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Design of a Bluetooth controlled Aerial Airship

A Low Cost Blimp Prototype For Various Applications.

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Abstract - *In this paper an aerial blimp is presented that can be controlled using a Bluetooth application. The application is based on Android Operating System based smart phones. The uniqueness of the blimp model lies in its cost effectiveness without compromising on the efficiency. The indoor flying blimp uses three servo motors for propulsion and Lithium ion batteries for power. A Bluetooth module is used for connectivity between the smart phone and the blimp. Helium gas is used as a lifting agent. The total weight of the blimp flying mechanism is not more than 12 grams. It is ideal for indoor flying and surveillance.*

Key Words: **blimp; bluetooth; servos; android; helium; arduino**

1.INTRODUCTION

In today's era there is a need of development of new low cost technologies in the field of robotics. Also low weight aerial robots models are being developed for ease of flying. Aerial robots such as quad copters require a meticulous design and use of high power motors. Weight of the frames is also high since it is generally made from metal. Also if the quad copter crashes into an obstacle, it gets destroyed completely and has to be again made from scratch. A lot of money goes in making them. Considering these problems, there is a need to design an aerial robot that is light weight, easy to design, that doesn't involve rebuilding the entire model when it crashes after hitting an obstacle and also has a low cost of development. Therefore Aerial Blimps are a solution to the mentioned problems as their model combines light weightiness, low power consumption and cost effectiveness. The main advantage of a blimp is that they use very less power and are also easy to test than drones or quad copters as the hardware is not damaged easily. Blimps are super light in weight and have great crash resistance. They make practically no noise therefore suited for wildlife photography or for live coverage of an indoor event. Basic structure of blimp is shown in figure 1, generally aerial robots are control by remote control using RF transmitter and receiver but in our model we use Bluetooth with the help of an android application thus making it possible to control the blimp with your personal smart phone. Basic structure of blimp is shown in figure 1; this makes the blimp very suitable for low cost applications [1].

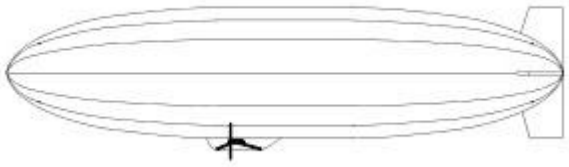

Fig-1: Basic Airship Structure

2. SELECTION OF STRUCTURE OF THE BLIMP

There can be various structures for a blimp the basic one being that its shape is held with the help of the pressure of its internal gases. We also have the rigid structure in which a metal framework is provided therefore making it a stronger and reliable structure but increasing the weight. We use a balloon made of latex which is not difficult to acquire and is cheap too. It also can be replaced conveniently in case it gets damaged compared to other aerial robots that have to be built from scratch if they crash and get damaged [2].

3. LIFTING AGENT

Earlier airships made the use of hydrogen as the lifting gas which was the lightest available at that time. Typically it was generated by reacting dilute sulphuric acid with metal filings. The first hydrogen balloon in 1783 used Hydrogen generated by iron filings whereas the British nully used Zinc [1].The disadvantage in using hydrogen gas is that it is flammable thus risking the entire airship in case of a fire. The discovery of the inert gas Helium caused a breakthrough as it was lighter than air but also not flammable and the procedure of making it was simple and nontoxic. Helium is 92.7% of the buoyancy of hydrogen therefore making it a

preferable option. We have thus used Helium as the lifting gas for the blimp because of its various positives over the other gases [1].

4. THE GONDOLA

Gondola is the term used to describe the electronic circuitry designed for maneuvering or steering the airship. The Gondola of the blimp consists of three motors. Mini servo motors with continuous rotation are used for our application. We have a front, back and center motor for ease in steering the blimp. The weight of the gondola has to be such that it can be lifted by the helium filled latex balloon and can float at a steady height without any actual power driving it. That is the blimp should be able to carry its weight, not go down or fly above but be steady at a certain height [1].

5. CONTROL MECHANISM

The control mechanism is simple; the Bluetooth app sends commands such as right left up or down and accordingly the front back and center motors switch on and off. Each aspect of the control mechanism is discussed below:-

5.1 Servo Motors

The motors used are hacked micro servo motors. The general servo motors basic structure of is shown in Fig 2 which are used in operations where we need the motors to move only up to the desired angle and stop when they reach there. But we need continuous rotation for our application. If we dismantle all the pins and gears attached to the micro servo we get a motor that provides continuous rotation as desired and this is called as a hacked servo motor with rotates 360 degrees with continuous motion. These motors are also light weighted therefore can be easily lifted by the blimp. The front motor helps in turning the blimp in any direction, the back motor is used for steering the blimp in forward or backward direction and the center motor is for moving the blimp up or down [5].

The specifications are:

- Tower Pro SG90 servo motor.
- Weight: 9 grams.
- Pulse width: 500-2400 microseconds.

Fig-2: Micro Servo motor

5.2 Microcontroller

The main points to be taken to consideration while selecting a microcontroller are that it should be easily available, also easily programmable in a known programming language, it should be able to interface the different modules used together and most importantly it should be light weight and compact in size to suit our application. The microcontroller selected is Arduino Pro Mini. Its basic structure is shown in figure 3which a part of the family of very versatile and open source Arduino platform. Easy programming of the chip can be done with C Programming on the open source Arduino IDE, thus serving our purpose [10].

The specifications of Arduino Pro Mini are as follows:

- ATmega328 running at 16MHz with external resonator (0.5% tolerance)
- 0.8 mm thin Printed Circuit Board (PCB).
- Weight: 2 grams
- 5 V regulator
- Maximum 150mA output current
- Digital I/O pins: 14
- DC input: 5 V -12 V

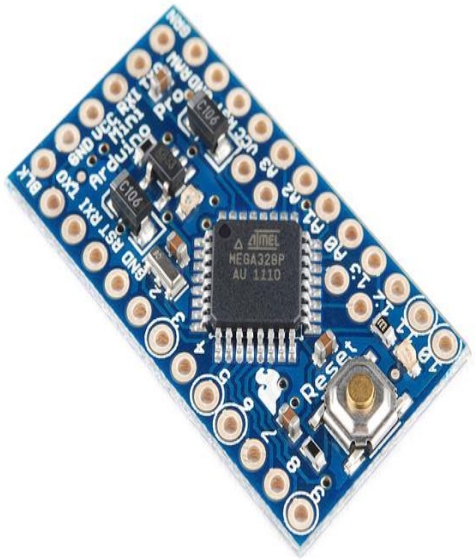

Fig-3: Arduino Pro Mini

5.3 Wireless Communication

There are different wireless communication standards such as Zigbee or Wi-Fi or Bluetooth after doing comparison [4][5]. As per our cost and range specifications we have selected the Bluetooth HC 05 model [11].
The specifications are as follows:

- Low Power 1.8V operation, 1.8V to 3.6V I/O.
- UART interface with programmable baud rate.
- Typical -80dB sensitivity.
- Permit pairing device to connect as default.

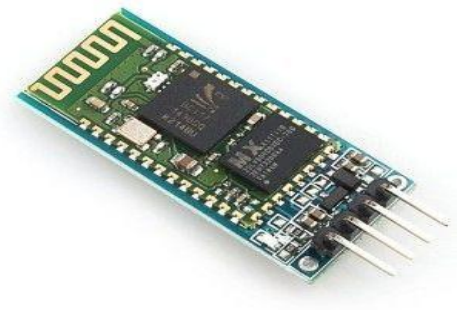

Fig-4: HC-05 Bluetooth Module

5.4 Smart Phone Application

Since we are using Bluetooth for wireless communication, there is a need to develop an app that can be used to control the blimp. We need an application that controls the speed of operation of the front and back motors and controls the clockwise and anticlockwise rotation of the centre motor. The development of the app is done by using the MIT App Developer 2 a platform specifically designed for development of various apps eliminating the basic need of android application coding [6].

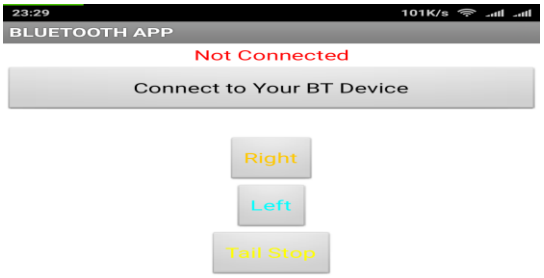

Fig-5: Smartphone Application

1.5 Power Supply

Preferred power supply for this blimp is using light weight battery available in the market and the best of them are small size lithium polymer battery because the provide more current than any other batteries[15] available in the market at this prize the basic structure is shown in figure 6 and the specification are as below :

- Type: Li-Po Battery
- Capacity: 100mAh
- Voltage: 3.7V
- Size: 19mm x 15mm x 7.5mm/0.75" x 0.59" x 0.30"

Fig-6: Li-Po Battery

6. BASIC WORKING

The basic steps of operation are as below:

- One of the command buttons on the Bluetooth Smartphone Application is pressed.
- This command is sent to the Bluetooth HC 05 module present on the blimp.
- The Bluetooth Module transmits the command to the RX pin on the Arduino Pro Mini.
- Once the command is received by the Arduino, it carries out the function that is assigned to that command whether it is turning on a specific motor or rotating it clockwise or anticlockwise.
- Thus we can steer the blimp with utmost ease and precision.

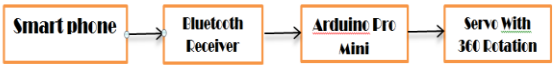

Fig-A: Control Block Diagram

7. EXPERIMENAL SETUP

We have used a balloon which is made of latex with all the setup mentioned in the paper and done an experiment with all the necessary precautions and preferred parts. In this experiment we have used helium which was filled by local vendor whereas power supply is provided externally [16] and the structure of the blimp is shown in Fig-7.

Fig-7: Bluetooth Airship

8. FUTURE SCOPE

- The range of Bluetooth is only about 10 meters so we can increase the range of the blimp by using wider range communication modules [3].
- Blimp is fully remote controlled so to make it autonomous we have to add GPS to this blimp which can be controlled by the instruction through the program fed in the microcontroller [8].
- As in the outer environment there is different type of birds and things are there so our work is to make the structure of the blimp more rigid so that it can be used outdoor [14].
- Can be used in agriculture Aviation to capture high resolution Maps [9]

9. CONCLUSIONS

We have studied the experimental characteristic of blimp and result is that it is very useful in the indoor application. But being a low cost blimp its range is less, but is easily controllable up to 10 meters and can be used as the alternative to many other unmanned aerial vehicles. There are many applications in which a blimp can be used and it can be customized according to the specific need and therefore has endless possibilities of development in many fields.

REFERENCES

[1] Airship "https://en.wikipedia.org/wiki/Airship".
[2] Simon Lactoix "Towards Autonomous Airship"R & D At LAAS/CNRS,Simon Lactoix,LAAC/CNRS
[3] L.M. Alkerdi and R.B. Fisher "Visual contol of Autonomous indoor blimp" University Of
[4] Pratibha singh,Dipesh Sharma"A Modern Study Of bluetooth Wireless technology,Rit,Raipur.
[5] Harneet kaur,Sukesha Sharma"A Comparative Study of Wireless Technologies: Zigbee, Bluetooth LE, Enocean, Wavenis"
[6] Servo motor Lab manual "SG90 9 g Micro Servo" From http://www.micropik.com/PDF/SG90Servo.pdf.
[7] MIT Application Development From http://ai2.appinventor.mit.edu/.
[8] MHV Quadcopter Workshop From https://canberrauav.readthedocs.io/en/latest/_downloads/MHV-Quadcopter-Workshop-v3.pdf.
[9] High resolution images and remote sensing"http://www.ars.usda.gov/SP2UserFiles/Place/30910515/Publications/2012/Yang%20COMPAG-88-2012.pdf".
[10] Arduino Pro mini Datasheet From https://www.arduino.cc/en/Main/ArduinoBoardProMini.
[11] The user manula of HC-05 "HC Serial Bluetooth Products" From http://www.tec.reutlingen-university.de/uploads/media/DatenblattHC-05_BT-Modul.pdf.
[12] Geoffrey A. Hollinger, Zachary A. Pezzementi, "Design and Construction of an Indoor Robotic Blimp for Urban Search and Rescue"Department of Engineering,Swarthmore
[13] Cyril Lutz,Maurice Rüegg,"The Airship "Simon" Book.
[14] Simon Lactoix "Towards Autonomous Airship"R & D At LAAS/CNRS,Simon Lactoix,LAAC/CNRS
[15] Celina Mikolajczak, Michael Kahn,Kevin White, "Lithium-Ion Batteries Hazard and Use Assessment"Exponent Failure Analysis Associates, Inc.