International Journal of Recent Advances in Multidisciplinary Topics
Volume 2, Issue 4, April 2021
https://www.ijramt.com | ISSN (Online): 2582-7839

Artificial Intelligence Based Drone for Healthcare

Arti Singh[1*], Rashmitha Shetty[2], Tanmay Kale[3], Sandhya Yadav[4], Rajiv Iyer[5]
[1,2,3,4,5]*Department of Electronics and Telecommunication Engineering, K. C. College of Engineering & Management Studies & Research, Kopri, India*

***Abstract*: Drones, due to their numerous applications ease human life. As drone technology advances, these aircraft are currently used in great demand. Pros of using drones are quality aerial image, precision, easily deployable, and security. The main objective of this work is to design and develop a drone that can be used in the healthcare sector. It is very difficult to supply basic medical kits or other healthcare items during a calamity or when there is traffic congestion due to bad weather. To overcome this problem, an artificial intelligence-based drone is designed for the delivery of necessary healthcare items. Components used in building the AI-based drone are the frame, Pixhawk flight controller, brushless motors, carbon fiber propeller, Global Positioning System (GPS), and a telemetry module. The proposed type can be controlled using a remote controller and an android mobile phone using a Qground control application. This proposed system can deliver necessary items up to1-1.5 pounds.**

***Keywords*: Quadcopter, Healthcare drone, Electrical speed Controller, Pixhawk.**

1. Introduction

Over the years, modern technology has paved the way for all industries as it evolves in the healthcare sector. Modern technology is rapidly increasing in all processes to improve the quality of people's lives. In health care, technology is rapidly increasing playing a role in almost all processes from virtually appearing on screen to lab tests. In remote areas, many people are deprived of basic health care making it available like drugs, vaccines, blood to collecting samples for investigation. Unmanned aerial vehicle (UAV), otherwise known as drones is helping to close these gaps are commonly used in situations where there is a high risk in sending a human-piloted aircraft or where using a manned aircraft is impractical. A drone can provide rapid delivery of vaccines, medications, and supplies right to the source and break the outsourcing of life-threatening communicable diseases [13]. A drone can also be used for disaster management and relief. It can provide a live video feed of the affected areas. In India, there are few locations and places which are hard to reach due to dangerous pathway and some have heavy traffic congestion or poor transport infrastructure, but then the drone is considered to be sufficient to perform some useful tasks [1]. The proposed system is unique in design and applications. This quadcopter can be used to detect an object and track that object using computer vision technology. So that it will be easy to track the person who requires an emergency.

2. Background Study and Related Work

There are ways or methodologies for Pose Estimation and we have studied one of them. They are as follows:

In the local small densely populated Taiwan, the recent spates of great natural disasters have caused a loss of lives and property. Because of the above, there is important to how to depend on a high flexibility remote sensing technology for disaster monitoring and management operations. According to the Unmanned Aerial Vehicle (UAV) technology advantages like great mobility, real-time rapid and more flexible weather, and this study used the UAV technology to urge real-time aerial photos. These photos can record and analyze the general environmental change caused by the MORAKOT typhoon. And also, after the process of Image Rectification, we could get the estimated data of newly collapsed lands to become useful references for emergency rescue [2].

The concept of employing unmanned aerial vehicles (UAV's) to accumulate imagery for disaster research and management has progressed into actual implementation in recent years. UAV's have been utilized following ecological, environmental, metrological, geological, and human-induced disasters. This paper provides a review of the recent utilization of UAVs for imagery collection for disaster monitoring and management [3].

The drone-based delivery of products could become a reality shortly, as witnessed by the increasing successful experiences in both research and commercial fields. In this paper, a prototype system exploiting a do-it-yourself quadcopter drone for delivering products is proposed. On the one hand, the hardware choices made to limit risks arising from autonomous delivery are presented. On the other hand, a framework for order placement and shipment is shown. The advantages of a system just like the one described during this paper are mainly associated with increased delivery speed, especially in urban contexts with traffic, to the likelihood to make deliveries in areas usually difficult to be reached, and to the drone's ability to autonomously perform consignments [4].

Quadcopter UAV is also referred to as quadrotor is that the next sort of helicopters having more dynamic stability than

*Corresponding author: artisingh20081998@gmail.com

helicopters. They play a predominant role in different areas like surveillance, military operations, fire sense, and some important areas having many complexities. Quadcopters are unmanned aerial vehicles with the ability of vertical takeoffs, landings, and hovering at the desired location. This research paper addresses the planning and development of an inclined arm Quadcopter for mini payload and longtime endurance [5].

Drone, due to their flexible application to facilitate human life is currently used in great demand. They perform tasks repetitively at a reasonable cost and quality level. The main objective of this work is to design and develop a Healthcare delivery drone. The delivery drone has the potential to possess an equivalent effect on traditional transportation infrastructure. Due to poor transportation infrastructure, or roads blocked by severe weather, disasters, or traffic jam, the delivery of small items like medicines, blood, and vaccines, or other healthcare items that are needed in locations with difficult access becomes critical in healthcare [1].

Object detection may be a common task in computer vision, and refers to the determination of the presence or absence of specific features in image data. Once features are detected, an object is often further classified as belonging to at least one of a pre-defined set of classes. This latter operation is understood as object classification. Object detection and classification are fundamental building blocks of AI. Without the event and implementation of AI within a UAV's on-board control unit, the concept of autonomous UAV flight comes right down to the execution of a predefined flight plan. a serious challenge with the mixing of AI and machine learning with autonomous UAV operations is that these tasks aren't executable in real-time or near-real-time thanks to the complexities of those tasks and their computational costs [6].

Hexacopter is also referred to as quadrotor is that the next sort of helicopters having more dynamic stability than helicopters. They play a predominant role in several areas like surveillance, military operations, fire sensing and a few important areas having many complexities. This paper focuses on the aerodynamic effects of hexacopter. It addresses all the aspects of hexacopter starting from mechanical design to electronics used. It provides backup to the choice of varied components with the assistance of various formulas from research papers. It also gives clear results concerning the load of components and their corresponding costs [7].

This paper presents an economical multipurpose drone equipped with multiple functionalities including water floating mechanism, water sampling, onboard sensor enabled water air quality monitoring, live video surveillance using GPS, and video capability. The proposed system integrates a water floating mechanism on the system capable of landing floating on the water surface with a high degree of stability precision. It can collect water samples with 50 ml to 100 ml per flight from the surface of water sources including pits, ponds, etc with stable water current. The system is provided with video image surveillance mechanisms on the board with GPS and video capability. we've equipped a high-quality Go-Pro 6 HD action camera on our UAV [8].

In recent years of the economic revolution, 3D printing has shown to grow as an expanding field of latest applications. The low-cost solutions and a brief time to plug make it a positive candidate to be utilized within the dynamic fields of engineering. Additive printing features a vast range of applications in many fields. This study presents the wide selection of applications of the 3D printers alongside the comparison of the additive printing with the normal manufacturing methods are shown. A tutorial is presented explaining the steps involved within the prototype printing using Rhinoceros 3D and Simplify 3D software including the detailed specifications of the top products that were printed using the Delta 3D printer [9].

This research paper aims to the expansion of Artifical Intelligence (from 2000 to 2015). During this era, it shows an upward trend in growth. In this, the evolution of AU owned an enormous development in both theories & techniques within the human society alongside time & the dramatic resolutions. during this paper we studied the evolution in AI at the start of 21st century using the foremost known publication "Metadata" which is extracted from 9-journals & 12-conference papers. during this paper, we've studied the tremendous growth within the field of AI with sustainable development [10].

Quadcopters are drones also referred to as unmanned aerial vehicles which will be controlled remotely. Quadcopters have uses in various fields. The proposed quadcopter is going to be utilized in flood relief. Components required in building the quadcopter are its frame, pixhawk flight controller, brushless motors, carbon fiber propellers, High Definition (HD) camera, Global Positioning System (GPS), telemetry module and robotic arm. The 2400kv powerful motor supplies enough strength to the propellers (carbon fibers) for smooth and balanced flight also as stability to fly in windy conditions. The proposed system can't only be controlled by the remote controller but also with an android mobile using Qground control application within a variety a 1km [11].

3. Proposed System

The prototype that we have proposed is an ambulance drone that can navigate using GPS with a set of sensors that can sense the various physiological parameters of the victim at the ground scene. They are used to send data immediately to the ambulance as well as to the nearby hospitals using GPS. This enables them to take a proper decision regarding therapeutic and diagnostic approaches. It also helps the paramedic in the ambulance to track the patient's condition and come prepared accordingly. This system also uses for detecting the object and to track them using computer vision technology.

4. Design and Development

Fig. 1, represents the diagram of the system. the foremost important stage of the merchandise is designing. the whole system is placed on the quadcopter frame. The electrical section consists of Lipo-battery, GPS module, Electrical speed controller, motors, and receiver. The battery is connected to the Pixhawk and power distribution and from Pixhawk the facility is generated and goes to the four ESC this is often how the electronic speed controls the speed of the four motors. The propellers are mounted on high-capacity brushless DC motors. The system can fly thanks to the rotation of the carbon fiber propellers. GPS and telemetry modules are wont to perform functions like maintaining the altitude of the quadcopter. The camera is connected to Pixhawk in order that it records and captures images of any object and therefore the receiver is connected to the Pixhawk which receives the signal. The system is often controlled using the remote controller also like an android mobile using the Qground control application. Path planning was wiped out the mission planner software using GPS.

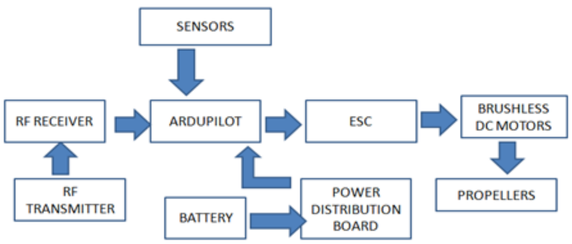

Fig. 1. Block diagram

5. Unified Object Detection

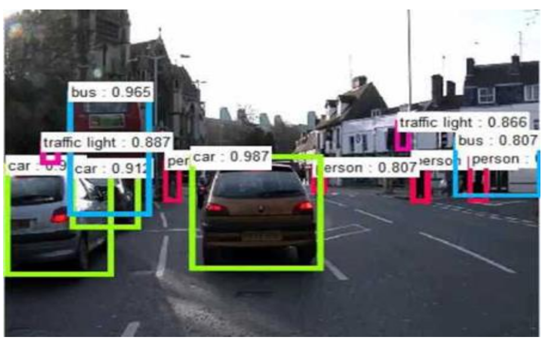

Fig. 2. The YOLO model used for testing

The structure that YOLO is built-in permits full scope training and real-time speeds whilst high average precision is maintained. The system segregates the input image into a S*S grid. Each grid cell is responsible for the prediction of B bounding boxes and confidence scores for each of those boxes. The confidence scores generated are a clear indication of how self-assured the model is when it comes to the box containing an object. The confidence is given by,

$$C = Pr(object) * IoU$$

There is a complete of 5 predictions contained in each Bounding Boxes namely x, y, w, h, and confidence. The (x; y) coordinates represent the middle of the box which is relative to the bounds of the grid cell. The width (w) and height (h) are predicted relative in respect to the entire image. Each grid cell also predicts C conditional class probabilities, Pr (Classi |Object). Each grid cell also predicts C conditional class probabilities, Pr (Classi |Object). These probabilities are conditioned on the grid cell containing an object. We only predict one set of sophistication probabilities per grid cell, no matter the amount of boxes B. At test time we multiply the conditional class probabilities and therefore the individual box confidence predictions,

$$Pr(Class\ i|Object)*Pr(Object)*IoU = Pr(Class\ i)*IoU$$

which gives us class-specific confidence scores for every box. These scores encode both the probability of that class appearing within the box and the way well the anticipated box fits the object [12].

These predictions are encoded as an, $S \times S \times (B * 5 + C)$ tensor. For evaluating YOLO on PASCAL VOC, we use S = 7, B = 2. PASCAL VOC has 20 labeled classes so C = 20. Our final prediction may be a $7 \times 7 \times 30$ tensor [12].

6. MATLAB Simulation of Quadcopter

A. *Computer Vision*

Computer vision may be a field of AI that trains computers to interpret and understand the visual world. Using digital images from cameras and videos and deep learning models, machines can accurately identify and classify objects — then react to what they "see". Today's AI systems can go a step further and take action to support an understanding of the image. We use the computer vision part of object detection and tacking in our project to discuss. How easy it can handle by detection of object and tracking by AI.

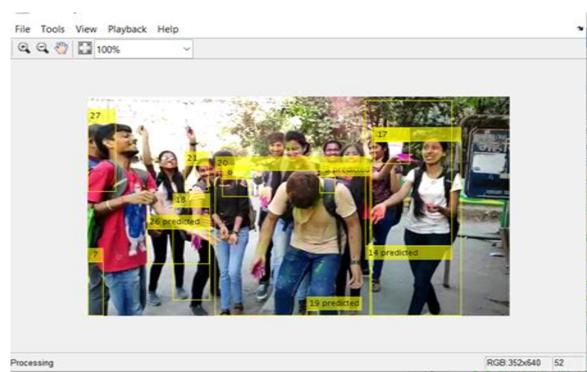

Fig. 3. Object detection in multiple frames and detect more than one image at single time

Fig. 4. This Image show Black and White colour range. Also, detection of object accuracy and motion

Applications range from tasks like industrial machine vision systems which, say, inspect bottles speeding by on an assembly line, to research into AI and computers or robots that can comprehend the world around them. The computer vision and machine vision fields have significant overlap. Computer vision covers the core technology of automated image analysis which is employed in many fields. Machine vision usually refers to a process of mixing automated image analysis with other methods and technologies to supply automated inspection and robot guidance in industrial applications. In many computer-vision applications, the computers are pre-programmed to unravel a specific task, but methods supported learning are now becoming increasingly common.

B. Simulation

In order to accurately simulate the behavior of the system, we must build a loop through which an input command to the system can be applied. Fig [5] shows how the system is implemented.

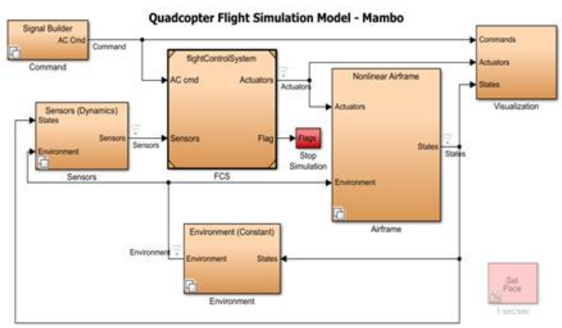

Fig. 5. Quadcopter flight simulation model

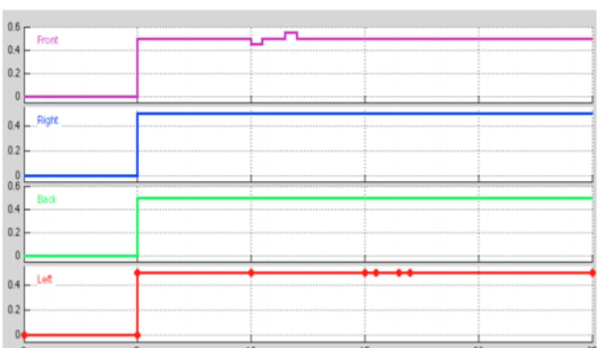

Fig. 6. Actuator signal Input for Forward path

The input block within the simulation diagram allows us to vary the commands getting to the motors. Thus, disregarding any external disturbances or noise from the physical implementation of the system, we will track how the system will react to changes within the actuator output. one among the foremost straightforward movements the craft can make may be a simple pitch or appear order to maneuver either forward/back or left/right. To the novice user unacquainted the actuator interactions and coupling, the primary attempt may involve changing the output speed of just one motor. for instance, if a small forward propagating pitch angle is desired, the primary attempt could also be to show on all actuators to realize altitude, provide a negative pulse to the front motor momentarily so as to cause the craft to pitch forwards, travel forwards for a couple of seconds before providing a positive pulse to the front motor to kick the craft out of forwarding pitch. internet movement of the craft would presumably be within the positive x-direction of the world fixed frame with no movement within the fixed y-direction. Fig. 6, illustrates the input described within the preceding paragraph.

The actuators are powered on at 5s, steadily gaining in altitude. At 10s, a negative pulse is provided to the front motor, causing a drop by speed, which should cause the craft to pitch forward and move within the positive x-direction. At 12s, a positive pulse is applied to presumably bring the craft out of forwarding pitch and back to a gentle hover.

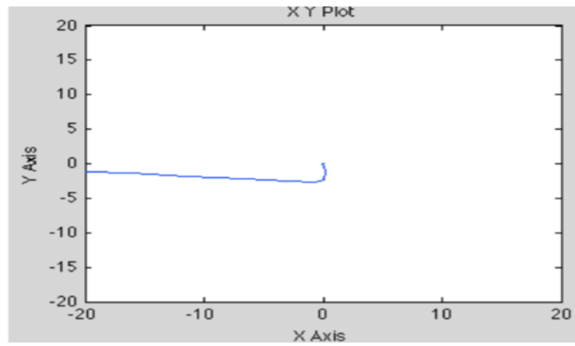

Fig. 7. Flight path under single actuator change

7. Results

The system can deliver necessary medical items up to 1-1.5 pounds. The quadcopter can fly about 50 meters above the ground continuously for 2 hours. The range for the remote controller is 2 km in open space but can also be remotely controlled by the mobile application. The HD action camera can record video 4K 30fps as well as can transmit live footage over Wi-Fi. The camera will not be affected by floodwater as it is 30m water-resistant. Also, the system will do the object detection as well as tracking of an object as the drone is equipped with computer vision to detect the people, vehicles, animals, and other key objects in real-time.

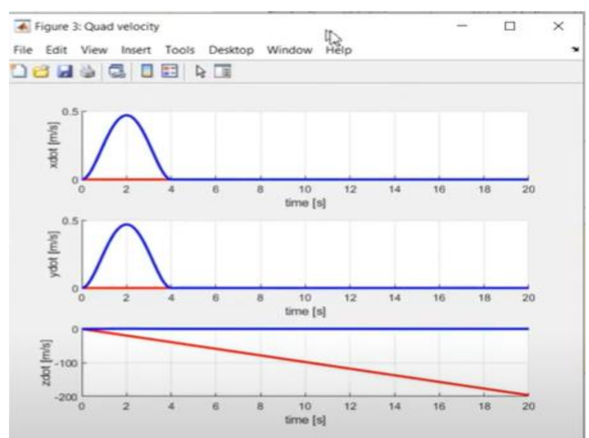

Fig. 8. Quad velocity of Drone

Fig. 8, shows the graph of the velocity of the quadcopter. In this, we observed that at the x-plot and y-plot the velocity increases from 0 to 0.5 after reaching up to 0.5 it starts decreasing again and after that, the velocity remains constant through the flight motion in the trajectory. But in z-plot, we observe that the velocity remains constant.

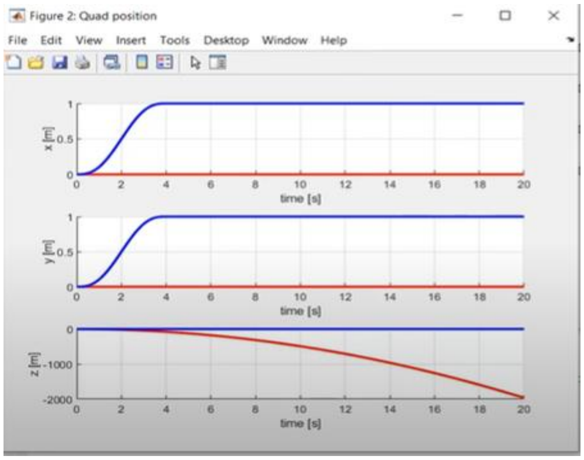

Fig. 9. Quad position of Drone

Fig. 10. Drone

8. Conclusion

The designed Drone provides an efficient and reliable method for shortcomings in the health care sectors. It is useful for improving health care, particularly in remote and disaster-affected areas. It can travel and deliver vaccines, blood, drugs, etc. in rural areas. The inbuilt hooks can be used to deliver medical kits. Drone use offers the opportunity of improving healthcare, particularly in remote or undeserved environments by decreasing lab testing turnaround times, enabling just-in-time lifesaving medical supply/device delivery, and reducing costs of routine prescription care in rural areas. The 3D printed case protects the components from any external damage during any unexpected crash. Webcam onboard will provide a live video feed of the disaster-affected areas. The floating mechanism helps the drone to be operated even on the water during any emergency landing. Hence, we have integrated both the simulation as well as to object detection and tracking of the drone on the hardware using Pixhawk Flight Controller. Fig. 10. shows the hardware of the system.

References

[1] N. Nuthatch, S. Pavithra, M. Naveen, B. Logesh, T. James, "Design and Development of Drone for Healthcare".

[2] Tien-Yin Chou, Mei-Ling Yeh, Ying-Chih Chen, Yen-Hung Chen In: Wagner W., Sz ekely, B. (eds.): "Disaster Monitoring And Management By The Unmanned Aerial Vehicle Technology" Publication: ISPRS TC VII Symposium – 100 Years ISPRS, Vi-enna, Austria, July 5–7, 2010, IAPRS, vol. 38, Part 7B.

[3] Stuart M. Adams and Carol J. Friedland "A Survey of Unmanned Aerial Vehicle (UAV) Usage for Imagery Collection in Disaster Research and Management".

[4] Valentia Gatteschi, Fabrizio Lamberti, Gianluca Paravati, Andrea Sanna, Claudio Demartini, Alberto Lisanti, Giorgio Venezia "New Frontiers of Delivery Services Using Drones. A Prototype System Exploiting a Quadcopter for Autonomous Drug".

[5] Vimal Raj, Sriram S, Ram Mohan.P, Manoj Austin T. "Design and Fabrication of Inclined Arm Miniature Sized Quadcopter UAV".

[6] Matija Radovic, Offei Adarkwa, Qiaosong Wang "Object Recognition in Aerial Images Using Convolutional Neural Networks".

[7] A.V. Javir, Ketan Pawar, Santosh Dhudum, Nitin Pafale, Sushant Patil "Design, Analysis and Fabrication of Hexacopter" Journal of the International Association of Advanced Technology and Science.

[8] Pankaj Agrawal, Mukesh Kr. Singh "A Multipurpose Drone for Water Sampling Surveillance" Second International Conference on Advanced Computational Paradigms (ICACCP), Gangtok, India, 2019.

[9] Taha Hasan Masood Siddique, Iqra Sami, Malik Zohaib Nisar, Mashal Naeem, Abid Karim and Muhammad Usman "Low Cost 3D Printing for Rapid Prototyping and its Application" Publication: 2019 Second International Conference on Latest trends in Electrical Engineering and Computing Technologies (Intellect), Karachi, Pakistan, 2019.

[10] Jiaying Liui, Xiangjie Kong, Feng Xia, Xiaomei Bai, Lei Wangi, Qing, and Ivan Lee, "Artificial Intelligence in 21st Century".

[11] Chirag Chaudhari, Mohnish Bhingarde, Ruchira Acharekar, Siddhesh Dalvi, Rajiv Iyer, "Quadcopter for Flood Relief".

[12] Joseph Redmon, Santosh Divvala, Ross Girshick, Ali Farhadi, "You Only Look Once: Unified, Real-Time Object Detection."

[13] Drone in Healthcare, https://www.dronesinhealthcare.com/