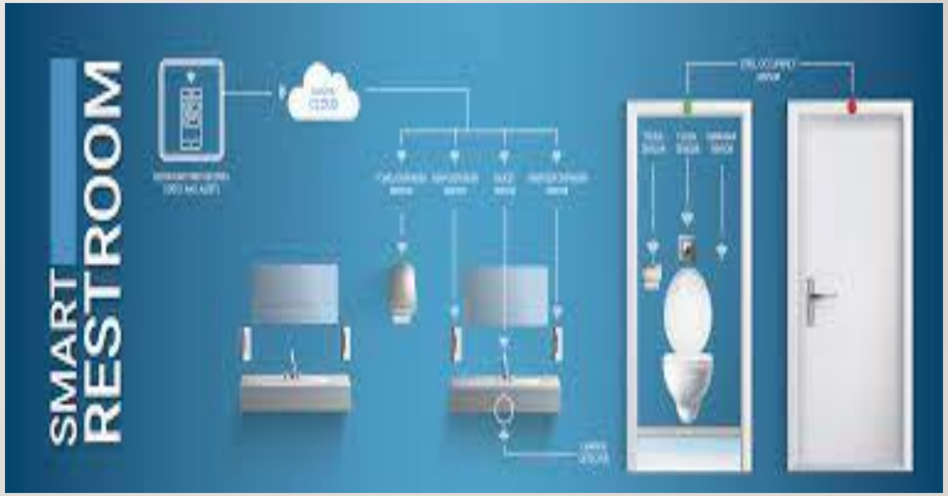
SMART PUBLIC RESTROOM

PROJECT DEFINITION:

- The project aims to enhance public restroom management by installing IoT sensors to monitor occupancy and maintenance needs. The goal is to provide real-time data on restroom availability and cleanliness to the public through a platform or mobile app. This project includes defining objectives, designing the IoT senor system, developing the restroom information platform, and integrating them using IoT technology and python.

PROJECT OBJECTIVE:

- Real-Time restroom availability information.
- Cleanliness monitoring.
- Improved user experience.
- Efficient restroom.



REAL-TIME RESTROOM AVAILABILITY INFORMATION.

- Real-time restroom availability information in smart public restrooms can significantly improve user satisfaction, reduce wait times, and enhance restroom management efficiency. It can also be a valuable feature in smart cities and public spaces where providing a high level of convenience to residents and visitors is a priority.

CLEANLINESS MONITORING.

- Cleanliness monitoring in smart public restrooms not only helps maintain a clean and hygienic environment but also contributes to cost efficiency by optimizing cleaning schedules and resource allocation. It enhances the overall user experience and public health, making it an essential feature in modern public facilities

IMPROVED USER EXPERIENCE.

Real-time availability information, cleanliness monitoring, touchless features , hand hygiene stations, accessibility features, baby changing station, multilingual signage , amenities and comfort, privacy considerations, emergency feature , maintenance alerts, queue management feedback mechanism , energy efficiency, security , smart notifications, hygiene supplies, green feature , regular maintenance, user education By focusing on these aspects, public restrooms can become more user-friendly and contribute to a positive overall experience, which is especially important in busy public spaces, transportation hubs, shopping centers, and smart city initiatives.

EFFICIENT RESTROOM

- Efficiency in smart public restrooms not only benefits users but also helps organizations save resources and reduce environmental impact. By integrating smart technologies, data analytics, and sustainable practices, smart public restrooms can provide a more streamlined and eco-friendly experience for the public.

IOT SENSOR DESIGN.

- Select the appropriate sensors for the parameters you want to monitor. Common sensor types for smart restrooms include:Occupancy sensors (infrared, ultrasonic, or weight sensors) to detect user presence.
- Environmental sensors (temperature, humidity, air quality) for monitoring comfort and cleanliness.
- Fluid level sensors for soap, water, and sanitizer dispensers.
- Image sensors or cameras for cleanliness assessment and occupancy tracking.
- Acoustic sensors for measuring noise levels and detecting issues.
- RFID or NFC sensors for tracking restroom supplies and equipment.

REAL-TIME TRANSIT INFORMATION PLATFORM

- Creating a real-time transit information platform in a smart public restroom can be a valuable service for users, especially in busy transportation hubs. This platform can provide up-to-date information about public transportation options, schedules, delays, and nearby services.

INTEGRATION APPROACH.

- Integration is a key component of a smart public restroom, as it allows various systems and technologies to work together seamlessly to provide a comprehensive and efficient user experience.

- These are the topics of phase 1 in smart public restroom.

THANK YOU

PREDICTIVE MAINTAINENCE ALGORITHM

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INTERNET OF THINGS

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PREDICTIVE MAINTAINENCE

- Predictive maintenance is a technique that uses condition-monitoring tools and techniques to monitor the performance of a structure or a piece of equipment during operation

PREDICTIVE MAINTAINENCE ALGORITHM

- At the heart of the predictive maintenance algorithm is the detection or prediction model. This model analyzes extracted condition indicators to determine the current condition of the system (fault detection and diagnosis) or predict its future condition (remaining useful life prediction).

PREDICTIVE MAINTENANCE SENSOR

Measurement	Sensor
Sound pressure	Ultrasonic microphone
Motor current	Shunt, current transformer
Magnetic field	Hall, magnetometer, search coil
Temperature	Infrared thermography

DATA NEEDED FOR PREDICTIVE MAINTAINENCE

- Predictive maintenance uses AI/ML, the Internet of Things (IoT), and big data to monitor equipment and check for part failure. Predictive maintenance is sometimes called condition monitoring, or CM, because it uses IoT data to track the condition of your parts.

BEST ALGORITHM FOR PREDICTIVE MAINTAINENCE

- For example, if you have data on the sensor readings or vibrations of a machine, unsupervised learning can be used to uncover patterns, anomalies, or clusters in the data. Common unsupervised learning algorithms for predictive maintenance include clustering and anomaly detection.

DATA COLLECT FOR PREDICTIVE MAINTAINENCE

- In a predictive maintenance program, sensors are used to collect data from the selected assets. There are different types of sensors, that can be measure temperature, vibration, pressure, and more. The sensors to be used are chosen depending on the nature of the asset and installed in strategic points.

STEPS FOR PREDICTIVE MAINTAINENCE PROGRAM

- Analyze your infrastructure to identify critical assets and failure areas. ...
- Set up a monitoring mechanism to collect a constant stream of data. ...
- Devise a response procedure. ...
- Implement and monitor the strategy

CONCLUSION

- Predictive maintenance reduces the maintenance costs of the systems, but it also helps reduce unexpected failures, overhauls, and repair time by approximately 60%.

IOB SMART PUBLIC RESTROOM

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DESCRPTION

- THE GOAL OF THE SYSTEM IS TO MONITOR AND EVALUATES TOILET CONDITION IN REAL-TIME, ENABLING CITY GOVERNMENTS TO IMPROVE THE TOILET CLEANING & UPKEEP THROUGH:
- MONITORING CAPABILITIES
- ACTIONABLE INTELLIGENCE
- ENGAGEMENT & BEHAVIOR CHANGE
- STANDARDIZATION OF TOILET HYGIENE
- TO ACHIEVE THIS GOAL, WE HAVE TO MONITOR
- NUMBER OF MALE/ FEMALE USING TOILETS
- WATER USAGE AND LEVEL MONITORING
- THE SMELL IN THE TOILET.
- LIGHT/ DARKNESS IN THE TOILET
- USER FEEDBACK FROM THE TOILET.

USER COUNTER

- THE REQUIREMENT IS THAT SENSOR THAT CAN BE MOUNT ON THE HEAD (TOP) OF THE DOOR/ GATE TO COUNT THE USER, WITH REASONABLE ACCURACY. ALSO, IT SHOULD BE RIGID ENOUGH TO PROTECT FROM VANDALISM.
- THERE ARE MULTIPLE WAYS TO DO USER COUNTING, CONSIDERING THE PUBLIC TOILET AND ENVIRONMENT, WE DECIDED TO USE A PIR SENSOR, WITH SOME CUSTOMIZATION.

SMELL SENSOR

- **SELECTION OF SENSOR**
- NEED TO DETECT GAS H2S (HYDROGEN SULPHIDE) WHICH IS PRODUCED FROM HUMAN WASTE.
- NEED TO DETECT NH3 (AMMONIA) WHICH IS PRODUCED IN URINE.
- IT SHOULD NOT CONSUME MORE POWER.
- IT SHOULD GET LESS AFFECTED BY AMBIENT ENVIRONMENT FACTORS LIKE TEMPERATURE, HUMIDITY, ETC.
- IT SHOULD HAVE A LONG LIFE.

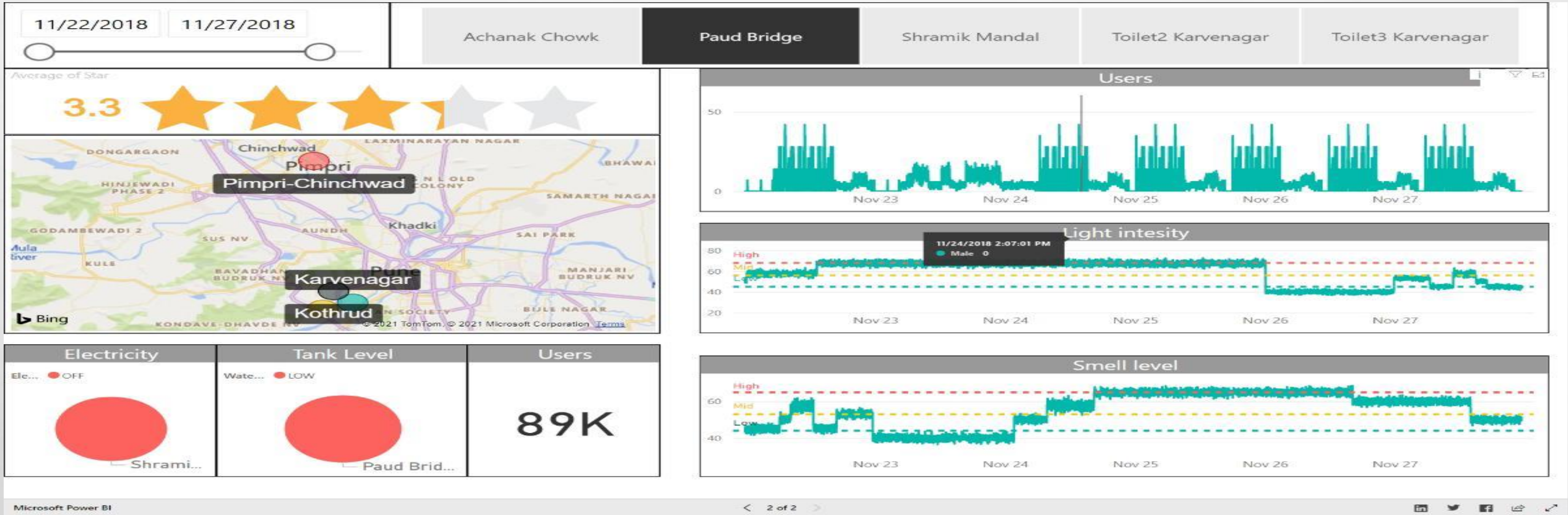
WATER LEVEL SENSOR

- THE WATER LEVEL SENSOR NODE IS A WI-FI-BASED DEVICE THAT IS USED TO DETECT FOUR LEVELS I.E. 25%, 50%, 75%, AND 100% (FULL) IN THE TANK.
- THERE ARE MANY WATER LEVEL SENSORS ARE PRESENT IN THE MARKET. BUT, WE NEED TO USE COST-EFFECTIVE WATER LEVEL SENSOR, SO WE HAVE SELECTED CONDUCTIVITY BASED WATER LEVEL SENSO

USER FEEDBACK MA

- THE USER FEEDBACK SYSTEM IS A WIRELESS-BASED DEVICE THAT TAKES USER FEEDBACK IN TERMS OF TOILET CLEANING. THERE ARE THREE SWITCHES FOR CLEAN, AVERAGE, AND DIRTY FEEDBACK.

INDIVIDUAL TOILET DASHBOARD



Project Title: SMART PUBLIC RESTROOM

Phase 2: Development Part 2

Continue building the project by developing the restroom information platform and mobile app.

Use web development technologies (e.g., HTML, CSS, JavaScript) to create a platform that displays real-time restroom availability and cleanliness data.

Design mobile apps for iOS and Android platforms that provide users with access to realtime restroom information

To create a Python script for IoT sensors that send real-time occupancy and cleanliness data to a restroom information platform, you'll need to follow these steps:

Hardware Setup:

- Acquire IoT sensors capable of detecting occupancy (e.g., motion or infrared sensors) and cleanliness (e.g., air quality or environmental sensors). - Connect these sensors to a microcontroller or single-board computer (e.g., Raspberry Pi) with internet connectivity.

Sensor Data Acquisition:

- Write Python code to interface with the IoT sensors and collect data. You can use libraries specific to the sensors you are using.

Data Processing:

- Process the sensor data to extract relevant information about occupancy and cleanliness. You may need to apply filtering and calibration.

Data Transmission:

- Set up a connection to the restroom information platform. This could be a REST API, MQTT broker, or another communication protocol. Use Python libraries such as `requests` for RESTful APIs or `paho-mqtt` for MQTT to send data to the platform.

Real-time Updates:

- Implement a loop or event-driven system to continuously monitor sensor data and transmit updates in real-time.

Data Packaging:

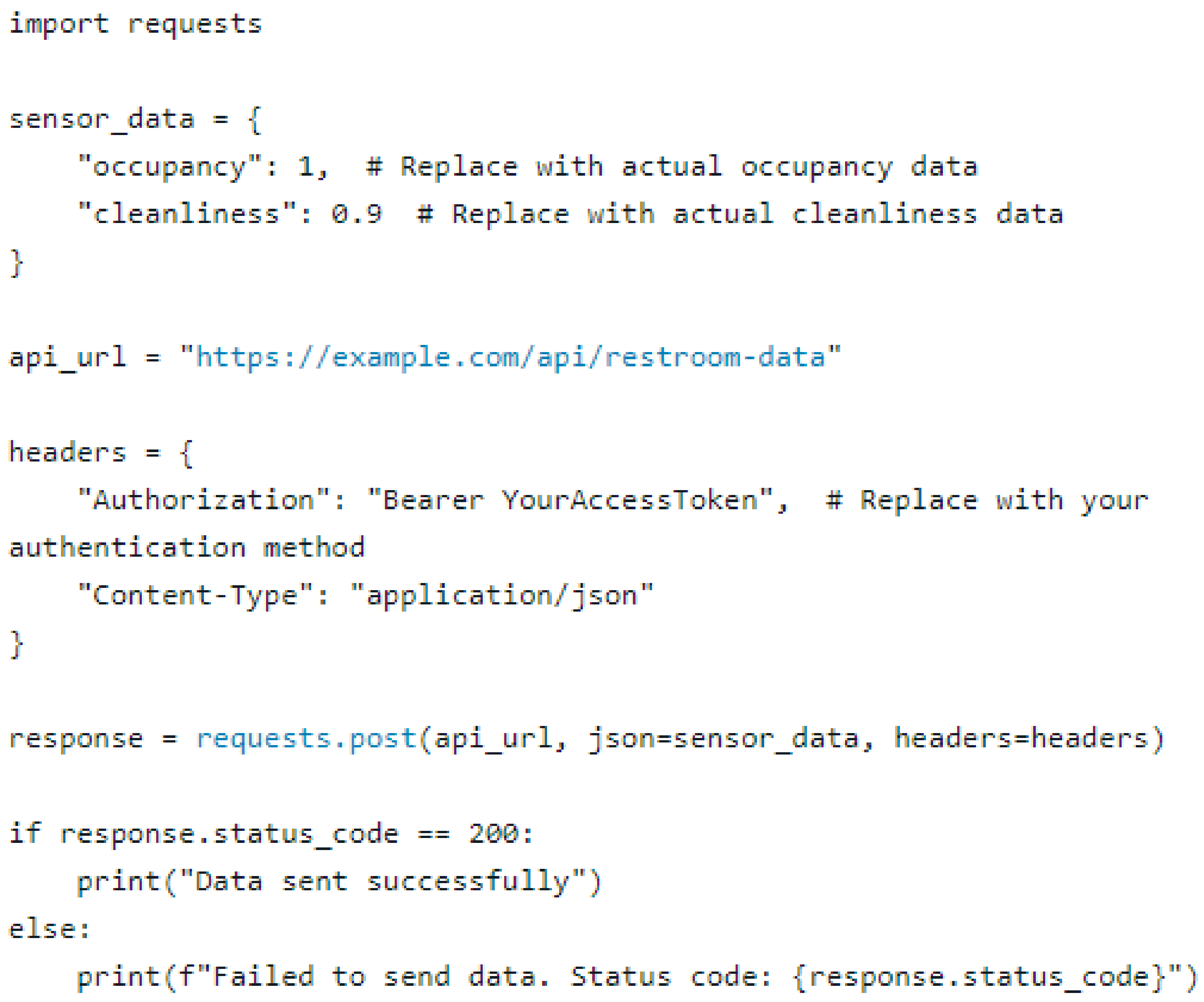
- Structure the data in a format that the platform can understand. For example, use JSON for REST APIs or MQTT payload.

Authentication:

- Ensure that your script is authorized to send data to the platform. Implement any necessary authentication methods (API keys, tokens, etc.).

Error Handling:

- Implement error handling to deal with issues like network connectivity problems or platform unavailability.



```
import requests

sensor_data = {
    "occupancy": 1,  # Replace with actual occupancy data
    "cleanliness": 0.9  # Replace with actual cleanliness data
}

api_url = "https://example.com/api/restroom-data"

headers = {
    "Authorization": "Bearer YourAccessToken",  # Replace with your
authentication method
    "Content-Type": "application/json"
}

response = requests.post(api_url, json=sensor_data, headers=headers)

if response.status_code == 200:
    print("Data sent successfully")
else:
    print(f"Failed to send data. Status code: {response.status_code}")
```

Creating a platform to display real-time restroom availability and cleanliness data using web development technologies involves creating a web application. Here are the steps to create such a platform:

1. *Front-end Development*:

a. *HTML*: Create the HTML structure for your web application. Define the layout, including elements for displaying data.

b. *CSS*: Style your web application using CSS. Use CSS to make it visually appealing and user-friendly.

c. *JavaScript*: Use JavaScript to add interactivity and real-time updates to your platform. You can use JavaScript libraries and frameworks to simplify this process, such as React, Angular, or Vue.js.

2. *Data Visualization*:

a. Retrieve real-time data from your IoT sensors or REST API. You can use JavaScript's `fetch` API to make asynchronous requests to your data source.

b. Process the data and display it on your web application. You may want to use JavaScript libraries like D3.js or Chart.js to create charts and graphs for cleanliness data.

3. *Real-Time Updates*:

Implement a mechanism for real-time updates. You can achieve this using technologies like WebSockets, Server-Sent Events (SSE), or polling your data source at regular intervals.

4. *User Interface*:

Design the user interface to display restroom availability and cleanliness data. You can use charts, tables, or other data visualization methods as needed.

5. *User Interaction*:

Add features that allow users to interact with the data, such as filtering, searching, or providing feedback on restroom conditions.

6. *Testing*:

Thoroughly test your web application to ensure it works as expected. Test both the functionality and responsiveness on various devices and browsers.

7. *Hosting*:

Choose a web hosting service or server to deploy your web application. Ensure that it has the necessary infrastructure to support real-time features if you're using WebSockets or SSE.

8. *Security*:

Implement security measures to protect your platform, especially if it involves sensitive data. Use HTTPS, validate user inputs, and consider authentication and authorization mechanisms if required.

9. *Optimization*:

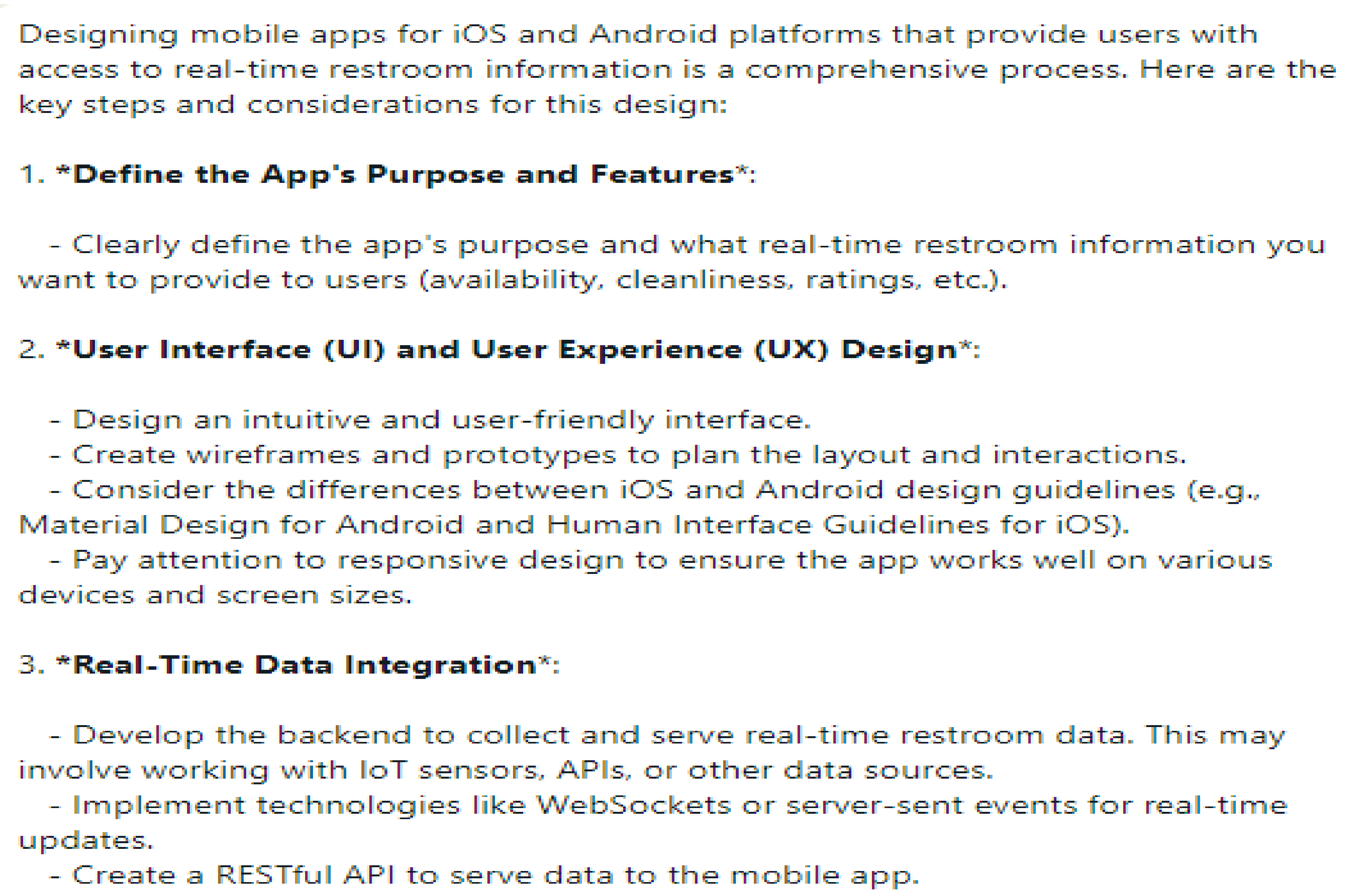
Optimize your code and assets for performance. Minify and compress your CSS and JavaScript files, and consider using a Content Delivery Network (CDN) for assets.

10. *Documentation*:

Provide clear documentation for users and administrators on how to use and maintain the platform.

```
html
<!DOCTYPE html>
<html>
<head>
    <link rel="stylesheet" type="text/css"
href="styles.css">
</head>
<body>
    <h1>Restroom Availability and Cleanliness</h1>
    <div id="availability"></div>
    <div id="cleanliness"></div>

    <script>
        // Use JavaScript to fetch and display real-
time data here
    </script>
</body>
</html>
```



Designing mobile apps for iOS and Android platforms that provide users with access to real-time restroom information is a comprehensive process. Here are the key steps and considerations for this design:

1. ***Define the App's Purpose and Features***:

   - Clearly define the app's purpose and what real-time restroom information you want to provide to users (availability, cleanliness, ratings, etc.).

2. ***User Interface (UI) and User Experience (UX) Design***:

   - Design an intuitive and user-friendly interface.
   - Create wireframes and prototypes to plan the layout and interactions.
   - Consider the differences between iOS and Android design guidelines (e.g., Material Design for Android and Human Interface Guidelines for iOS).
   - Pay attention to responsive design to ensure the app works well on various devices and screen sizes.

3. ***Real-Time Data Integration***:

   - Develop the backend to collect and serve real-time restroom data. This may involve working with IoT sensors, APIs, or other data sources.
   - Implement technologies like WebSockets or server-sent events for real-time updates.
   - Create a RESTful API to serve data to the mobile app.

4. ***Cross-Platform vs. Native App Development***:

- Decide whether you want to develop separate native apps for iOS and Android or use cross-platform development frameworks like React Native, Flutter, or Xamarin.

5. ***App Development***:

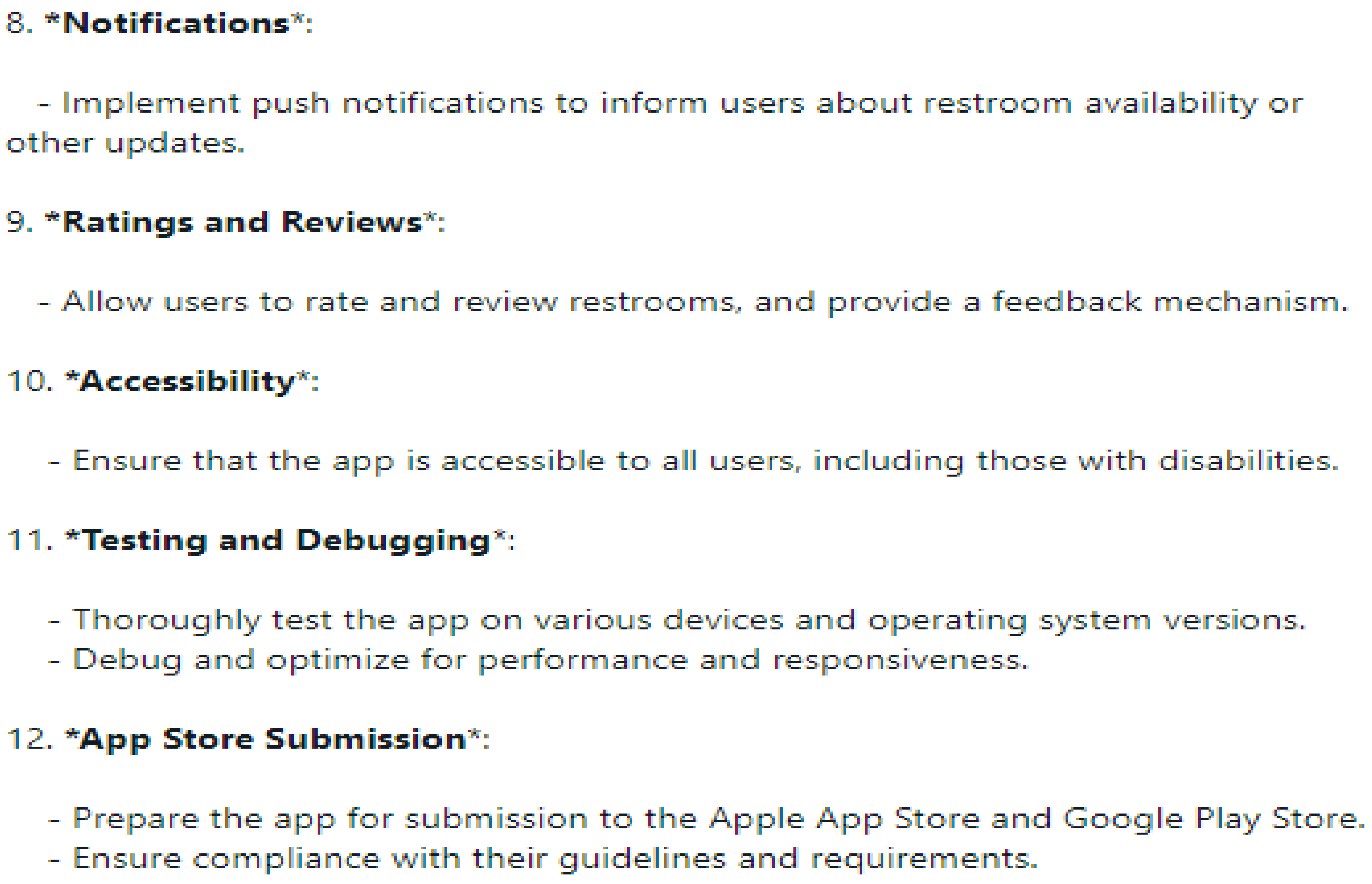
- Develop the app using the programming languages and tools suitable for the chosen approach (Swift and Objective-C for iOS, Kotlin and Java for Android, or the chosen framework).
- Implement real-time data fetching, storage, and display.

6. ***Authentication and Security***:

- Implement user authentication and data security features.
- Use HTTPS for data transmission.
- Protect user data and privacy.

7. ***Maps and Location Services***:

- Use maps and location services to help users find nearby restrooms.
- Provide directions and navigation features.



8. *Notifications*:

   - Implement push notifications to inform users about restroom availability or other updates.

9. *Ratings and Reviews*:

   - Allow users to rate and review restrooms, and provide a feedback mechanism.

10. *Accessibility*:

    - Ensure that the app is accessible to all users, including those with disabilities.

11. *Testing and Debugging*:

    - Thoroughly test the app on various devices and operating system versions.
    - Debug and optimize for performance and responsiveness.

12. *App Store Submission*:

    - Prepare the app for submission to the Apple App Store and Google Play Store.
    - Ensure compliance with their guidelines and requirements.

13. *Marketing and Promotion*:

- Plan how you will market and promote the app to attract users.

14. *Feedback and Iteration*:

- Collect user feedback and make iterative improvements to the app.

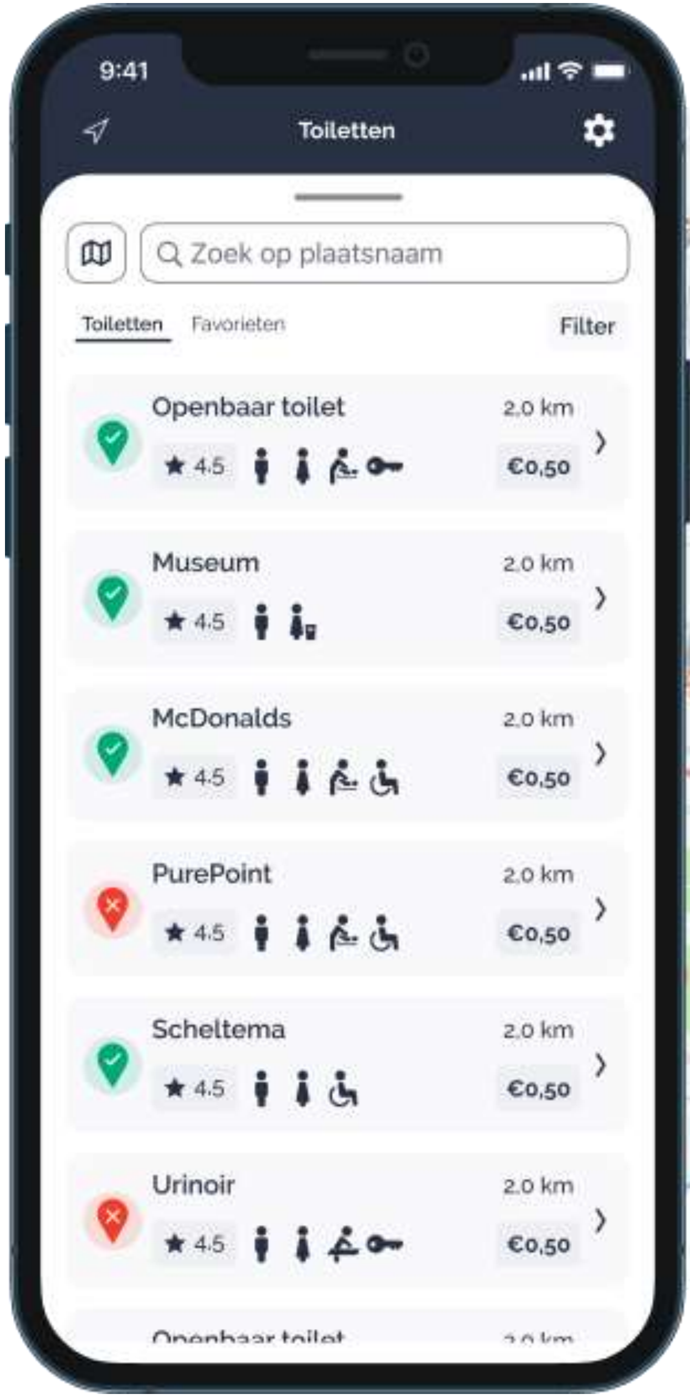
15. *Maintenance and Updates*:

- Regularly maintain and update the app to fix bugs, enhance features, and adapt to changing technologies and user needs.

16. *Documentation*:

- Provide user documentation and support resources.

Remember that mobile app development is a multi-disciplinary process, involving design, development, backend infrastructure, and ongoing maintenance.



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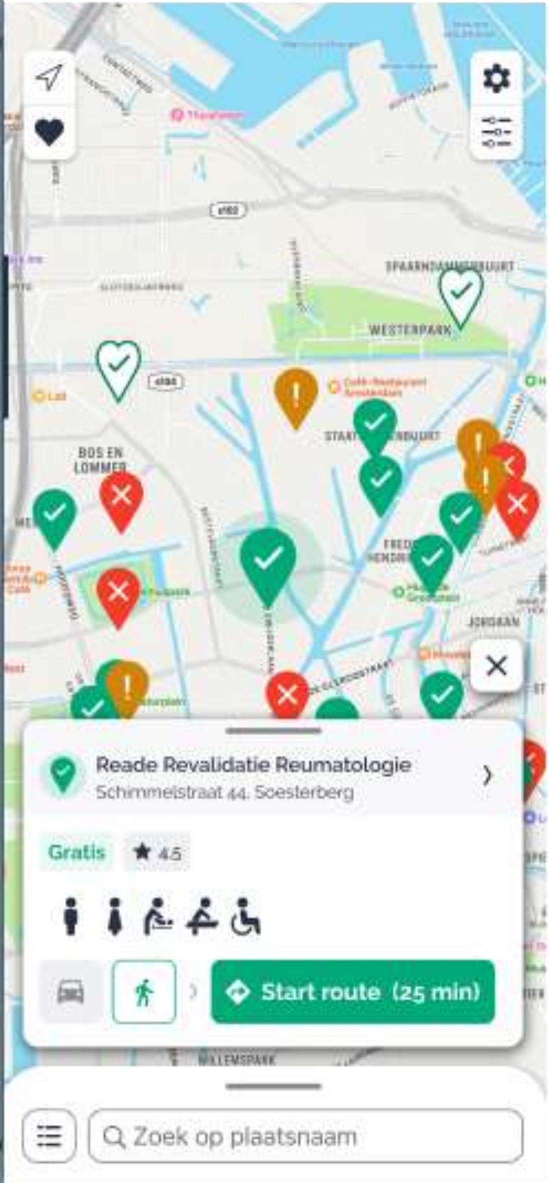
Toiletten

Zoek op plaatsnaam

Toiletten | Favorieten | Filter

Openbaar toilet	★ 4.5	2.0 km €0,50
Museum	★ 4.5	2.0 km €0,50
McDonalds	★ 4.5	2.0 km €0,50
PurePoint	★ 4.5	2.0 km €0,50
Scheltema	★ 4.5	2.0 km €0,50
Urinoir	★ 4.5	2.0 km €0,50
Openbaar toilet		2.0 km



Reade Revalidatie Reumatologie
Schimmelstraat 44, Soesterberg

Gratis ★ 4.5

Start route (25 min)

Zoek op plaatsnaam