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Automated Beach Security System using Autopilot Drone

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ABSTRACT: Beach is the most attractive holiday spot to visit, over 35% of people in the India visit beach every year and witnessing 9% of drowning accidents per annum. The life-guards safes the drowning victim when the lifeguard spots the victim and reaches out there which takes a mean time of 240 minutes. This paper presents the design of the lifesaving system using the autopilot drone which delivers life-rings to victim;thus, the victimsurvives long enough until the lifeguard reaches them. The proposed system focuses on identifying the RIP Current and the drowning victim using Machine learning classification algorithms and trigger an action like Broadcasting the emergency situation to Life guard and dropping a life ring using drone. Thus, The Automated beach security system using autopilot drones results in a reduction in mean time to reach a victim and increasing the probability of a successful rescue from 93.2% to 99.6%.

KEYWORDS: video processing, autopilot drone, drowning, machine learning algorithms.

I. INTRODUCTION

Drones are an emerging technology as such there is a lot of research on potential applications. With the amount of weight, a drone can carry and with the speed a drone can travel, they seem ideal for emergency and fast responder work and hence drones were chosen to the rescue of drowning victims in hopes of saving lives.
Machine Learning has been great advancement in the field of technology, Machine learning is the brain where all the learning takes place. The way the machine learns is similar to the human being. Humans learn from experience. The more we know, the more easily we can predict. Machines are trained the same. To make an accurate prediction, the machine sees an example. When we give the machine a similar example, it can figure out the outcome. The core objective of Machine Learning here is to find the people who are swimming in RIP Currents and classify whether the person is drowning or not using the classification algorithms. This makes 24/7 observance on the beach through a fixed camera and if a drowning victim is detected it triggers the live location of the victim to drone.The paper enhances in automating the beach security process using the advanced technologies which are mentioned above such that it is more efficient than the existing manual beach security process.

II. LITERATURE SURVEY

The research was done on various aspects to find the existing system and drone laws in India and found few papers related and accepted universally, few of them are listed below

Design of the Life-Ring Drone Delivery System for RIP Current Rescue
Authors: Gang Xiang, Andrew Hardy, Mohammed Rajesh And LahariVenuthurupalli.
The manually operated drone delivers the life ring to the drowning victim ,System dynamics, UAV, stochastic simulation etc. were the methodologies

Drone laws in India with new updates in 2019 According to the Ministry of Civil Aviation, Govt. of India flying a drone is legal in India,the drone then according to the Drone Laws in India you must have to register your drone with the respective authority likeDigital Sky.

An Automatic Video-based Drowning Detection System for Swimming Pools Using Active Contours
Authors: Nasrin Salehi and Maryam Keyvanara and SeyedAmirhassanMonadjemmi.
In this paper, a real time drowning detection method based on HSV color space analysis is presented which uses prior

knowledge of the video sequences to set the best values for the color channels, HSV Color Space Analysis, Contour Detection were the methodologies.

Oceanographyis an Earth science coving a range of topics, including ocean currents, waves, plate tectonics and the sea floor. Nearshore research comprises one area of oceanographic research, understanding this is very important as the RIP currents are the major cause for drowning.

III. PROBLEMSTATEMENT

The existing systems use the manually operated lifebuoy ring delivery drone system when an drowning victim is found by the life guard. Hence without proper management by life guard or other parameters the existing systems is not very efficient to save the lives.

IV. PROPOSEDSYSTEM

The live video streaming is done to detect the drowning victim, if found the latitude and longitude points of the location of victim is updated to the drone, thus the drone flies to the location and drops the lifebuoy ring. Thus the entire existing system is automated.

V. METHODOLOGY

Prototype methodology is selected to implement the system and all the activities done for each and every stage is discussed below.

5.1 Planning

A feasibility study was conducted mainly under three categories. They are time, cost and scope. Even though this is a research project, it needed to complete within a very limited time period. Is it possible? Then check whether the project was able to complete with the limited budget which the project team had. The technologies, hardware and software components which are needed to implement the system were new to the research team. Therefore, check whether project team has interest and ability to adapt or learn new frameworks or other new technologies. After conducting these feasibility study project team identified this project was enough feasible to start implementing in the planning phase.

5.2 Requirement gathering & analysis

The requirement gathering was done using primary data and secondary data. As primary data interviews were conducted with the Disaster Recovery Center. The results of interviews were, current methods are the life guard or other person finding the drowning victim and rescuing him, whereas if no person is there at that time it may cost the loss of a life. Therefore, proper method like object detection through video streaming is done to find the drowning victim and then drone which is very small compared to other delivery methods is most suitable way to deliver goods in order to rescue human's life was the final conclusion of the interviews. As the secondary data project team went through several research papers. In this, research team researched for existing similar systems and analyzed their functionalities, to better understand the methodologies used. Information regarding object detection and autopilot techniques of the drone were analyzed using existing research as well.

5.3 Designing

The object detection structure, Convolutional Neural Network (CNN) algorithm is used as to detect the drowning victim and reports the location of the victim. The research was done in finding the best machine learning algorithm among various other, CNN algorithm stood best among it by providing more accuracy.

The drone structure, collision detection algorithm, obstacle avoidance algorithm, autopilot system and interfaces are designed as main component of the system in this phase. Hardware parts needed to implement the drone structure was contained several varieties and it is very difficult to find the best ones with the limited budget. Therefore, first small designing plan was made for the behavior of the flight controller, Power supply module, GPS Mast and how they were placed in the drone frame in more organizing way.

Figure 1 is illustrated the Architecture diagram. It is explained about main relationships between the user and other system components. The camera is connected to the personal computer (PC) and performs live video processing, if the drowning victim is detected the location is updates to the drone flight controller through the PC, the operator is used to maintain the PC functions as well as the transmitter.

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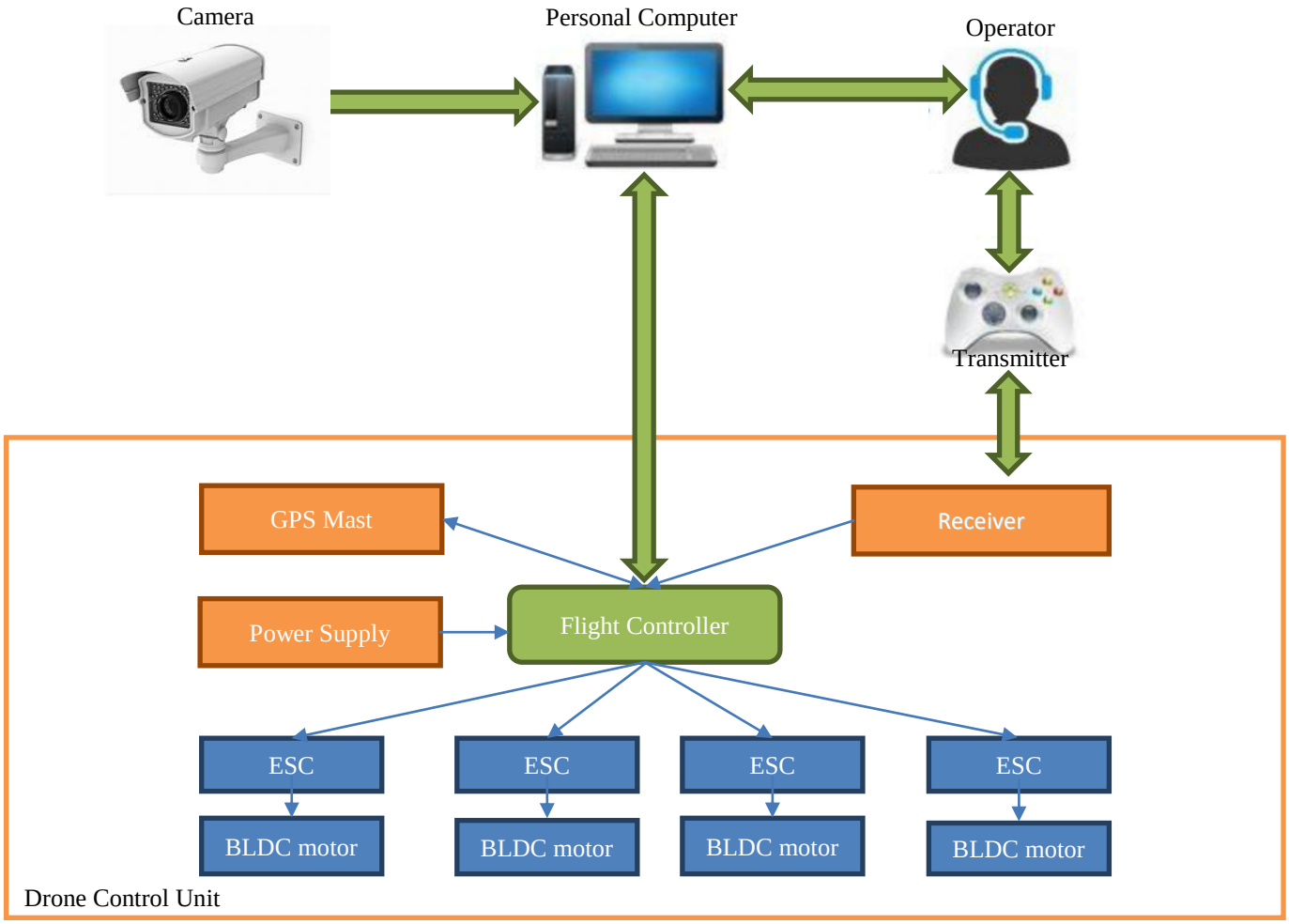

Figure 1: Architecture Diagram

4.4 Implementation

As a first step for this phase drone was implemented by combining all the hardware parts as shown in figure 2. The System is developed as separate units for the purpose of developing the code. The requirements are met by developing the system separately as smaller units and integrating to form one full system. The python language was used to code for CNN algorithm, the train and test data was sorted in 7:3 ratio for training and testing respectively. The drone was incorporated with ArduPilot flight controller and certain settings for uploading the location and other was made.
Figure 2 is the prototype of the drone.

4.5 Testing

All testing was done in the "prototype level". The two main testing methodologies used were Black-Box testing and White Box testing. Black box testing was done to ensure all the functionality of the system is working as specified. Structure of the functionalities is checked using white box testing.

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Figure 2: Drone prototype

VI. RESULT

The "Automated beach security system using autopilot drone" System has two subsystems and the result of both are shown below, the system was trained to detect three activities like Normal, Drowning and Swimming and the output of that activity detection is shown in Figure 3 Figure 4 and Figure 6 respectively. The ArduPilot software used to set the GPS Co-ordinates is shown in the Figure 5, thus the flight path is set. Now the drone is set for its flight to the victim and drop the lifebuoy ring.

Figure 3: Activity Drowning detected

Figure 4: Activity Normal detected

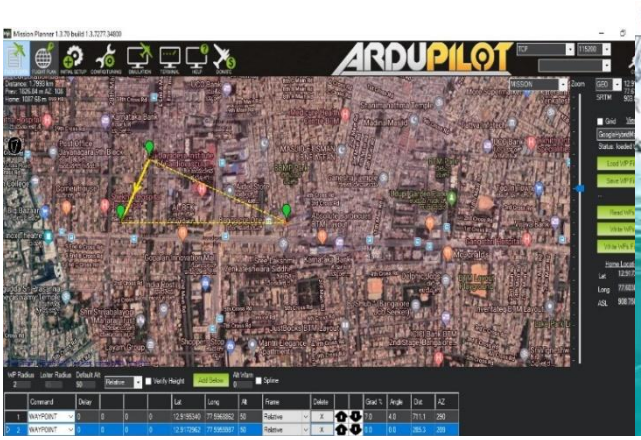

Figure 5: Drone GPS Co-ordinates fix

Figure 6: Activity Swimming detected

VII. CONCLUSION

The system is developed to save life of drowning victim, itincreases the victim survival time during the rip current rescue process.This is an autonomous drone delivery system which can easily reach to any area without any trouble and through video processing the drowning victim can be detected easily.
With all these functionalities, this system has some limitations as well. This system is completely depending on power supply. If it is not supplied, system can stop the operation. This system is not capable of travelling to long distance because of the less battery power, less motor speeds and other hardware component capacity issues in the drone. When situation like bad whether condition is occurred, this system cannot handle itself because of the less battery capacity, insufficient esc power thus not capable enough to give 100 percent accurate result.

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