SMART PARKING

TEAM MEMBER

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Phase-2 Document submission

Project: *SMART PARKING*

Introduction:

Integrating camera-based solutions with IoT sensors for parking space availability detection can create a powerful and comprehensive smart parking system.

Objective:

Plan the design and deployment of iot sensors in parking spaces to detect occupancy and availability. In PHASE 1 we discussed about the problem definition and their application used in iot

PHASE 2:

Consider integrating camera-based solutions for image processing to detect parking space availability.

Camera-based solutions for detecting parking space availability are widely used in smart parking systems. These systems utilize computer vision techniques to process images or video streams from cameras installed in parking lots.

Here are some key components and methods commonly used in such solutions:

1.***Camera Placement***:

Cameras are strategically placed to cover the parking area efficiently. The angles and heights of the cameras are important considerations to ensure optimal visibility.

2. ***Image Processing and Analysis***:

Utilize image processing algorithms to detect vehicles and analyze images for precise occupancy information. it involves using computer vision techniques to extract meaningful information from images captured by sensors or cameras.

Here are key steps and considerations for image processing and analysis in IoT:

- Image Acquisition
- Image preprocessing
- Object Tracking
- Pattern Recognition

- Face Recognition

Figure 1. Straight equalization processing contrast: (a) original grayscale; (b) original gray scale histogram; (c) equalization processes; (d) histogram of grayscale after processing.
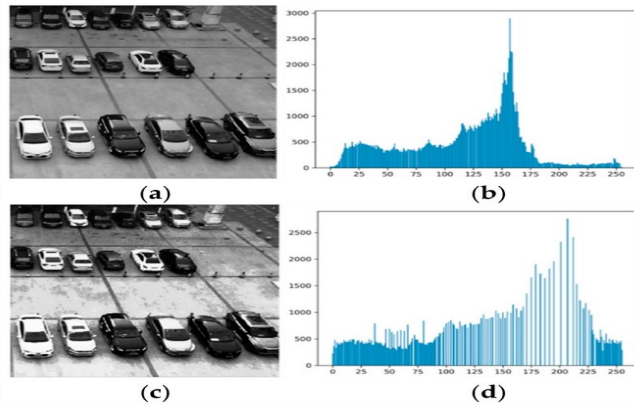
3. *Occupancy Detection*:

- Sensors are equipped with various technologies to detect the presence or absence of a vehicle. Common sensor types include:
    1) Ultrasonic Sensors: Measure the distance between the sensor and an object, detecting the presence of a vehicle.
    2) Magnetic Sensors: Detect changes in the Earth's magnetic field caused by the presence of a vehicle.
    3) Infrared Sensors: Detect the heat emitted by a vehicle.
    4) Camera Sensors: Use image processing to identify parked vehicles.


Waterproof   Flush-mount   Long lifespan

4. *Sensor Deployment*:

IoT sensors are installed in individual parking spaces or in strategic locations within a parking lot.

Here are some key considerations and steps involved in sensor deployment for IoT applications:

1. Monitoring and Maintenance

2. Redundancy and Reliability

3. Scalability and Expansion

4. Power Source
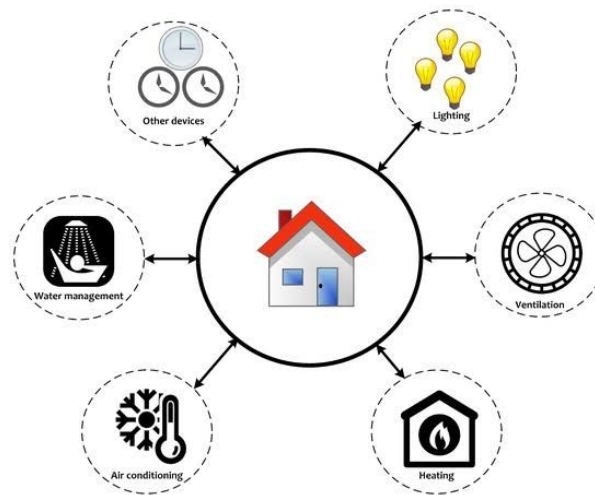
5. ***Data Transmission***:

- The sensors are connected to a network (usually wireless) that allows them to transmit data to a central server or cloud platform.
- The process of sending information from IoT devices or sensors to a central system or other connected devices.
- This is a crucial step in enabling real-time monitoring, analysis, and decision-making in IoT applications
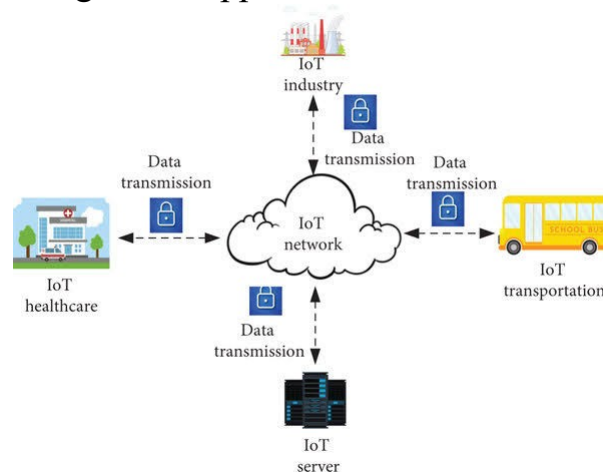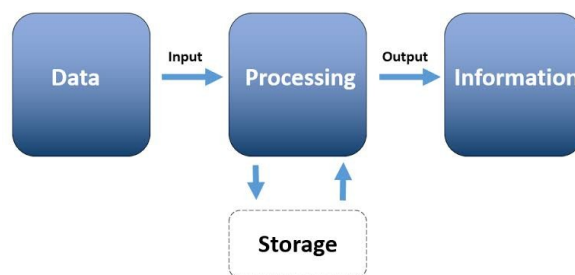
6.**Data Processing and Analysis**:

The collected data is processed to determine the occupancy status of each parking space.

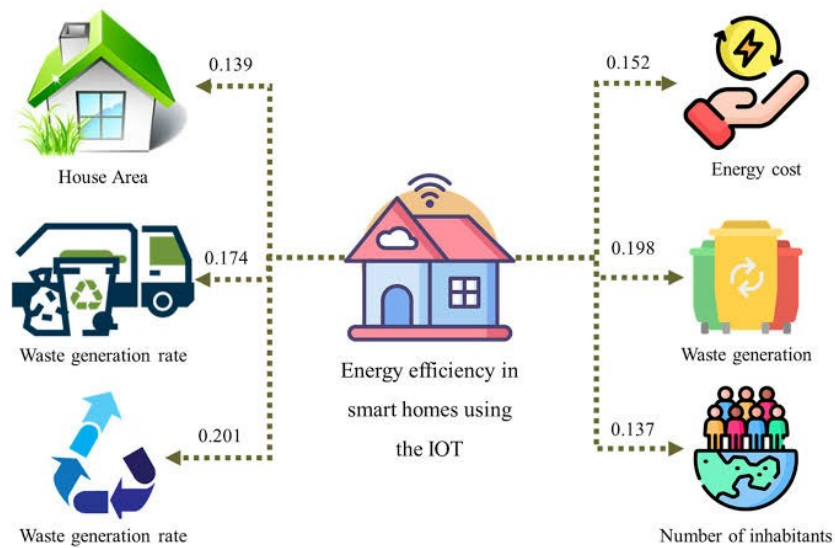Here are key steps and considerations for effective data processing and analysis in IoT:

- Data Visualization
- Data Privacy and Security
- Storage

7.**Energy Efficiency and Sustainability**:

- Ensure that both sensors and cameras operate efficiently to conserve energy and reduce environmental impact.
- Energy efficiency and sustainability are crucial considerations in IoT (Internet of Things) implementations. Here are some key points to consider:

  1.Low Power Consumption Devices
  2.Energy Harvesting
  3.Edge Computing
  4.Efficient Data Transmission

House Area   0.139

Waste generation rate   0.174

Waste generation rate   0.201

Energy efficiency in smart homes using the IOT

Energy cost   0.152

Waste generation   0.198

Number of inhabitants   0.137

8.Privacy and Security Measures:

Implement measures to protect user privacy and secure the data collected by the system

End User

Privacy & Security policies

Device/Sensors

Cloud
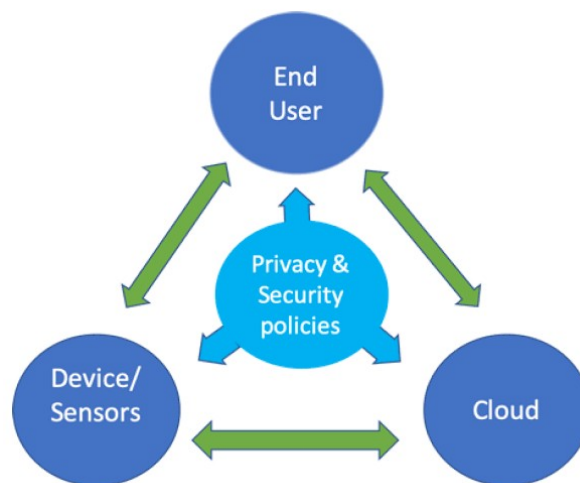
**Conclusion**:

- By integrating camera-based image processing with IoT sensors, the parking system benefits from the strengths of both technologies, offering a more accurate, reliable, and user-friendly experience for drivers.
- This integrated approach enhances the efficiency of parking operations and contributes to more sustainable urban mobility.
- Overall, smart parking systems using IoT sensors are a key component of modern urban planning, aiming to optimize the use of limited parking resources in densely populated areas.