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Design Fabrication and Analysis of Nano Quad-Copter Video Transmitting Drone Controlled by Smart Phone (Butterfly)

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Abstract: ***This paper presents an account on design, analysis and fabrication of Nano Quadcopter with 1080-Pixel video camera which transmits video to and controlled by a Smartphone. The aim of this project is to Create or fabricate a Nano Quad-copter drone under the guidelines of Civil Aviation Department's "New Drone Policy of India- 2018" which is below 250 grams. With addition to it we also tried to control it by Smartphone through Wi-fi and transmit video in real time in the same screen.***

Keywords: Nano Quad-Copter, Nano Drone, Small Drone, Commercial drone, Smartphone Controlled Drone, Video Transmitting Drone, Raspberry Drone, Mini Drone, Butterfly.

I. INTRODUCTION

Drones are one of the most anticipated sunshine industry from 2020, it is expected to take Quantum leap in a few months. Some of the Start-Ups and Entrepreneurs are trying catch the bus before it leaves the stop. World countries are aware of it and India as one of the technologies driven economy is very much aware of it. So, Indian Government's Civil Aviation Department drawn a policy called "New Drone Policy of India- 2018" which states that all Drone users should be licensed to fly one but a Nano Drone. We thought it would be a big opportunity for our economy by creating a commercial or a domestic drone which could be used by everyone by controlling through there Wi-Fi enabled Smartphone. We believe that it will be a Pioneer move for a paradigm shift. We named our drone as Butterfly. The reason behind it is we thought that it was in a Pupa stage when we were working on it. When it started to fly it predict it will be a big change and bring another dimension in our economy and in all our life. So, let's make way for the new Butterfly in our space

II. BODY DESIGN

In the initial stage we want an existing solid modelling so that it will give us some ideas about the real difficulties such as weight management, space management, size management, technical errors, body strength, safe strength, damage durability, air flow variables effect on body and etc. So, we went for hand-carving modelling method and did a successful model. All the above we learned some important lessons from many golden mistakes we did. After that we designed the model in Engineering diagram and with that as a reference, we managed to draw it in solid modelling software in 3-D. With that help we decided to print it in 3D printing. Now we go a precisely sized Drone body frame.

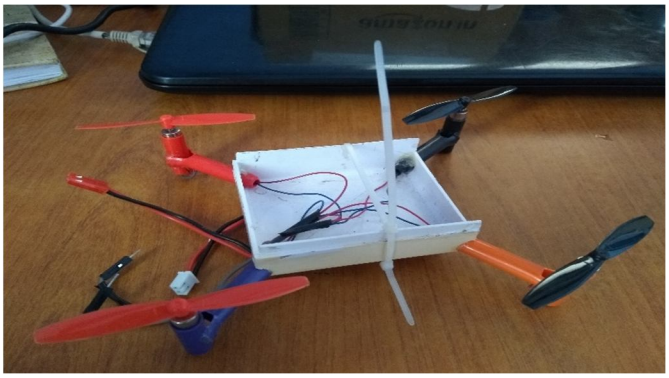

Fig: 1 Hand- Carve Model

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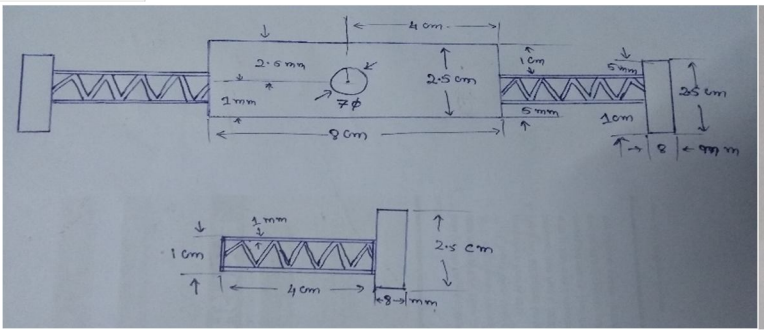

Fig: 2 Engineering Design Drawing (Front View)

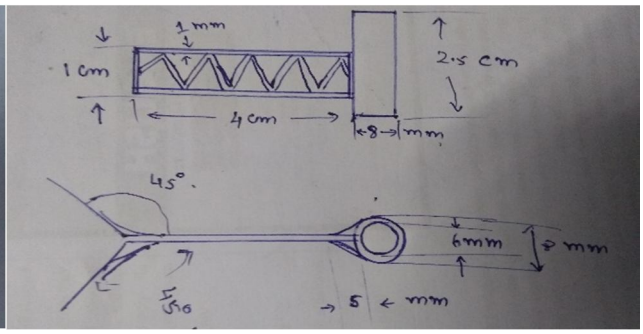

Fig: 3 Arm Drawing

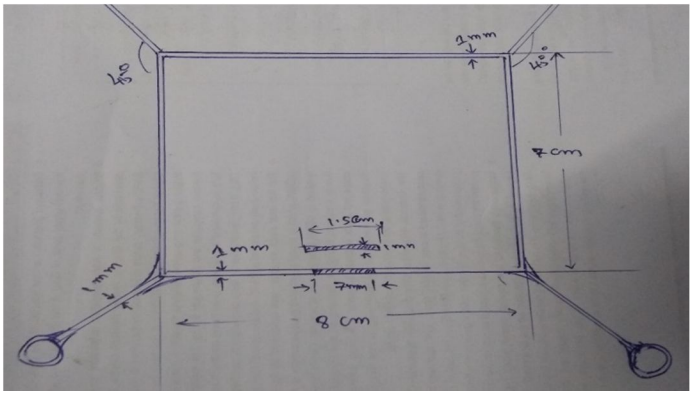

Fig: 4 Engineering Design Drawing (Top View)

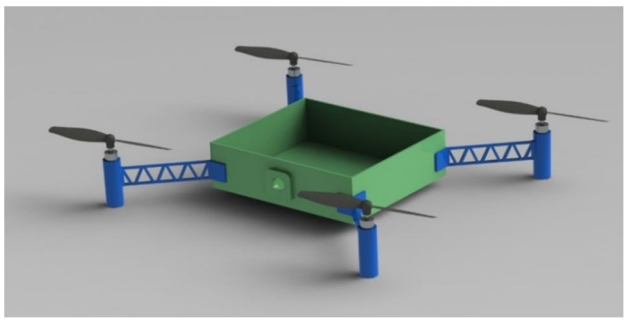

Fig:5 SolidWorks Design

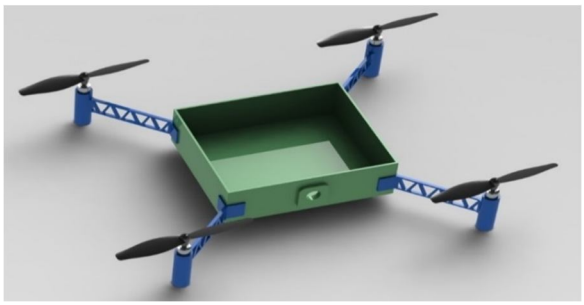

Fig:6 SolidWorks Design 2

III.COMPONENTS USED

TABLE 1

Si-No	Components	Quantity
1	Raspberry Pi Zero W	1 Nos.
2	Arduino Nano	1 Nos.
3	Arduino Gyroscope	1 Nos.
4	Coreless motor	4 Nos.
5	DC Motor Driver – MOSFET	4 Nos.
6	Pi Camera	1 Nos.
7	Pi Camera Module Cable	1 Nos.
8	Propeller	4 Nos.
9	Battery Orange Li-Po (6.4V)	1 Nos.
10	Multi-Purpose PCB Board (8x7 cm)	1 Nos.
11	1 mm Gauge Wires (Red & Blue)	Required Amount

IV. SOFTWARE USED

A. Raspbian OS
B. Python
C. Arduino IDE
D. Embedded C
E. Putty.exe
F. VNC Server

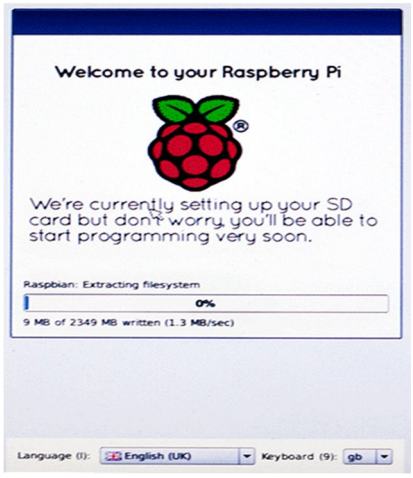

Fig:7 Raspbian OS

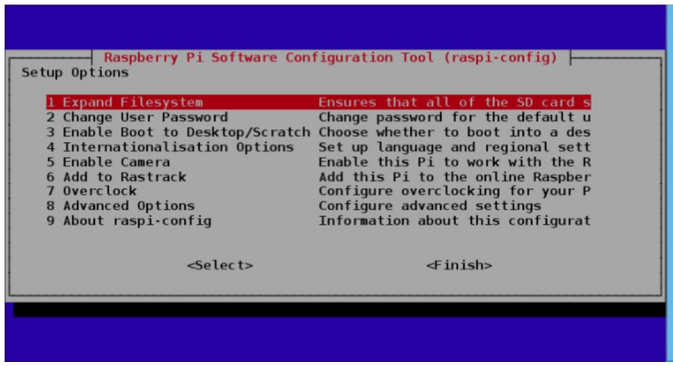

Fig: 8 Raspiconfig

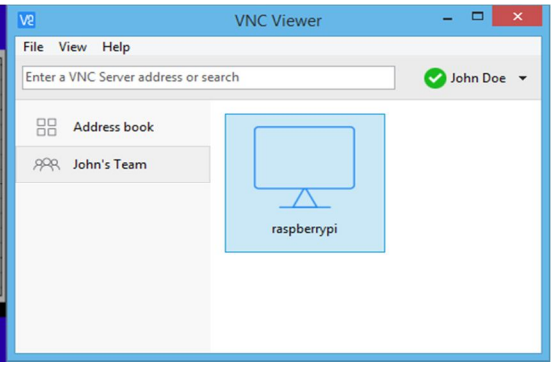

Fig: 9 VNC Server

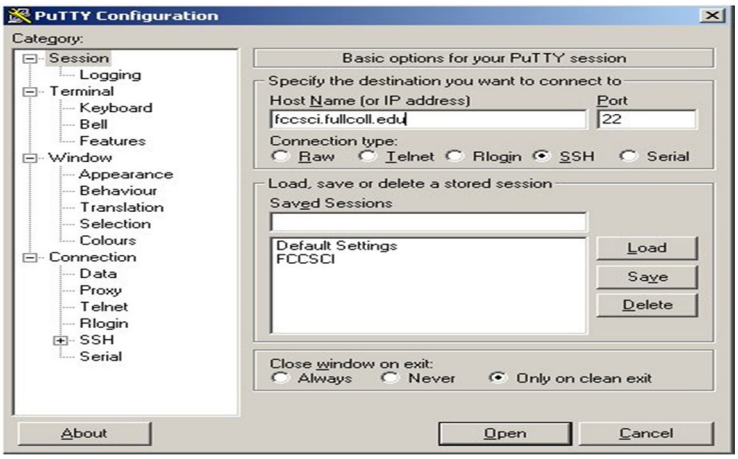

Fig: 10 Putty.exe

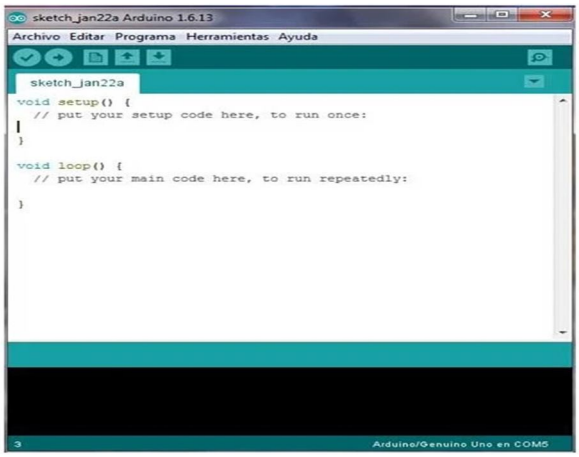

Fig: 11 Arduino

```
for i in traceVecs:
    newVecs = []
    for a in range(LENGTH):
        r = p.Noise(noisetype, False, i * nScale, octaves=5, time=1) # 4 x noise ?
        angle = r * TWOPI
        sn, cs = SinCos(angle)

        i.x += cs * speed
        i.z += sn * speed

        r = p.Noise(noisetype, False, i * nScale, octaves=5, time=50)
        angle = r * TWOPI
        sn, cs = SinCos(angle)

        i.y += cs * speed
        i.x += sn * speed

        r = p.Noise(noisetype, False, i * nScale, octaves=5, time=100)
        angle = r * TWOPI
        sn, cs = SinCos(angle)

        i.z += cs * speed
        i.y += sn * speed

        newVecs.append(c4d.Vector(i))
    strand.append(newVecs)


sc = c4d.BaseObject(c4d.Onull)

for l in strand:
    lo = c4d.BaseObject(c4d.Oloft)
    theseVecs = l
    for i in range (0,len(theseVecs) - 1):

        start = theseVecs[i]
        end = theseVecs[i + 1]
        rot = lookBack(start,end)
        ob = c4d.BaseObject(c4d.Osplinecircle)
```

Fig: 12 Python

V. CIRCUIT DIAGRAMS & CONNECTIONS

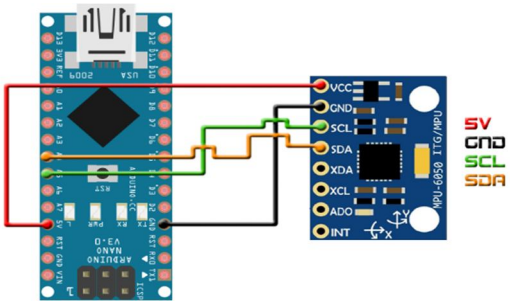

Fig: 13 Arduino Nano & Gyro

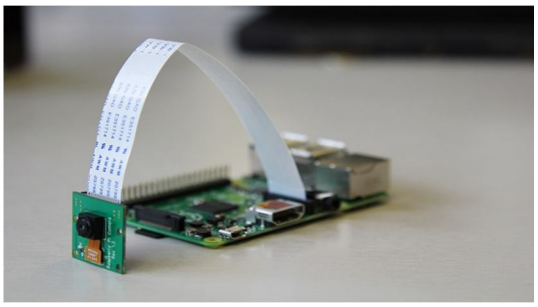

Fig: 14 Raspberry Pi Zero W & Pi Camera

VI. ANALYSIS

The Design is been analyzed in the Solidworks software for both Static and Dynamic load. In the static part the Load is been applied in center of the design and four corner the material. For static load we applied 250 grams of load to check the strength of the design, and it was a Safe & Successful Design. In the CFT analysis we considered all the variables like weight of the Quad-copter, Gravity and Ambient Air Variables. It was a Sound and Safe design in CFT analysis. Due to our Pratt Bottom Chord Truss design for our Arm, We eliminated the Ambient Air effect on our Nano Quad-copter Drone

VII. SMARTPHONE CONTROLLER

The Drone is been controlled by the Raspberry OS Raspbian in Raspberry pi zero W (Wi-fi enabled). It could be connected and controlled through Wi-fi in Smartphone. At the same time it can transmit the Video of Raspberry pi Camera eye in the flying drone in real time on the same screen of Smartphone. Now the drone can be commended and manipulated as per the smartphone controller wish.

Fig: 15 Nano Drone with Camera which is Video Transmitting and Controlled by Smartphone via Wi-fi

VIII. RESULT & CONCLUSIONS

The Objectives of building a Nano Quad-copter Drone is built by designing in a hand caved modelling and specified the dimensions in the engineering hand drawing and 3D modeled in Solid-Works software. The Structure of the body is build in 3D printing process with Poly Latic Acid(PLA) filament. We Selected the materials for the Nano Quad-copter Drone as per the calculation and requirements Eg: Body material, Coreless motors, Raspberry pi zero W, Arduino Nano , Arduino Gyroscope, PCB board, Pi Camera, Li-Po Battery and Wires. We went for the right and available software as per the specifications and made possible to Fly the drone as well as recorded and transmitted the video in the real time via Wi-fi.

We conclude our paper by happily announce you that our Butterfly have found way out of his Pupa. We are monitoring him from the egg stage to a Beautiful Butterfly form. When he came out of his egg as just an idea, we hoped his growth will be a difficult part for us. We thought he may even die as an idea but he surprised us every time by not only surviving but also inspiring. He inspired us by coming to our dreams in night and day. When he attained the Caterpillar form as just a Hand-Carved body, he was moving very slow as a worm but never stopped. He ate everything that came by as food (Arduino Uno, Arduino Nano, Gyroscope, a 3.7V battery which eventually burned and nearly killed him) and digested them all. For a very longtime we thought we were helping him to grow but really, he helped us to make our lives meaningful and Knowledgeable. He grew himself as a Pupa connected with electronic chips & wires and stayed in our college ECE lab updating himself with many computers. They say “Idealness is a fools desire”, but his idealness was the thirst for knowledge. His desire for a better growth. An insect waiting for his right moment to fly and inspire many lives in our world is over.

If you want to see him don’t look here in down. Look into the sky, He is already flying.

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