Project Plan Presentation
Small Object Detection Using CCTV Cameras

The Capstone Experience

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Fall 2023
Project Sponsor Overview

• International Software Company
• AI company focused on tracking & analyzing consumer behavior
• Provide businesses with valuable insights into their operations
• From understanding customer and employee behavior to implementing security systems
Project Functional Specifications

- Automated Firearm Detection
  - Utilizes ML model to automatically detect firearms in surveillance feed

- Real-time Alerts
  - Sends email or text notifications when a firearm is detected

- User-friendly Interface
  - Web interface to view surveillance feeds and check current or past detected threats

- Enhance Security
  - Provides real-time insights so clients can mitigate threats as soon as they occur
Project Design Specifications

• Utilizes an AI model for small object detection to identify guns in CCTV footage
• Real-time detection on CCTV feeds from uploaded RTSP links
• Send real-time alerts when a gun is detected
• Modular frontend & cloud-based hosting
• Continuous monitoring
Screen Mockup: Home Dashboard
Screen Mockup: Alerts Stack
Screen Mockup: Alert Dashboard
Screen Mockup: View Alert
Screen Mockup: Camera Dashboard
Screen Mockup: View Camera Feed
Screen Mockup: Upload Dashboard
Screen Mockup: Uploaded Photo
Project Technical Specifications

• Web Application
  ▪ Frontend
    o React (HTML, JavaScript, & CSS)
    o Deployed on Firebase
    o User can access CCTV camera info and threat alerts
  ▪ Backend
    o Flask server framework
    o Deployed on Google Cloud Platform
    o Communicates with the Machine Learning API
    o Sends JSON files for predictions to the ML API (breaks down feed)

• Machine Learning API
  ▪ API communicates between the model & web app
  ▪ Deployed on Google Cloud Platform
  ▪ Machine Learning Model
    o YOLOv8 model takes JSON file input → returns bounding box
    o Trained using the SAHI method
    o Using PyTorch ML library for training
    o Training data extracted from Google Cloud Bucket
Project System Architecture
Project System Components

• Software Platforms / Technologies
  ▪ Web Application
    o HTML/CSS/JS
    o React
    o Firebase
    o Flask
    o OpenCV
  ▪ Machine Learning API
    o Google Cloud Platform
    o FastAPI
    o Paperspace
    o PyTorch
    o YOLOv8
    o SAHI
Project Risks

• Fetch CCTV camera feed into Flask application
  ▪ Description: Get real-time feed from the CCTV camera.
  ▪ Mitigation: Research OpenCV library, which has a real-time processing feature.

• Break CCTV camera feed in frames
  ▪ Description: Web app should break the real-time CCTV feed up into frames that will be sent to the ML Model API. This should be done efficiently so there is little delay in notifications.
  ▪ Mitigation: OpenCV allows programmers to get individual frames from a video file or video stream.

• Long ML model training time
  ▪ Description: Training a ML model takes a lot of computational resources. Can take several hours if the correct hardware is not used.
  ▪ Mitigation: Will use Paperspace, a cloud computing platform, to rent GPU power.

• Balance ML Model accuracy and speed
  ▪ Description: Important to balance how well the model can predict with how fast it can make the prediction.
  ▪ Mitigation: Use a YOLO model and the SAHI model training method.
Questions?