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Object Reorganization and Tracking using Unmanned Aerial Vehicle

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ABSTRACT

This is a vision based control strategy for tracking and following objects using an Unmanned Aerial Vehicle. We have developed an image based visual serving method that uses only a forward looking camera for tracking and following objects from a multi-rotor UAV, without any dependence on GPS systems. Our proposed method tracks a user specified object continuously while maintaining a fixed distance from the object and also simultaneously keeping it in the center of the image plane. The algorithm is validated using a Drone in outdoor conditions while tracking and following people, occlusions and also fast moving objects, showing the robustness of the proposed systems against perturbations and illumination changes. Experiments show that the system is able to track a great variety of objects present in suburban areas, like peoples, windows, AC machines, cars and plants.

1. INTRODUCTION

The motivation of this work is to show that Visual Object Tracking can be a reliable source of information for Unmanned Air Vehicles (UAV) to perform visually guided tasks on GPS-denied unstructured outdoors environments. Navigating populated areas is more challenging to a flying robot than to a ground robot because it requires to stabilize itself at all moments; in addition to the other usual robotics operations. This provides a second objective to the presented work to show that Visual Serving, or positioning a Vertical Take-Off and Landing (VTOL) UAV relative to an object at an approximate fixed distance, is possible for a great variety of objects. The capability of autonomous tracking and following of arbitrary objects is interesting by itself; because it can be directly applied to visual inspection among other civilian tasks.

2. LITERATURE SURVEY

This paper describer's a system that enables a low-cost quadrocopter coupled with a ground-based laptop to navigate autonomously in previously unknown and GPS denied environments. Our system consists of three components: a monocular SLAM system, an extended Kalman filter for data fusion and state estimation and a PID controller to generate steering commands. Next to a working system, the main contribution of this paper is a novel, closed-form solution to estimate the absolute scale of the generated visual map from inertial and altitude measurements.

3. PROPOSED SYSTEM

A technique for automating the methodology of detecting and tracking objects utilizing color feature and motion was introduced. Video Tracking is the methodology of finding a moving object over the long distance using a camera. The main aim of video tracking is to relate target objects in consecutive video frames. The relationship can be especially troublesome when the objects are moving speedy with respect to the frame rate. An interchange situation that grows the unpredictability of the issue is the time when the tracking object changes orientation after eventually. For these circumstances video tracking frameworks typically utilize a movement model which depicts how the image of the target may change for distinctive conceivable movements of the object. In this work an algorithm is developed to track the real-time moving objects in different frames of a video using color feature and motion.

4. OVERVIEW OF REAL TIME OBJECT TRACKING

Tracking can be characterized as the problem of assessing the trajectory of an object in the picture or image plane as it moves around a scene. The requirement for high power PCs, the accessibility of high quality and modest camcorders, and the expanding requirement for automated feature analysis has produced a lot of interest for object tracking algorithms. There are three key steps in feature analysis: recognition of target moving objects, tracking of such objects from frame to frame, and analysis of object tracks to perceive their conduct. In its least complex form, tracking can be characterized as the issue of evaluating trajectory of an object in the image plane as it moves around a scene. The main goal of this investigation is to track the real time moving objects in different video frames with the assistance of a proposed algorithm.

4.1 BLOCK DIAGRAM

The algorithm has been developed for real-time object detection and tracking using color feature and motion. Tracking of the object is done on the basis of region properties such as centroid, bounding box etc. Here, motion detection and tracking is done using background subtraction and optical flow method. Most of the time median filtering is used in image processing to remove noise during real-time object detection and tracking. Median filtering is far better the convolution technique when the aim to prevent edges and to eliminate noise. Specify the characteristics or property of video input. Begin with video acquisition. Separate the frames from video input. After separating frames from the acquired video generate image after subtraction contains motion region and noise. Median filter is used to eliminate noise. Morphological technique is used for further processing. Vertical along with horizontal projection is utilized to detect the height of motion part. Make the Video Device framework object. Make a framework object to calculate path and velocity of object movement from one video frame to another utilizing optical flow technique. Set up the vector field lines.

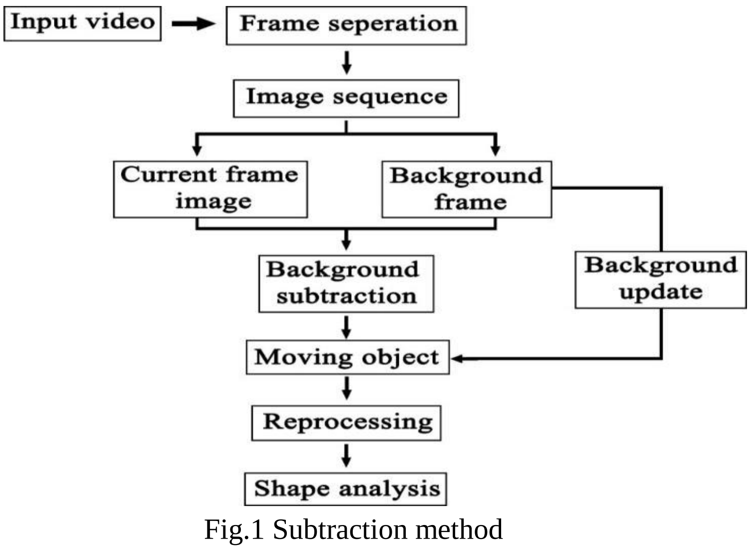

Fig.1 Subtraction method

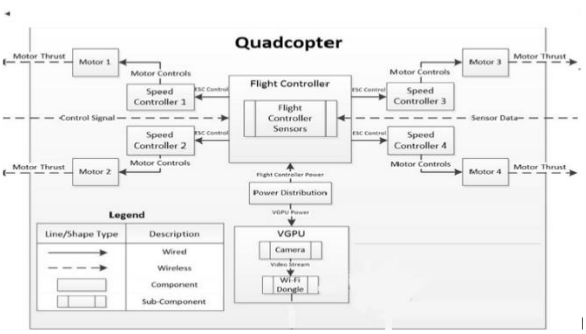

Fig 2: Block diagram of the UAV

5. RESULT AND DISSCUSION

The tests where various urban objects were used as targets, one of them with selected targets moving along a street a car and a person following tests along suburban area streets and tests were people were followed from close distances showing occlusion handling.

Various tests were performed to ascertain what kind of objects could be tracked visually. The selected targets ranged from a quarter of the tuned size to more than ten times the tuned target surface. The drone was able to visually track all these targets even when the objects were at a distance, relatively far from the stable visual tracking position.

The bounding box can be chosen with background on it and the tracker and system will still work successfully. The reason for this is that big targets tend to move slowly in the image plane, which accounts for the tracker's higher performance. People following was highly successful.

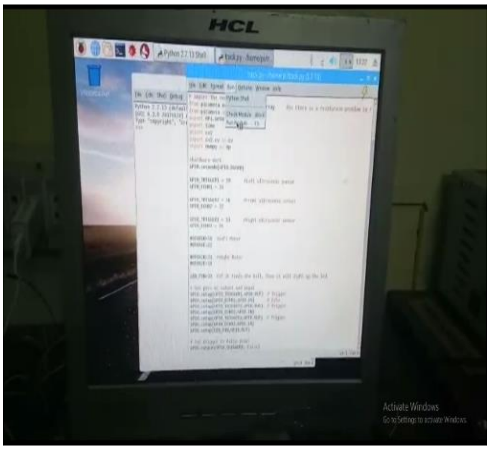

Fig 3 Running of python program

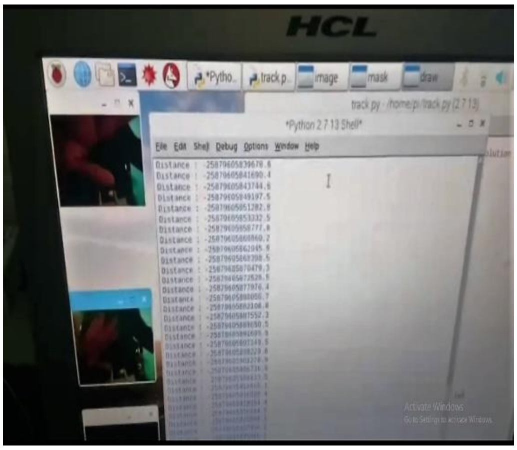

Fig 4 Tracking program running

A second battery of tests was performed to showcase moving object following, mainly including people following and some car following tests. For small moving targets, such as logos on people's t-shirts, the best performance was achieved when no background is included in the bounding box.

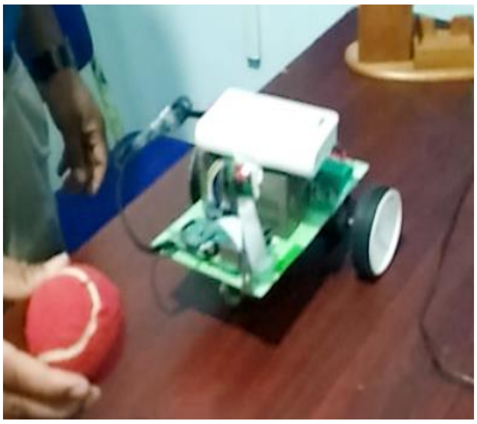

Fig 5 Tracking of a ball using rover

6. CONCLUSION

A visual based object tracking and following system is presented. Our flying robot is able to follow a variety of static and moving targets, without any dependence on GPS signals, using a recently developed visual tracking and target model learning algorithm. The system does not require the targets to be marked, and no prior knowledge about the targets is required. Our system has been able to perform Visual Serving task on targets of varying size, from a quarter to more than ten times the tuned target size, and at varying distances from 1-2 m to 10-15 m of distance from the target. It has also achieved person following at up to 1.5 m/s of speed. All the experiments have been performed in an unstructured suburban area, in an outdoors environment. Our system has been tested for person following tasks being able to handle occlusion by trees or other people. The computations are performed in an offboard computer that commands the vehicle from a WiFi link. Safety is assured even when the wire-less connection is suddenly degraded by using a multirotor platform that can attain on-board autonomous hovering using floor optical flow. The main contribution of the paper is to demonstrate that Visual Servoing on a great variety of targets including person following with occlusions handling, on an unstructured suburban area, and without dependence on GPS signals is feasible by a current low-cost but reliable UAV robotic platform.

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REFERENCES

[1] T. Hamel and R. Mahony, “Visual servoing of an under-actuated dynamic rigid-body system: an image-based approach,” Robotics and Automation, IEEE Transactions on, vol. 18, no. 2, pp. 187–198, 2002.

[2] Muthukumaran. N and Ravi. R, 'Hardware Implementation of Architecture Techniques for Fast Efficient loss less Image Compression System', Wireless Personal Communications, Volume. 90, No. 3, pp. 1291-1315, October 2016, SPRINGER.

[3] Muthukumaran. N and Ravi. R, 'The Performance Analysis of Fast Efficient Lossless Satellite Image Compression and Decompression for Wavelet Based Algorithm', Wireless Personal Communications, Volume. 81, No. 2, pp. 839-859, March 2015, SPRINGER.

[4] C. Mart´ınez, I. F. Mondragn, P. Campoy, J. L. Sanchez-L ´ opez, and ´M. A. Olivares-Mendez, “A hierarchical tracking strategy for vision- ´based applications on-board uavs,” Journal of Intelligent & Robotic Systems, pp. 1–23, 2013.

[5] Muthukumaran. N and Ravi. R, 'VLSI Implementations of Compressive Image Acquisition using Block Based Compression Algorithm', The International Arab Journal of Information Technology, vol. 12, no. 4, pp. 333-339, July 2015.

[6] Muthukumaran. N and Ravi. R, 'Simulation Based VLSI Implementation of Fast Efficient Lossless Image Compression System using Simplified Adjusted Binary Code & Golumb Rice Code', World Academy of Science, Engineering and Technology, Volume. 8, No. 9, pp.1603-1606, 2014.

[7] Ruban Kingston. M, Muthukumaran. and N, Ravi. R, 'A Novel Scheme of CMOS VCO Design with reduce number of Transistors using 180nm CAD Tool', International Journal of Applied Engineering Research, Volume. 10, No. 14, pp. 11934-11938, 2015.

[8] Muthukumaran. N and Ravi. R, 'Design and analysis of VLSI based FELICS Algorithm for lossless Image Compression', International Journal of Advanced Research in Technology, Vol. 2, No. 3, pp. 115-119, March 2012.

[9] Manoj Kumar. B and Muthukumaran. N, 'Design of Low power high Speed CASCADED Double Tail Comparator', International Journal of Advanced Research in Biology Engineering Science and Technology, Vol. 2, No. 4, pp.18-22, June 2016.

[10] N. Muthukumaran, 'Analyzing Throughput of MANET with Reduced Packet Loss', Wireless Personal Communications, Vol. 97, No. 1, pp. 565-578, November 2017, SPRINGER.

[11] P.Venkateswari, E.Jebitha Steffy, Dr. N. Muthukumaran, 'License Plate cognizance by Ocular Character Perception', International Research Journal of Engineering and Technology, Vol. 5, No. 2, pp. 536-542, February 2018.

[12] H. Zhang and J. Ostrowski, “Visual servoing with dynamics: control of an unmanned blimp,” in Robotics and Automation, 1999. Proceedings. 1999 IEEE International Conference on, vol. 1, 1999, pp. 618–623 vol.1.

[13] N. Muthukumaran, Mrs R.Sonya, Dr.Rajashekhara and Chitra V, 'Computation of Optimum ATC Using Generator Participation Factor in Deregulated System', International Journal of Advanced Research Trends in Engineering and Technology, Vol. 4, No. 1, pp. 8-11, January 2017.

[14] Ms.Mary Varsha Peter, Ms.V.Priya, Ms.H.Petchammal, Dr. N. Muthukumaran, 'Finger Print Based Smart Voting System', Asian Journal of Applied Science and Technology, Vol. 2, No. 2, pp. 357-361, April 2018.

[15] Ms. A. Aruna, Ms.Y.Bibisha Mol, Ms.G.Delcy, Dr. N. Muthukumaran, 'Arduino Powered Obstacles Avoidance for Visually Impaired Person', Asian Journal of Applied Science and Technology, Vol. 2, No. 2, pp. 101-106, April 2018.

[16] Mrs. S. Murine Sharmili, Dr. N. Muthukumaran, 'Performance Analysis of Elevation & Building Contours Image using K-Mean Clustering with Mathematical Morphology and SVM', Asian Journal of Applied Science and Technology, Vol. 2, No. 2, pp. 80-85, April 2018.

[17] R. Mahony, A. Brasch, P. Corke, and T. Hamel, “Adaptive depth estimation in image based visual servo control of dynamic systems.” In Decision and Control, 2005 and 2005 European Control Conference. CDC-ECC ’05. 44th IEEE Conference on, 2005, pp. 5372–5378.

[18] Keziah. J, Muthukumaran. N, 'Design of K Band Transmitting Antenna for Harbor Surveillance Radar Application', International Journal on Applications in Electrical and Electronics Engineering, Vol. 2, No. 5, pp. 16-20, May 2016.

[19] Akhil. M.S and Muthukumaran. N, 'Design of Optimizing Adders for Low Power Digital Signal Processing', International Journal of Engineering Research and Applications, Vol. 5, pp. 59-65, March 2014.

[20] Muthukumaran. N and Ravi. R, 'Quad Tree Decomposition based Analysis of Compressed Image Data Communication for Lossy and Lossless using WSN', World Academy of Science, Engineering and Technology, Volume. 8, No. 9, pp. 1543-1549, 2014.

[21] O. Bourquardez, R. Mahony, N. Guenard, F. Chaumette, T. Hamel, and L. Eck, “Image-based visual servo control of the translation kinematics of a quadrotor aerial vehicle,” Robotics, IEEE Transactions on, vol. 25,no. 3, pp. 743–749, 2009.

[22] I. Mondragon, P. Campoy, M. Olivares-Mendez, and C. Martinez, “3dobject following based on visual information for unmanned aerial vehicles,” in Robotics Symposium, 2011 IEEE IX Latin American and IEEE Colombian Conference on Automatic Control and Industry Applications (LARC), 2011, pp. 1–7.