

Novelty

The parking space counter project is a novel solution to the problem of parking shortages. The project uses a combination of cameras and sensors to count the number of available parking spaces. This approach is more accurate and reliable than traditional methods, such as counting cars in parking spaces.

Feasibility

The parking space counter project is feasible with the available resources. The project can be implemented using off-the-shelf hardware and software. The project can also be implemented in a variety of settings, including urban areas, suburban areas, campuses, airports, and shopping malls.

Business Model

The parking space counter project can be implemented using a variety of business models. The project can be sold to municipalities, businesses, or individuals. The project can also be implemented as a free service with advertising.

Social Impact

The parking space counter project can have a positive social impact. The project can reduce traffic congestion, improve air quality, and make it easier for people to find a place to park. The project can also help to make cities more livable and sustainable.

Scalability

The parking space counter project is scalable. The project can be implemented in a variety of settings and can be used to count a large number of parking spaces.

Solution Architecture Document

Overview

The Parking Space Monitoring System is designed to process videos and count the number of free parking spaces in real-time. The system utilizes OpenCV for video processing, IBM Cloud for authentication, and Flask for building the web application. The architecture consists of several components that work together to achieve the desired functionality.

Architecture Components

1. Video Source

- The video source can be a camera feed or pre-recorded video files.
- It provides the input video stream for processing.

2. OpenCV

- OpenCV (Open Source Computer Vision Library) is a popular open-source computer vision library used for video and image processing.
- It is used to analyze video frames, detect parking spaces, and count the number of free spaces.
- OpenCV provides various algorithms and techniques for object detection and image processing, which are utilized in this system.

3. Flask Web Application

- Flask is a lightweight web framework written in Python.
- It is used to build the web application that allows users to access the parking space monitoring system.
- The Flask application handles user authentication, video processing requests, and displays the results to the user.

4. IBM Cloud Authentication Service

- IBM Cloud provides authentication services that can be used to secure access to web applications.
- The IBM Cloud Authentication Service is integrated into the Flask application to ensure secure access to the parking space monitoring system.
- It provides user authentication and authorization mechanisms, ensuring that only authorized users can access the system.

5. Parking Space Detection Model

- A trained machine learning model is used to detect parking spaces within video frames.
- The model is trained using computer vision techniques and can identify whether a parking space is occupied or vacant.
- OpenCV is used to apply the model to video frames and determine the status of each parking space.

Architecture Workflow

1. User Authentication

- Users access the Flask web application through a web browser.
- The IBM Cloud Authentication Service authenticates users based on their credentials.
- Authorized users are granted access to the parking space monitoring system.

2. Video Processing

- The user selects a video source, either a camera feed or a pre-recorded video file, through the web application.
- The selected video is processed frame by frame using OpenCV.
- The parking space detection model is applied to each frame to determine the status of parking spaces (occupied or vacant).
- The number of free parking spaces is calculated based on the model predictions.

3. Display Results

- The processed video frames are displayed in real-time through the web application.
- The number of free parking spaces is presented to the user.
- Historical data and occupancy trends may be displayed through charts or visualizations.