

# IoT Parking Monitoring System

Team El manajek | Internet of Things and Applied Data Science | Fall 2025

Instructor: Dr. Mehmet Ali Akyol





## The Urban Mobility Challenge

Modern cities face a critical disconnect between parking availability and driver information, leading to severe congestion and inefficiency.

### Congestion

Up to 30% of urban traffic is caused by drivers circling for parking, increasing carbon emissions and commute times.

### Inefficiency

Without real-time data, space utilization remains unbalanced, leaving some areas empty while others overflow.

### Data Gap

Municipalities lack the granular, sensor-based insights needed to optimize infrastructure planning.



## Dataset & Methodology

Leveraging granular sensor data to build a responsive monitoring architecture.



- **Source: Kaggle IoT Smart Parking**

A comprehensive dataset capturing real-time parking states across multiple zones.

- **Scale: 2,769 Records**

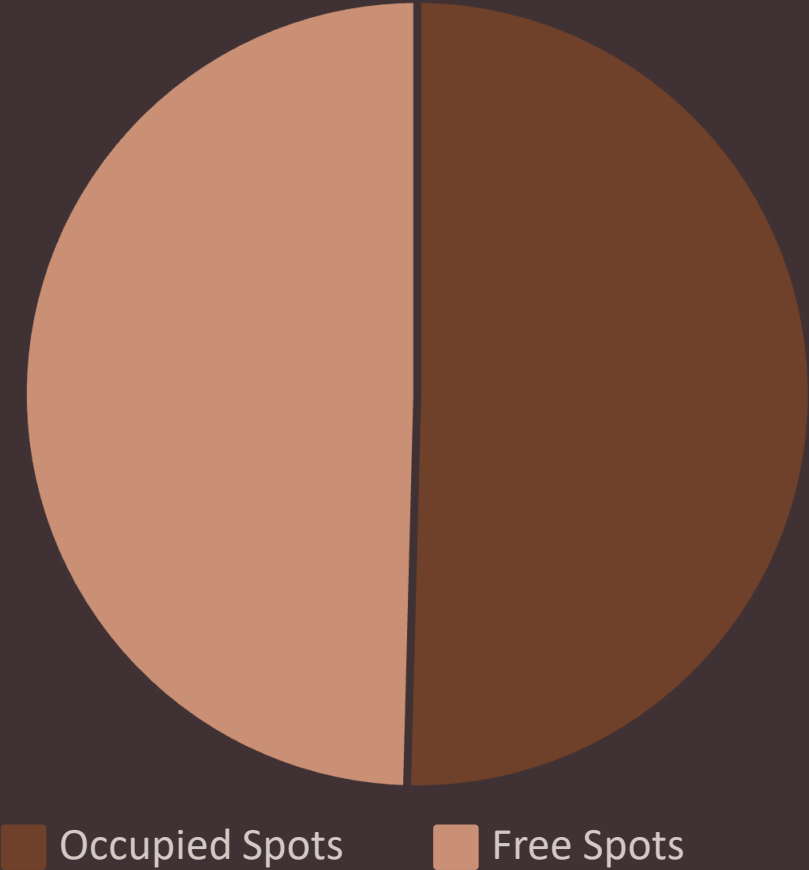
High-frequency data points providing a robust foundation for pattern analysis.

- **Hardware: 50 Infrared Sensors**

Simulated sensor array tracking presence/absence in individual parking bays.

# Analysis of Parking Occupancy

Our analysis revealed a highly balanced utilization rate across the monitored sector.



50.4%

Occupancy Rate

The system maintains a near-perfect equilibrium between availability and usage.

2,769

Total Data Points

Processed records validating the sensor network reliability.

# Real-Time Dashboard Interface

We developed an interactive command center using **Streamlit** to visualize sensor streams instantly.



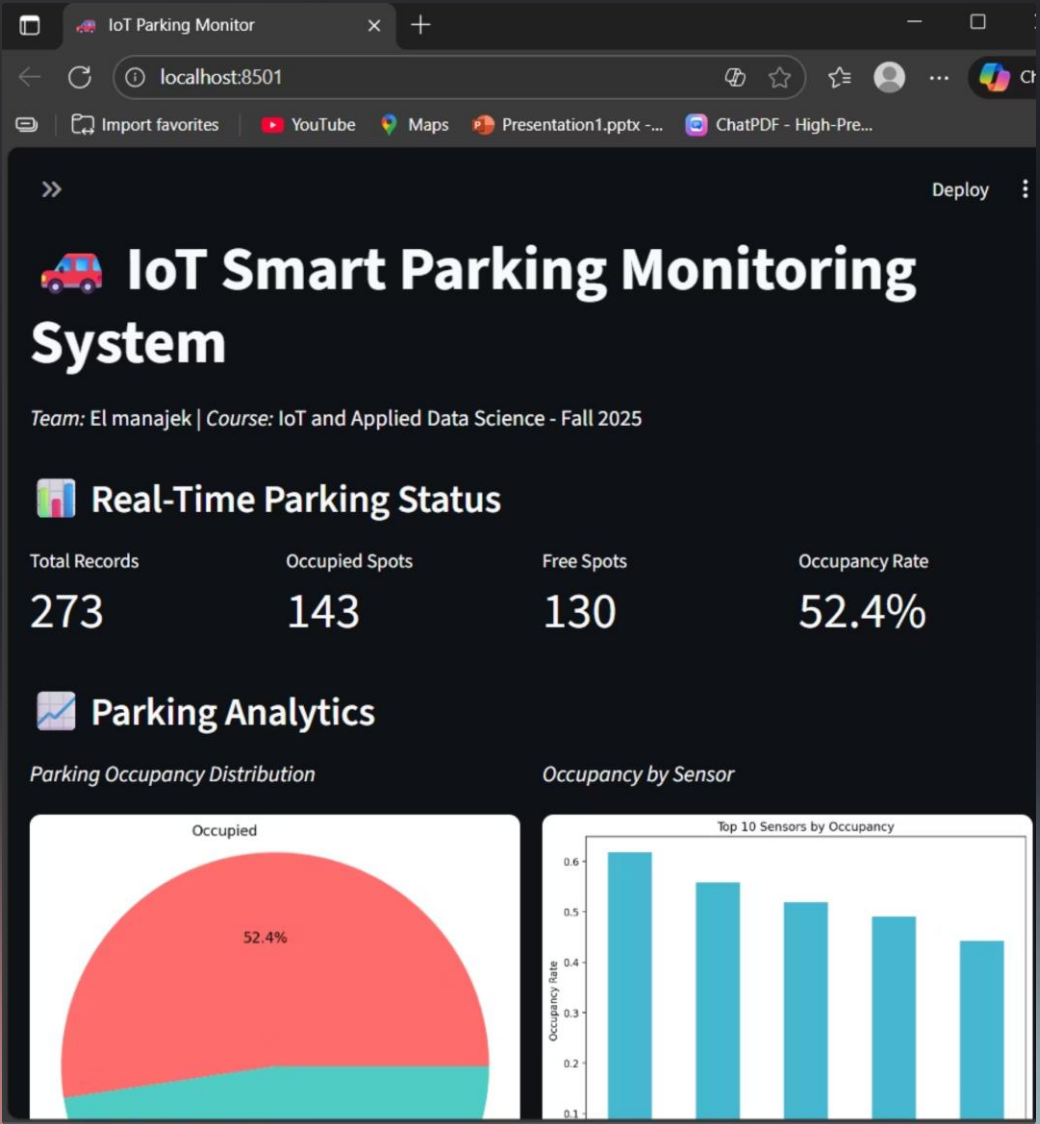
## Live Analytics

Real-time visualization of occupancy trends and peak hours.



## Dynamic Filtering

Isolate specific sensor clusters or timeframes for detailed inspection.



# Technical Architecture

A modular tech stack designed for scalability and rapid data processing.



## Core Logic: Python

The backbone of our data processing and backend logic.



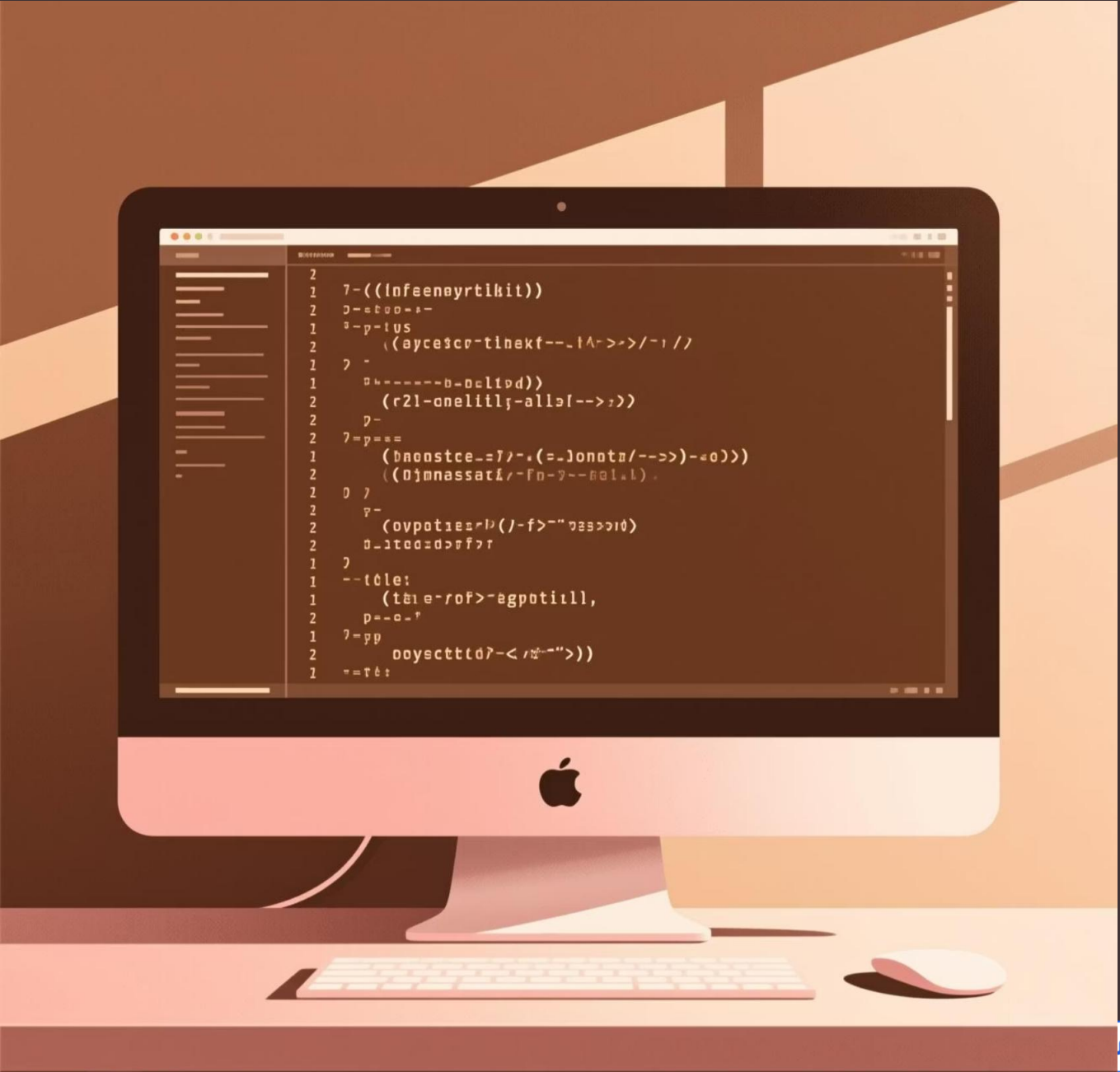
## Data Handling: Pandas

Efficient manipulation of large sensor datasets and state cleaning.

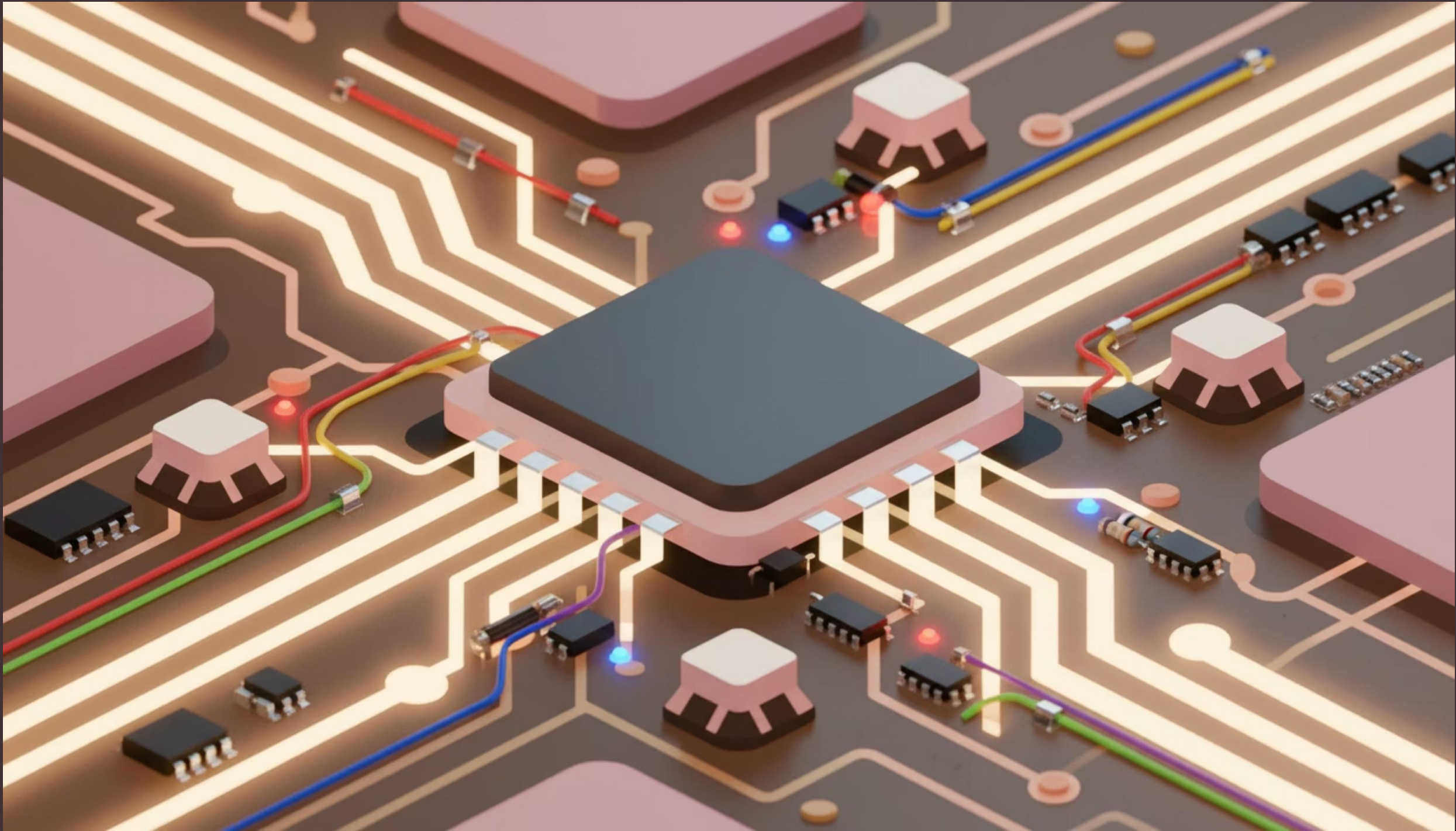


## Frontend: Streamlit

Rapid deployment of the interactive web application.







### Challenges & Key Learnings

The development process highlighted critical insights into IoT data management.

## Conclusion & Future Scope

Our prototype demonstrates that low-cost sensor networks can effectively solve urban parking density issues through data transparency.

## Future Improvements

- Integration of predictive ML models
- Mobile app for driver navigation
- LoRaWAN hardware implementation

---

Explore the

**Code:**[github.com/osamanabil283-design/IOT-Parking-Monitoring-system](https://github.com/osamanabil283-design/IOT-Parking-Monitoring-system)  
[system](https://github.com/osamanabil283-design/IOT-Parking-Monitoring-system)

## Team El manajek

Thank you for your attention.

