science Program, University of Maryland, USA.
4. Elia Kaufmann, Antonio Loquercio, René Ranftl , Matthias Müller , Vladlen Koltun , Davide Scaramuzza., "Deep Drone Acrobatics", Robotics: Science and Systems, 2020.
5. Ryad Benosman, Charles Clercq, Xavier Lagorce, Sio-Hoi Ieng, and Chiara Bartolozzi, "Event-Based Visual Flow ", IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING SYSTEMS, VOL. 25, NO. 2, FEBRUARY 2014.

6. Jin-Chun Piao and Shin-Dug Kim, "Adaptive Monocular Visual–Inertial SLAM for Real-Time Augmented Reality Applications in Mobile Devices", Department of Computer Science, Yonsei University 2017.
7. Matia Pizzoli, Christian Forster and Davide Scaramuzza, "REMODE: Probabilistic, Monocular Dense Reconstruction in Real Time ", Robotics and Perception Group, University of Zurich, Switzerland.
8. Barza Nisar, Philipp Foehn, Davide Falanga, Davide Scaramuzza, "VIMO: Simultaneous Visual Inertial Model-based Odometry and Force Estimation", Robotics: Science and Systems Conference, Freiburg, 2019, and the IEEE Robotics and Automation Letter.
9. Junhaeng Lee, T. Delbruck, Paul K. J. Park, Michael Pfeiffer, Chang-Woo Shin, Hyunsurk Ryu, and Byung Chang Kang, "Gesture-Based remote control using stereo pair of dynamic vision sensors ", Institute of Neuroinformatics, University of Zurich and ETH Zurich, Switzerland
10. Tomoyuki Mori and Sebastian Scherer, "First Results in Detecting and Avoiding Frontal Obstacles from a Monocular Camera for Micro Unmanned Aerial Vehicles", Carnegie Mellon University, Pittsburgh..
11. Tobi Delbruck, "Fun with Asynchronous Vision Sensors and Processing ", Inst. of Neuroinformatics, University of Zurich and ETH Zurich.
12. Tobi Delbruck and Shih-Chii Liu, "Data-Driven Neuromorphic DRAM-based CNN and RNN Accelerators.", Sensors Group, Institute of Neuroinformatics University of Zurich and ETH Zurich, Switzerland.