

# Object Tracking and Image Stabilization using PixyCam and Arduino

## Simple Approach to Image stabilization and Object Tracking

Ashik Eapen Mathews<sup>1</sup>, Rachel Sara Jacob<sup>2</sup>, Reshma Susan Biju<sup>3</sup>, Ushus Maria Joseph<sup>4</sup>

<sup>1</sup>BTech Student <sup>2</sup> BTech Student, <sup>3</sup> BTech Student <sup>4</sup>Assistant Professor

<sup>1</sup>Department of Computer Science and Engineering

<sup>1</sup>MBC CET, Kuttikanam, Kerala, India

**Abstract:** Tracking systems based on image processing is widely used in various fields. It aims at the problem of image blurring while photographing in vibration environment. Many people tend to shake the hand while taking a photograph or video. The project helps in stabilizing the video or image captured via a camera in a vibration environment using color detection algorithm. This technique learns the environment and then stabilizes the camera according to the vibration environment.

**IndexTerms -** image processing, image stabilization, object tracking, hardware based.

### I. INTRODUCTION

Now a days we all take photos and we need it to be as good and sharp as possible. While we take a photo on a vibration environment we have the risk of getting a shaken image and we will get the blurred image as the input and we will have to bare with the lose of loosing the perfect snap. But now here proposes the way to reduce vibration by image stabilization and also object tracking. Tracking a moving target using computer vision technology is a research hotspot. It can be used by government in many occasions, such as moving target tracking in ground strike missions, tracking of vehicle crime in urban anti-terrorism combat, etc. Here presents a pixy camera module which centers the target for object tracking. The pixy camera module will move in accordance with the target as it moves. Also servomotors are used for providing the image stabilization.

### II. SYSTEM DESIGN

There are mainly two function the paper proposes that is image stabilization and object tracking. The image stabilization is done using the simple physical motion compensation and object tracking is done using the Pixy CMU Cam5.0 and the image stabilization is done using the Arduino Nano and the Servomotors

Now let us understand these different components.

#### 2.1 Pixy CMUCam5.0

Pixy is a smart vision sensor you can quickly “teach” to find objects. It saves you time by only outputting the object data you're interested in. A multitude of connection(s) options means that you can use Pixy with almost any microcontroller. It connects it directly to Arduino with the included cable, and fully supports Raspberry Pi and BeagleBone Black with included software libraries. Included inside the box is mounting hardware to attach Pixy to your own robot creation.



Figure 1 : PixyCam Module

The firmware or software and hardware are open source or a OpenCV , so you can tweak to your heart's delight. These are more features of Pixy Module in the Object Tracking using the purple dinosaurs or Color Code algorithm.

- Small, fast, easy-to-use, low-cost, readily-available vision system
- Learns to detect objects that you teach it
- Outputs what it detects 50 times per second
- Easily Connects to Arduino with included cable.
- All the libraries for Arduino, Raspberry Pi, etc. are provided
- C/C++ and Python are also supported
- Communicates via one of several interfaces: SPI, I2C, UART, USB or analog/digital output
- Configuration utility runs on Windows, MacOS and Linux
- All software/firmware is open-source GNU-licensed

All hardware documentation including schematics, bill of materials, PCB layout, etc. are provided in the website.

### 2.2 Arduino

Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures single board. Microcontroller and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL) permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself (DIY) kits.

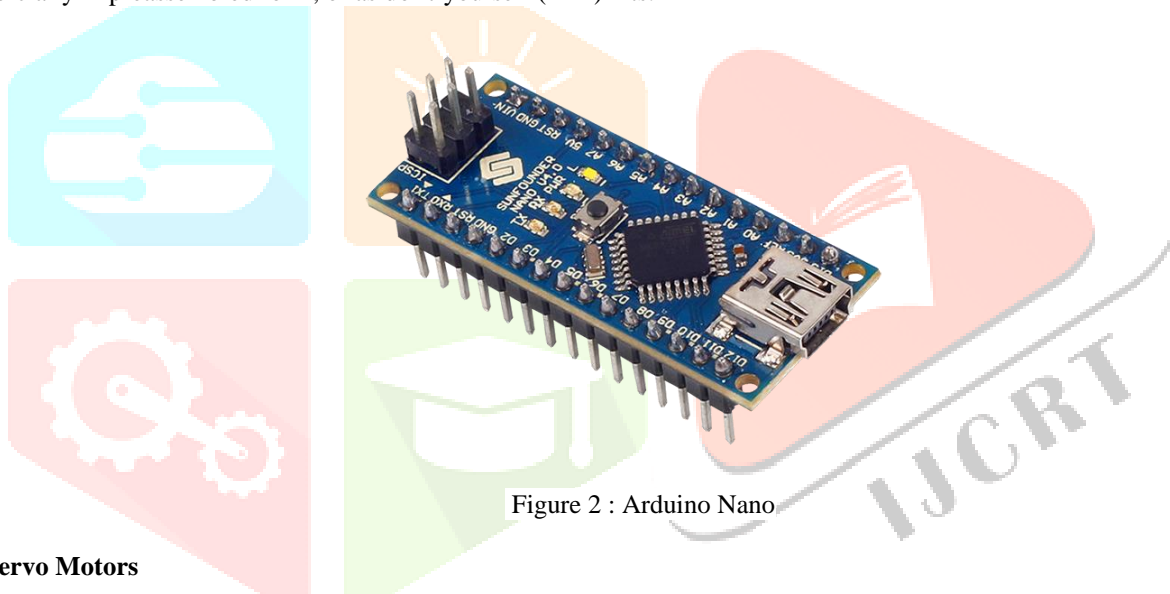


Figure 2 : Arduino Nano

### 2.3 Servo Motors

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. Servomotors are not a specific class of motor although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system. A servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft.



Figure 3 : Servo Motor

The motor is paired with some type of encoder to provide position and speed feedback. In the simplest case, only the position is measured. The measured position of the output is compared to the command position, the external input to the controller. If the output position differs from that required, an error signal is generated which then causes the motor to rotate in either direction, as needed to bring the output shaft to the appropriate position. As the positions approach, the error signal reduces to zero and the motor stops. The very simplest servomotors use position-only sensing via a potentiometer and bang-bang control of their motor; the motor always rotates at full speed (or is stopped). This type of servomotor is not widely used in industrial motion control, but it forms the basis of the simple and cheap servos used for radio-controlled models.

More sophisticated servomotors use optical rotary encoders to measure the speed of the output shaft and a variable-speed drive to control the motor speed. Both of these enhancements, usually in combination with a PID control algorithm, allow the servomotor to be brought to its commanded position more quickly and more precisely, with less overshooting.

### III. PROPOSED MODEL

The image capturing subsystem consists of a camera and a data transmission line. A general image capturing system includes a lens, a camera, an optical source and an image transfer circuit. In this paper, a general USB interface camera is good enough to capture the high-quality image information of the object being tracked. The object tracking subsystem is the key part of the whole system. The platform usually used is a general-purpose computer or embedded microcontroller. The core of this subsystem is an image processing algorithm. It detects the object in the image and calculates its coordinates by the appropriate algorithms selected. The subsystem is executed on a laptop using PixyMon.

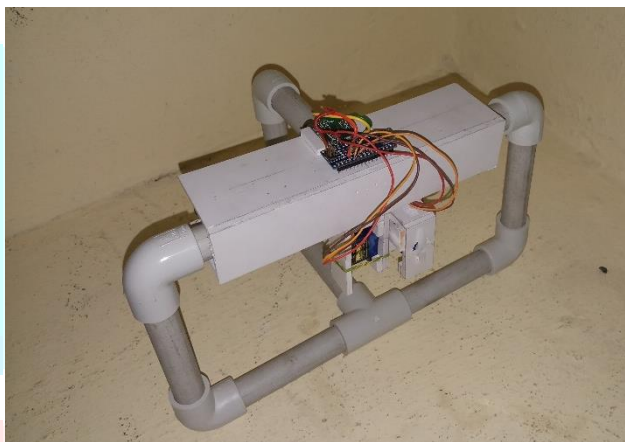


Figure 4 : Image Stabilization module only

Firstly the PixyCam is powered up and then left to be in the centered position which will be according to the x and y coordinates of the accelerometer which is positioned with the Arduino in the project. The stabilization is done using the physical motion compensation. That is it will be done using the x and y out of accelerometer which feeds the Arduino and then later progresses the servo motors and the pixy camera.



Figure 5 : Image Stabilization and Object Tracking Modules together

The pixy camera is an open source platform that allow us to use it smart colour code algorithm for tracking and saving lots of color signatures and also setting it to its memory for later user. The information that we get from the pixy camera is provided to the pixymon software present in the computer for the further processing.

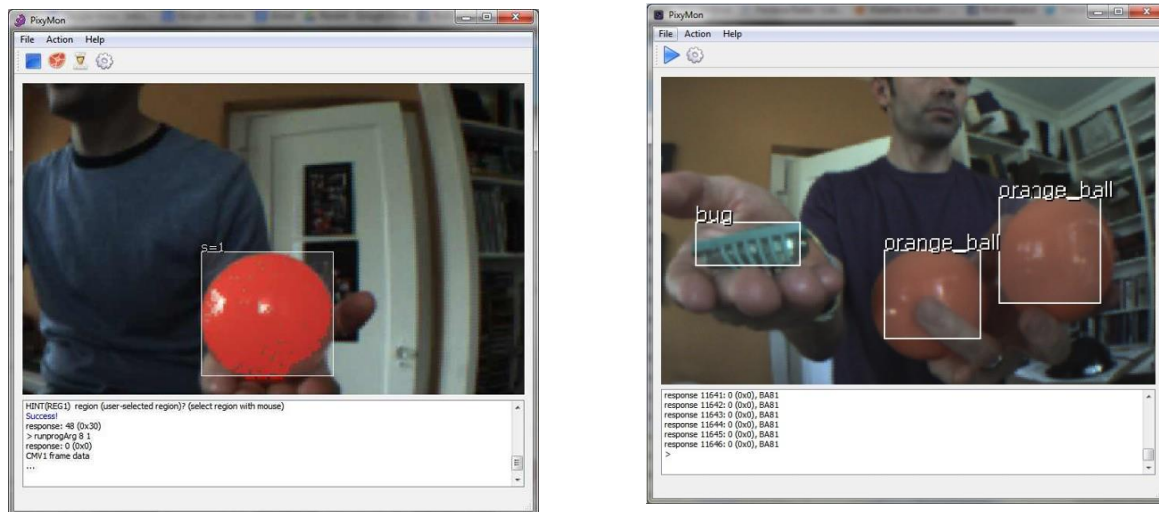


Figure 6 : PixyMon Interface and Output via the laptop

#### IV. RESULTS AND DISCUSSION

The results is viewed by a laptop using the pixymon software and the interface allows the user to bound the signatures to the software which in turn stores the signatures to the software and this allows the software to completely store an object. This will give the value to track an object using the pixymon and pixy module. The application is done using an array of these object tracking modules to track multiple modules and this is the only way to track multiple modules.

The project offers a simple and low cost algorithm in image stabilization that allows you to implement the image stabilization in a very simple and effective way.

#### V. ACKNOWLEDGMENT

It will create a great deal in the world of tracking and image stabilization. As the algorithm used is a smart and versatile algorithm we could optimize the measures used in the tracking algorithm and create a stabilized output even if the environment has the vibration and it affects the footage. By using this method and the paper the world can be made better and it can provide a better way to many people in the world of research and development . As always there are two sides of a coin and this can have bad effects if it gets in bad hands which in the world we can't make sure of it.

#### REFERENCES

- [1] A.T. Alouani ,W. D Blair (1991)“ Use of a kinematic constraint in tracking constant speed, maneuvering targets”
- [2] E. Mazor , A. Averbuch , Y. Bar-shalom, J. Dayan (1998)”Interacting Multiple Model Methods in Target Tracking : A Survey”
- [3] Bhatti, U. and Hanif. M. 2010. Validity of Capital Assets Pricing Model.Evidence from KSE-Pakistan.European Journal of Economics, Finance and Administrative Science, 3 (20).
- [4] Shuhe Chang, Yanqing Zhong<sup>2</sup>, Zhenhua Quan<sup>3</sup>, Yuxiang Hong<sup>1</sup>, Jinle ZengDong Du “A Real-time Object Tracking and Image Stabilization System for Photographing in Vibration Environment using OpenTLD Algorithm”
- [5] Zdenek Kalal , Krystian Mikolajczyk , Jiri Matas (2010) “ Face-TLD: Tracking-Learning- Detection Applied to Faces”
- [6] Longyun Shen, Weidong Pan, Yinhua Quan, Fajun Chen, Jin Zheng (2012) “Improved Tracking Strategy with Camshift Algorithm”