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Advanced Wildlife Detection Using Thermal Imaging and Passive Infrared Sensors on a Smart Robot

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Abstract:**UAV (Unmanned Arial Vehicle) it can be utilized for many purposes. Current UAV technology is capable of performing high precision tasks, due to flight operations and possibility to equip UAV with computers and sensors, including thermal cameras. Thermal imaging is interesting technology in outdoor surveillance, pedestrian detection and agriculture use, due to the invariance to illumination and the lowered price of thermal camera. Detection of wildlife within the agricultural fields is important to reduce wildlife mortality and, thereby, promote wildlife-friendly farming. And also including PIR sensor results of capturing wild-life can improve.**

Keywords: UAV, Hybrid Drone, Wi-Fi Control, Thermal Camera, PIR Sensor

I. INTRODUCTION

Drones have been around us for years, and we are using for different purposes and it help in numerous occasions. However, these devices have become more popular in current times and their use and application increases rapidly in many fields. Mainly Drones are known for “An unmanned aircraft or vehicle that can navigate autonomously, without human control i.e. (by using remote we can control it) or beyond the line of sight”. Another definition is: “Drone is unmanned aircraft that is guided remotely”. Drones are among the most advanced devices in aeronautics, electronics and robotics alike. The use of drones has grown rapidly in recent years because unlike manned aircraft they can stay aloft for many hours. In this paper, we introducing a device (UAV) which will locate people or poisonous creatures at very small places where the intervention of human is not possible. We can also use wireless camera with it to do different types of tasks. And also by adding PIR sensor latency of getting reply is reduced.

II. LITEARUTURE SURVEY

William Metzler [1] explained Low-Cost Drone System for Analyzing Elevation the relatively recent advancements in the design and costs associated with unmanned aerial vehicles. The system consists of a sensor package of a microcontroller, Light Detection and Ranging sensor (for elevation), geospatial data from a Global Positioning System (for latitude and longitude), and a process for using spatial mapping software to convert the collected data to an elevation model. The paper will show the preliminary results from the sensor package and software tools, as well as analysis comparing the results to traditional methods. There are new opportunities forcollecting environmental data using drones because of theirdecreasing cost and design improvements. Using drones could help reduce resources needed for creating digital elevation models, which can be helpful for understanding the spatial distribution of risk associated with flooding.

Shahid Karim [2] gives an image processing based proposed drone for detecting and controlling street crimes. In this system bag of featuresapproach was tested with predefineddatabase which performance is optimal and HOG isimplemented for weapon detection and SVM is used forclassification. Activity recognition in crime scene is also help to make accurate decision in real time situations so in future we will also emphasis on the activity recognition in crime scenes. Image classification can be made more efficient by increasing the number of image sets, decreasing processing time and enhancing the average accuracy.

DymitrPietrow [3] explained digital image objects detection and recognition system using artificial neural networks and drones. It contains description based on example of person identification system where face is the key object of processing. It describes the structure of the system and components of the learning sub-system as well as the processing sub-system (detection, recognition). The system proposed in this article is used for identification of people who are located in an area of special security. The system contains a learning sub-system and a processing sub-system. The next chapters describe each component of system and most significant algorithms which have particular influence on the system’s performance. In a certain way in the course of the learning process the system better than its designer. The neural networks allowed for the system to get general knowledge about the requested object.

AakashSehrawat [4] gives an idea for surveillance drone for disaster management and military security. Several designs of such drones already exist and are being implemented for rescue operations and surveillance. However, the primary issue is

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that it can only see what an infrared sensor based camera can see out in the open field. Animate objects obstruct this drone's field of vision and hinder the ability to detect human presence past thick walls of cement. The concept of surveillance drones arises toaid the problem of tracking humans quickly withoutrisking more human lives in desperate times likedisasters or terrorist attacks. The design consists of aQuad-Copter with a Wi-Vi sensor, infrared cameraand GPS to quickly track humans from distance onareas which are not quickly reachable from landand/or are not safe for a human to reach unknowingly. Quad-Copters are still being made using different techniques in hopes of increasing its performance all over the world. The various applications it can be put through once it is developed can be of great service in the long run and may expand its scope to more fields with time.

PawełSmyczyński [6] explained the complete description of hardware and software solutions used to realize autonomous flight are presented in this work. Main objective of the research was to develop software which provides ease of adjustment and extendibility to drone system with different equipment. Presented system is utilizable on various hardware platforms and is capable of realizing different missions with minimal adjustments. Described concept significantly simplifies designing complex system by introducing modular architecture. Presented method of dividing software components into modules with single functionality minimizes amount of work necessary to adjust system in case of changes in hardware. In the near future there is a plan to change an onboardcomputer to more powerful one so that it allows morecomplex operations without introducing additional delay intothe control loop. This should enable further work ondevelopment of the more efficient control law.For the general design no immediate changes are needed,however introducing the new set of nodes for controllingadditional equipment e.g. gimbal movements is considered. For data handling nodes there are two categoriesas described before. There are two nodes in Hardware handlenodes. The first one is GPIO handle node which is responsiblefor managing GPIO pins on Raspberry Pi board.

RikSmit [7] Objects on the ground are detected by a UAV using the on-board camera and Computer Vision (CV) algorithms. A framework is built that uses a video recorded with a UAV as input for a detector that is given the task to locate the different objects (animals) in the recording. The detector will run o_-line, i.e. after the UAV recorded the videos and landed safely on the ground. A framework has been developed that incorporates the aspect of collecting and annotating data, and using machine learning and computer vision for detecting animals in natural environments. Instead of the use of airplanes, helicopters or satellites to obtain ground images, also UAVs have been used. An unmanned aerial system (UAS) can be developed to automatically detect and inspect targets located on the ground. This method can reduce the time required to act on situations where now the UAV first has to return to a central point for inspection.

III. SYSTEM ARCHITECTURE

The proposed system is development of smart hybrid drone using thermal camera and PIR sensor. The system is used for detection of wildlife animal using thermal camera and PIR sensor. Drone is controlled using android app and the output of the PIR sensor is displayed on the application.

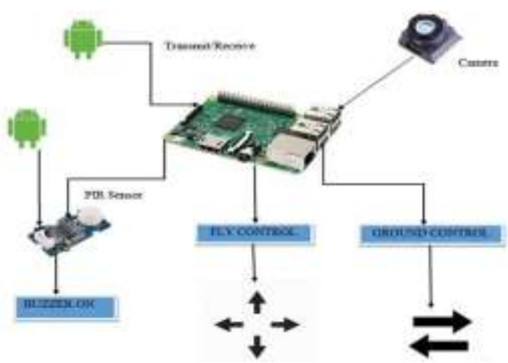

Figure 1 System Architecture

Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects which can be sensed and controlled both physically and digitally. We have used Arduino Nano for connecting and controlling PIR sensor. RC Board consists of Resistor and Capacitor. This board is used to transmit and receive the electrical signals. PIR sensor i.e. Passive Infrared sensor, this sensor does not emit IR signals itself, rather passively detects the infrared radiations coming from the human body in the surrounding area. We use this PIR sensor to detect animal. Camera is used for getting live view from robotic device. This camera is also known as network camera. We are using ESP8266 Wi-Fi module to access Wi-Fi network. Using this module we are controlling the robotic device through android app which is connected using Wi-Fi. Bluetooth HC06 module to get output of PIR sensor over smartphone app. This module enables PIR sensor's result to be displayed over the smartphone app using bluetooth of smartphone. Android app is used to control the robotic device and for getting PIR sensor output. Generally, we are using two android apps. One for controlling the robotic device and receiving the output of the camera on smartphone. Another application is use to get output of PIR sensor.

IV. ALGORITHM

PID algorithm for controlling Motors:-
Proportional–integral–derivative controller is algorithm by using we can control motor speed and we can control the drone and operate with respect to our requirement.
The feature of the PID controller is the ability to use the three control terms of proportional, integral and derivative influence on the controller output to apply accurate and optimal control.

Luminance Algorithm:-
To generate thermal view output on mobile app by using Luminance Algorithm can easily generate.

V. RESULT

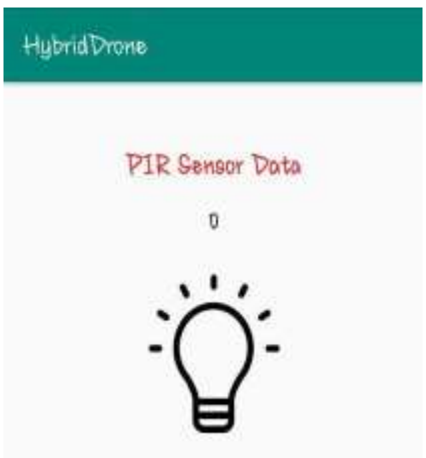

Figure 2 Buzzer Output before Sensing

Figure 3 Buzzer Output after Sensing

Figure 4 Normal View

Figure 5 Thermal View

Figure 6 Controlling Drone

VI. CONCLUSION

Using Thermal Camera and PIR sensor, we can easily detect wildlife and will receive result more accurately. Hybrid smart robot helps us in tracking of exact location of animal or human. In future, GPS module can be added to get exact location and also by using Image processing, recognition of wildlife is possible.

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