CV Based Obstacourse

Computer Vision & Autonomous Robotics Competition

Ingenium — IIT Indore

Competition Overview

The **CV Based Obstacourse** competition challenges participants to design and build a robot capable of autonomously navigating a predefined course using computer vision techniques.

The competition integrates image processing, sensor-driven navigation, and control algorithms, emphasizing precise path tracking and obstacle avoidance at high speeds. Participants are required to optimize both control accuracy and traversal speed while efficiently utilizing onboard computational resources.

Problem Statement

Teams must design and build a camera-based obstacourse robot that uses computer vision to detect obstacles and traverse a defined path autonomously.

The robot must process real-time video feeds using an onboard computer system and employ a control algorithm as the primary feedback mechanism. The objective is to complete the course in the minimum possible time while ensuring reliable obstacle avoidance and path adherence.

System Setup and Requirements

Design and Hardware Requirements

- The robot must use a camera (e.g., USB webcam or Raspberry Pi Camera) for real-time video capture
- An onboard computer system such as NVIDIA Jetson or Raspberry Pi must be used for image processing and control
- Chassis design should support smooth motion through curves and straight paths, with optimized placement of hardware components
- Motor drivers such as L298 must be used to control standard DC motors
- The camera must be mounted to provide an optimal field of view of the track

Software Requirements

- Implement a computer vision pipeline for obstacle detection and path traversal using libraries such as OpenCV
- Use a control algorithm to compute motion corrections based on processed visual input
- Dynamically adjust motor speeds in real time to balance speed and precision
- Handle sharp turns, intersections, and varying path widths through adaptive control strategies

Expected Deliverables

Participants must present:

- A functional camera-based autonomous robot with onboard processing
- A detailed report describing:
  - Hardware design and component selection
  - Computer vision methodology
  - Control algorithm design and tuning approach
  - Overall algorithm development process
- A live demonstration of the robot completing the course autonomously in minimum possible time

Evaluation Parameters

Submissions will be evaluated based on:

- **Completion Time:** Total time taken to finish the course
- **Robot Design:** Stability, compactness, and effective motor control
- **Algorithm Efficiency:** Effectiveness of the computer vision and control system
- **Autonomy and Precision:** Accuracy of obstacle detection and path traversal

Reference Resources

The following resources may be useful:

- PID Controllers in MATLAB: https://in.mathworks.com/help/control/ug/proportional-integral-der html
- OpenCV Overview: https://www.geeksforgeeks.org/opencv-overview/

Rules are subject to change at the discretion of the organisers.
Further instructions will be communicated to registered participants.