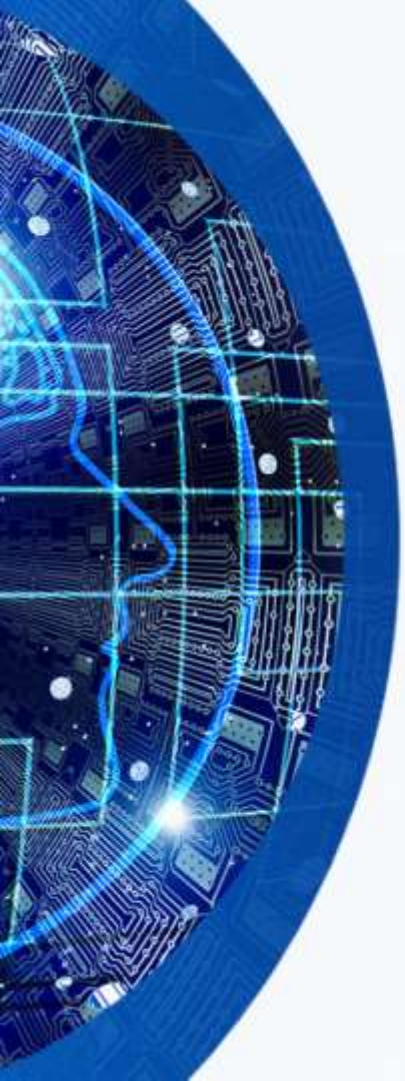
Ball Follower Robot Using OpenCV

Project Description

- The major drawback in today’s surveillance rests on the involvement of human operators which can easily be distracted, so we need a system which can autonomously monitor regions continuously ,identifying unwanted or obnoxious things and respond accordingly. Object tracking using computer vision is crucial in achieving automated surveillance.
- This project involves tracking a ball using OpenCV through Raspberry Pi and then serial communicating with a microcontroller(Arduino UNO) to control the robot and follow the ball as it move around in the environment.



How it Works?

- First of all, we calibrate HSV threshold to mask out the ball. Then we perform a couple of erosions and dilations to remove noise.
- A circular contour is generated on the target ball which gives it the coordinate of its centroid and its radius.
- We already calculated the focal length of Pi camera module which is then used to find the distance of the ball from the robot using pixel width of the ball in the image.
- Now we send the centre's coordinate and distance to Arduino which moves the robot in such a way that it tries to keep the center of the ball in the center of the video.
- If the ball goes out of frame, the bot rotates to re-track the ball location.

Components Used

- Raspberry Pi 4
- Arduino UNO
- L298N Motor driver
- Pi camera Module v1.3
- DC motors and wheels

Language and Libraries

- Python and C
- OpenCV
- Numpy
- Pyserial

Components Description

- **Arduino UNO**-It is an open-source microcontroller board based on the Microchip ATmega328P. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.
- **Raspberry Pi 4** -It is a small single-board computer developed by the Raspberry Pi Foundation. The Raspberry Pi 4 uses a Broadcom BCM2711 SoC with a 1.5 GHz 64-bit quad-core ARM Cortex-A72 processor, with 1MB shared L2 cache.
- **PI Camera Module v1.3 - The** 5 MP native resolution sensor-capable of capturing 2592 x 1944 pixel static images is a custom designed add-on for Raspberry Pi.
- **L298N Motor Driver –** It is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time. The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A.

Future Applications

- The project can be extended to sense human heat using heat sensor.
- Machine learning models can be implemented to better train the robot to track unusual or out of the place objects or people in a busy environment.
- Image analysis part can be used for home automated security systems, automated CCTV’s which can track intruders and click pictures and sent it over wireless system.