COMPUTER VISION SEMESTER PROJECT

# FOREIGN OBJECT DETECTION

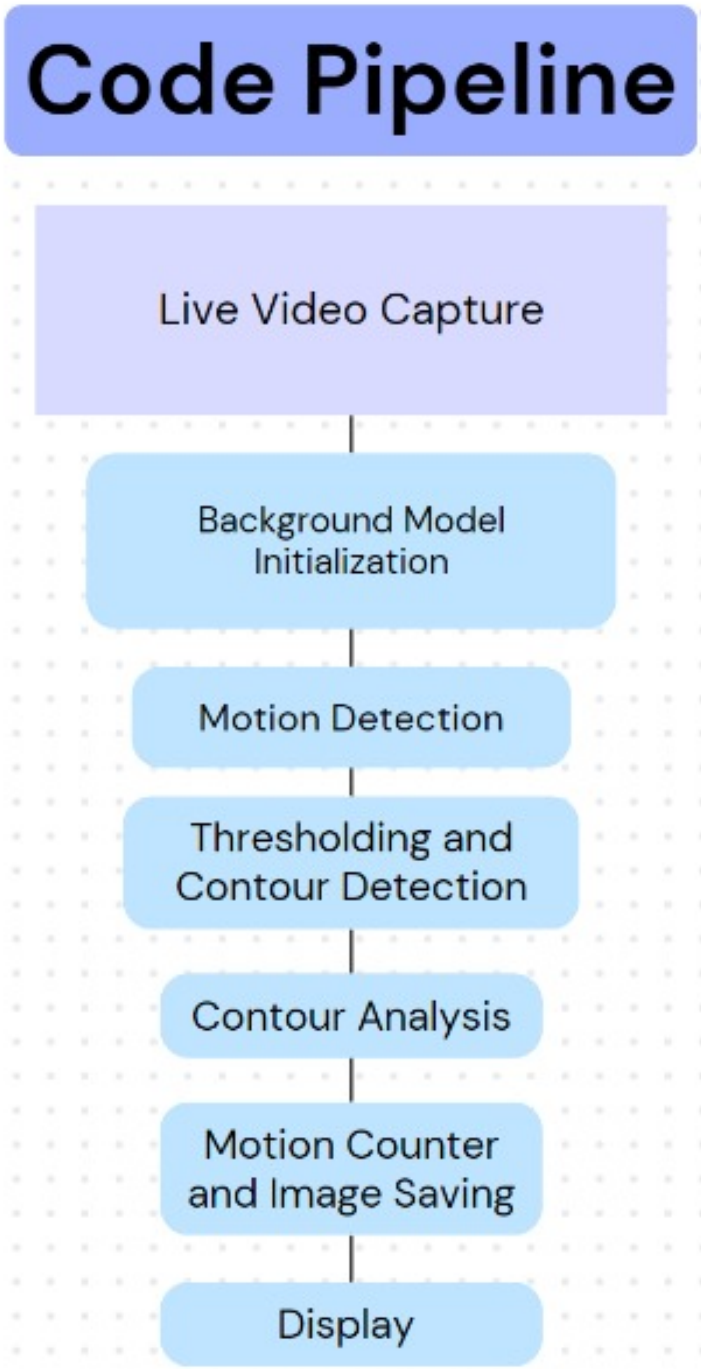

**Group Members:**
Minahil Shafqat
Maheen Salman
Sania Khan Tareen

# WHAT IS A FOREIGN OBJECT DETECTOR?

Focuses on leveraging cutting-edge computer vision techniques to **detect and identify foreign objects in video streams**.
By combining the power of cameras and advanced algorithms, our system provides a comprehensive solution for various applications

# OBJECTIVES

1. USE OPENCV TO DETECT AND IDENTIFY FOREIGN OBJECTS IN VIDEO STREAMS
2. USE CONTOURS AND THRESHOLDING TO DETECT MOVING OBJECT AND DIRECTION OF MOVEMENT BY EMPLYOING LUCAS KANADE OPTICAL FLOW ALGORITHM
3. USE SHI TOMASI (HARRIS-LIKE) DETECTOR TO GET FEATURES FOR LUCAS KANADE OPTICAL FLOW


Code Pipeline
Live Video Capture
Background Model Initialization
Motion Detection
Thresholding and Contour Detection
Contour Analysis
Motion Counter and Image Saving
Display

# TECHNOLOGICAL OVERVIEW

- **Video Processing:**
  - Efficient extraction of information from video streams.
  - Preprocessing frames for enhanced feature extraction.
  - Resize, convert to grayscale, and filter frames for noise reduction.
- **Object Detection:**
  - Identifying and classifying foreign objects in video frames.
  - Utilizing contour detection to isolate potential foreign objects.
  - Applying thresholding and dilation for creating binary motion masks.
- **Optical Flow Analysis:**
  - Dynamic tracking of object movements across consecutive frames.
  - Using Lucas-Kanade optical flow to calculate motion vectors.
  - Deriving speed and direction information via optical flow keypoints.
- **Foundation for Foreign Object Detection:**
  - Integrating video processing to prepare frames for analysis.
  - Employing object detection techniques to identify potential foreign objects.
  - Leveraging optical flow analysis for insights into object movement.

# WORKFLOW FOR FOREIGN OBJECT DETECTION

## Video Capture and Preprocessing

The process begins with capturing high-resolution video data, ensuring a detailed analysis. Preprocessing involves cleaning and enhancing the video feed for subsequent stages

## Background Modeling and Motion Detection

Our system distinguishes between static backgrounds and dynamic objects by modeling the background. Motion detection identifies areas of change, signifying potential foreign objects

## Object Detection and Identification (Future Prospect)

Utilizing advanced algorithms, the system identifies and classifies objects within the video stream, flagging potential foreign entities.

## Optical Flow Analysis

Optical flow analysis tracks the movement of identified objects, providing insights into their trajectory and behavior over time.

# MODULES

To ensure modularity and maintainability, our code is segmented into modules:

- **Video Processing**: Handles the extraction and enhancement of video data.
- **Background Modeling:** Creates a stable representation of the environment.
- **Optical Flow Analysis:** Tracks the movement patterns of detected objects.

Key Algorithms or Methods Employed

- **Background Subtraction Algorithms:** Enable precise modeling of static scenes.
- **Lucas-Kanade Method:** Implemented for optical flow analysis.

## INCLUDE A REAL-TIME DEMONSTRATION

-**Detected Objects:** Visual markers or bounding boxes around identified foreign objects.
-**Tracking:** Display the trajectory of objects over the video feed.

# RESULTS


Foreign Object Detected
Direction: (−16.67, −1.33)
Avg Speed: 16.88 px/frame


Foreign Object Detected
Direction: (2.71, −1.00)
Avg Speed: 2.94 px/frame

# POTENTIAL APPLICATIONS

## SURVEILLANCE SYSTEMS

Enhancing security by proactively identifying potential threats.

## SAFETY MONITORING

Ensuring safe operations in industrial environments.

## AUTOMATED INSPECTION

Improving efficiency in quality control processes..

# THANKYOU!