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Target Identification and Tracking Using UAV

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Abstract----Unmanned Air Vehicles (UAV) have been widely used in the battlefield. They are usually employed for surveillance and intelligence gathering. An Automatic Targeting System (ATS) would greatly enhance its capability for such reconnaissance. Therefore this project aims to design such a system onto UAVs. The ATS includes the camera system and the wireless communication system. The camera system provides the 'eyes' for the UAV, and the wireless communication system reports the actual GPS position of the target. There are two different methods for creation of the image patches. Initially the stored image patch created prior to flight with previous flight data is used for detecting and tracking. The next method takes in images manually and it is further used for detecting and tracking the object.

I. INTRODUCTION

Unmanned aerial vehicle or UAV have great potential in military as well as civil missions. It is a fast developing remote sensing platform in present world. In rescue and surveillance mission people and vehicle detection from aerial platform has become an important aspect of deployment for autonomous unmanned aerial vehicles (UAV) system. Ground target tracking is an important application of UAV. Human quest for an automatic detection system of everyday occurrence lead to the necessity of inventing an intelligent surveillance system which will make lives easier as well as enable us to compete with tomorrows technology and on the other hand it pushes us to analyze the challenge of the automated video surveillance scenarios harder in view of the advanced artificial intelligence. Now a day, it is seen that surveillance cameras are already prevalent in commercial establishments, with camera output being recorded that are either rewritten periodically or stored in video archives. To extract the maximum benefit from this recorded digital data, detect any moving object from the scene is needed without engaging any human eye to monitor things all the time. Real-time segmentation of moving regions in image sequences is a fundamental step in many vision systems. Background subtraction is a typical method. Image background and foreground are needed to be separated, processed and analyzed. The data found from it is then used further to detect motion. In this work accurately detecting moving objects have been developed and analyzed.

The method chosen to obtain the goal, the problems faced during the implementation and the primary idea of the solution is discussed, along with the proposed algorithm with its describe implementation of algorithm, simulation results and conclusions and the future work.

II. PROPOSED DESIGN OR FLYING PLATFORM

The quad rotor designed with expandable poly propylene material to reduce the gross weight. Four geared motors are used to fly the UAV. The design can act as a UAV as well as drone. It has USB and Wi-Fi (802.11n) interfaces. The onboard sensors are made more sensitive for better control. The ultrasound altimeter is enhanced with the addition of an air pressure sensor, allowing for more stable flight and hovering.ARM CORTEX processor is used. It is designed with the customized flight control system. FCS consists of accelerometer gyro and magnetometer. Three axis gyros are used to get stability. Calibrated compass is used to indicate the direction. It can achieve maximum of 165ft altitude. And the endurance is 20-30mins. Lithium iron battery is used to give the power to the UAV. Inertial measuring unit is used for the orientation purpose. It is designed with twin cameras for safer side. Cameras are mounted in front of the UAV which is front camera and another one is a vertical camera mounted downwards.

A. Front camera 720p sensor with 93° lens, recording up to 30fps.
B. Vertical camera: QVGA sensor with 64° lens, recording up to 60fps.

The source code is designed with a facility of using any camera for future purpose. It accepts all type of HD cameras. Considering camera as the main hardware, in this paper the high resolution cameras are used. It can automatically avoid blurriness and clutters. This paper is designed with the ability of using both cameras. The data can be collected after the UAV landing with the flight recorder.

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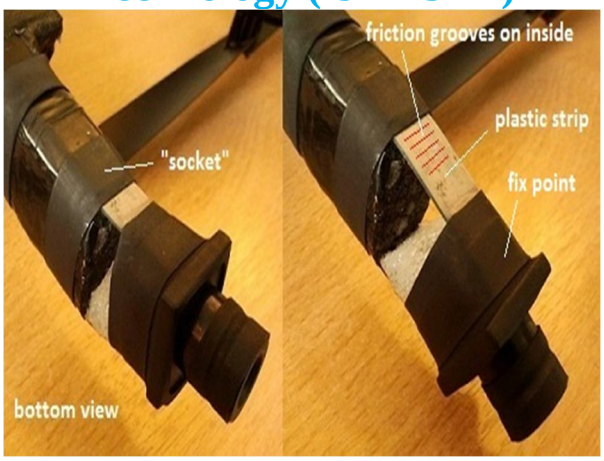


Figure 1: Front Camera

III. TARGET IDENTIFICATION SYSTEM ARCHITECTURE

This is main part of this project. The SURF algorithm is used to identify the particular object and then the background will be subtracted to follow the identified object.

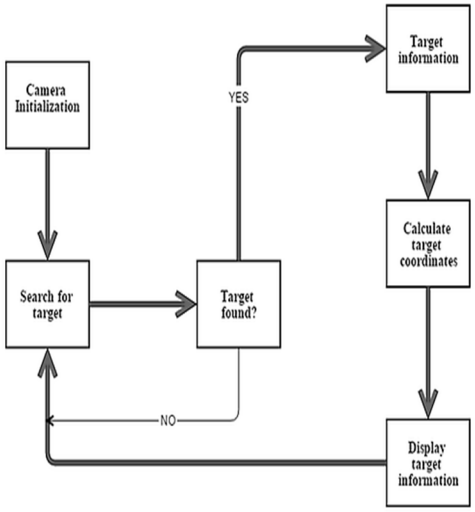


Figure 2: Target identification system

Serial communication will be initialized to start the communication between camera and the computer. After the initialization the camera starts to search for the defined target in the environment. There are two options. It may detect the object or may not detect. If it detects the defined object the target information will be collected and then transmitted to ground control system or GCS to calculate the center point of the target. The information is then used to calculate the target position/ X, Y coordinates altitude and time. The information of the object will be displayed in the system monitor. If the target is not found then the UAV starts to search the target again. If the target is missing for a long time the UAV will come back to its starting position. Ultrasonic sensor used to collect the data about the target and the Wi-Fi is used to transmit the data to the ground control system GCS.

IV. IMAGE PROCESSING

Two tasks are given to the processor to complete this project. First one is ground motion estimation and second task is target

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detection and tracking. Depending on imaged scene both tasks leads to many problems. In order to avoid this target identification and tracking is made simpler by assuming the color and the size of the target or object. And the tests are conducted in daytime. The target standard specification parameters are stored in the beginning of the source code. This allows ease in changing the parameters to cater for different mission which may require targeting of different vehicle. This paper used the source code which has the flexibility of changing the camera and its parameters.

An example of image processing is shown in figure 3.

When capturing the video simultaneously the coding will change the original images into grayscale image. First window shows the original image from the video camera and the second window demonstrate the image which is processed from the original video. Information about the UAV is updated by the micropilot. It collects height and heanding of the UAV. Targrt information is sent to GCS only when the target is found.

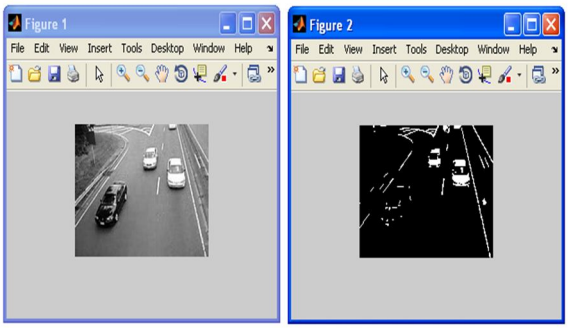
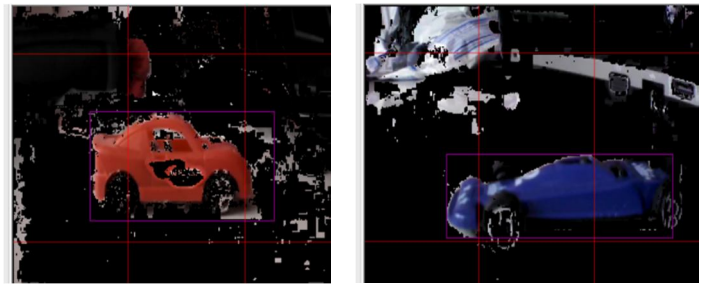


Figure 3: Image Processing

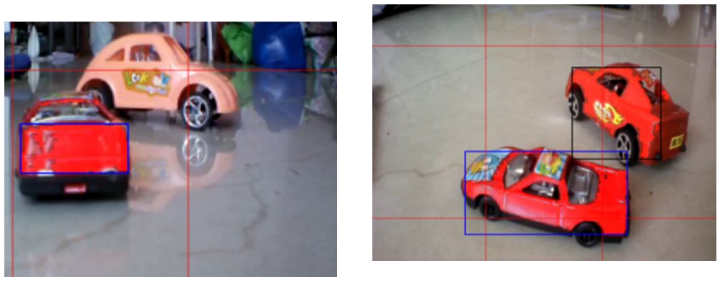
V. EXPERIMENTAL RESULT

In order to test the designed target identification system, a test is conducted. Preliminary test is color matching and the next one is vehicle detection. The below images are the results got from the test. The small size of car with 10cm by 10cm is used as a target to get the experimental result.



(a) Red Target (b) Blue Target

Color detection with background subtraction (a) and (b)



(c) Object detection without background subtraction (d) Multiple Target Detection

Figure 4: Experimental result

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From figure 4 it's clearly understood that the target identification system works properly. Pictures a and b are the examples of background subtraction in color based target detection and tracking and figure c gives the result without background subtraction. Image d is the multiple target identification. The final tests were carried out for checking data transmission and found a good result.

VI. CONCLUTION

This paper proposed the UAV for vision based target identification and tracking method in all types of environment. This paper has mainly highlighted on automatic target identification system. It begins with designing the source code for the real time experiment build on UAV. The full system has been designed and tested carefully before integrating into UAV. All the required tests have been tested and integrated successfully.

This has proven the concept of target identification system. If we can replace the camera with military specified camera clearer and better results can be achieved.

VII. FUTURE WORK

This paper concentrated on multiple target identification but single target tracking. Future it can be upgraded with multiple targets tracking system with different object parameters. The target identification parameters like size, color are preloaded before the integration. In future it will be better if the parameters can be changed by the GCS. In this paper we used only ground moving targets. It can be developed to identify and track the air targets.

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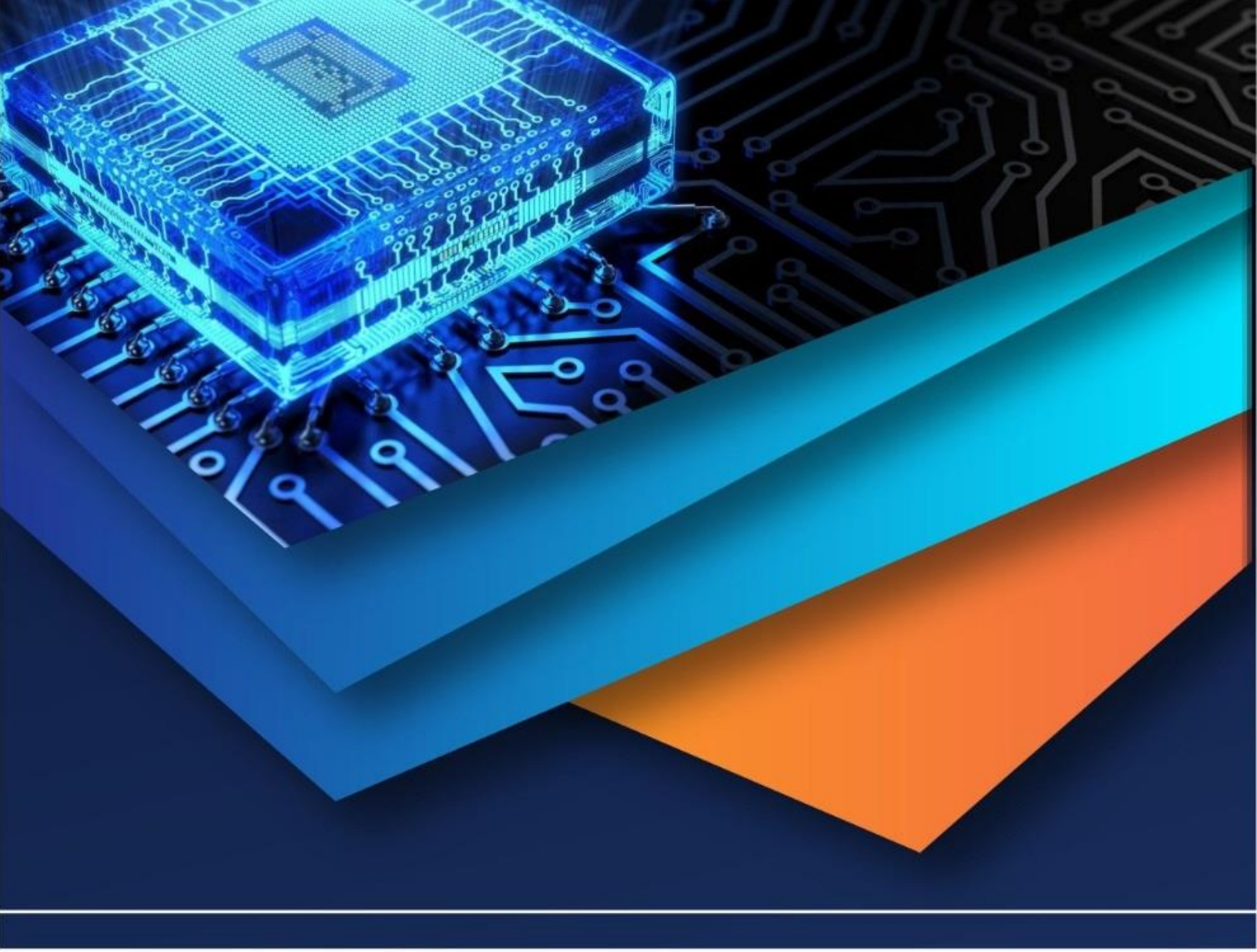
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