SMART PUBLIC RESTROOM

INTERNET OF THINGS - PHASE 5 - GROUP 1

Smart public restrooms can leverage the Internet of Things (IoT) to enhance user experience, improve hygiene, and optimize maintenance. The objectives of integrating IoT into public restrooms include:

Real-time monitoring:

Implement sensors to monitor the occupancy of stalls and the usage of utilities, such as water and soap dispensers, to optimize cleaning schedules and supply management.

Maintenance optimization:

Utilize IoT sensors to detect issues such as leaks, overflows, or faulty equipment, enabling proactive maintenance and reducing the downtime of facilities.

Resource management:

Track resource usage, including water and electricity, to identify areas where conservation can be improved, leading to reduced operational costs and a smaller environmental footprint.

Enhanced hygiene:

Incorporate IoT devices to provide touchless experiences, including automatic flushing, touchless faucets, and sensor-operated soap dispensers, promoting a cleaner and more hygienic environment.

User feedback and satisfaction:

Integrate IoT-enabled feedback mechanisms, such as touchscreen kiosks or mobile applications, to gather user feedback, enabling authorities to promptly address concerns and improve overall user satisfaction.

Security and safety:

Deploy IoT-enabled surveillance cameras and alert systems to ensure the safety of users, deter vandalism, and promptly respond to emergencies, creating a secure environment for all visitors.

Accessibility and inclusivity:

Implement IoT technologies to cater to the needs of differently-abled individuals, such as automated doors, accessible fixtures, and personalized settings for enhanced inclusivity.

Data-driven decision-making:

Collect and analyse data from IoT devices to identify usage patterns, peak hours, and popular amenities, enabling authorities to make informed decisions for infrastructure upgrades and facility management.

Sustainability initiatives:

Integrate IoT sensors to monitor energy consumption, waste management, and overall environmental impact, facilitating the implementation of sustainable practices and promoting eco-friendly initiatives within the restroom facilities.

Seamless maintenance requests:

 Enable users to report issues or request maintenance through IoT-enabled interfaces, ensuring that problems are addressed promptly and efficiently to maintain a high standard of cleanliness and functionality.

IOT Device Setup:

Device Selection and Placement:

- Choose IoT devices such as occupancy sensors, water flow sensors, automated dispensers, and smart surveillance cameras tailored to the needs of the public restroom.
- Strategically place the devices to capture relevant data and monitor critical areas, including stalls, sinks, and entry points.

Power and Connectivity:

- Ensure a stable power source for the IoT devices, either through direct electrical connections or the use of long-lasting batteries.
- Establish a secure and reliable internet connection, preferably using a dedicated Wi-Fi network, to facilitate data transmission and remote monitoring.

Configuration and Integration:

- Follow the manufacturer's instructions to configure each IoT device and integrate it into the designated network.
- Set up the devices to communicate with a centralized management system, enabling real-time data collection and analysis.

Data Security and Privacy:

- Implement robust security protocols to protect the data collected by the IoT devices from unauthorized access or breaches.
- Utilize encryption techniques and authentication measures to safeguard sensitive information and maintain user privacy.

Monitoring and Control Interface:

- Deploy a user-friendly monitoring and control interface, accessible either through a web-based dashboard or a dedicated application, to oversee the functioning of the IoT devices in real time.
- Enable remote control capabilities to manage settings, receive alerts, and perform necessary adjustments as required.

IOT Platform development:

Automation and Control Features:

- Incorporate automation capabilities within the platform to enable remote control of restroom functions, such as water flow, air quality, and waste management.
- Integrate scheduling algorithms to automate routine tasks and optimize resource utilization based on predefined parameters.

Data Analytics and Reporting Tools:

- Implement data analytics tools to process and analyse the collected data, generating actionable insights for optimizing restroom operations and enhancing user experiences.
- Develop customizable reporting features that provide detailed analytics, performance metrics, and trend analysis for informed decision-making.

Code implementation:

```python
import random

def get_occupancy_data():

    return random.choice([True, False])  # Simulating random data for demonstration

 def get_water_flow_data():

     eturn round(random.uniform(0.5, 2.5), 2)  # Simulating random water flow data for demonstration

def control_devices(occupancy, water_flow):

   if occupancy:

      print("Restroom is occupied. Activating appropriate systems.")

   else:

      print("Restroom is unoccupied. Systems on standby.")

def main():

   while True:

      occupancy_data = get_occupancy_data()

      water_flow_data = get_water_flow_data()

      print(f"Occupancy: {occupancy_data}, Water Flow: {water_flow_data} liters/minute")

      control_devices(occupancy_data, water_flow_data)

      time.sleep(5)  # Simulating a 5-second delay for demonstration purposes

if __name__ == "__main__":

   main()
```
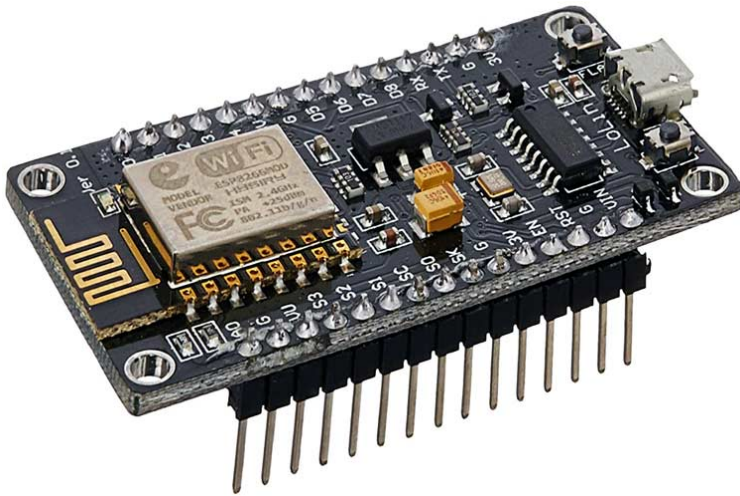
Schematic:

Smart Public Restroom Making Public Restroom Smart and Hygienic

Diagram:

Smart public restroom

An example Nodemcu esp8266:

PROJECT DETAILS

- IoT-enabled occupancy sensors can track the number of individuals using the restroom, allowing for better management of cleaning schedules and resource allocation. This data helps restroom administrators optimize staffing and maintenance efforts.
- IoT devices facilitate the automation of various processes, such as automated flushing, touchless faucets, and sensor-operated soap and sanitizer dispensers. These systems promote a hygienic and touchless restroom experience, reducing the spread of germs and improving overall cleanliness.
- IoT sensors can monitor resource usage, including water and electricity. By collecting data on consumption patterns, the restroom can implement measures to conserve resources, reduce waste, and promote sustainable practices.
- IoT devices can detect issues like leaks, malfunctions, or low supply levels in real-time. By promptly identifying and addressing these issues, maintenance teams can improve efficiency, reduce downtime, and ensure a seamless restroom experience for users.
- By collecting and analysing data from IoT devices, restroom managers can gain valuable insights into usage patterns, peak hours, and maintenance requirements. This data-driven approach enables informed decision-making, leading to better resource allocation and improved service delivery.
- Smart restrooms can incorporate user feedback systems, such as touchscreens or mobile applications, allowing visitors to report issues, provide suggestions, or rate their experience. This feedback mechanism enables administrators to address concerns promptly and enhance user satisfaction.
- IoT-enabled surveillance cameras and alert systems can ensure the security of restroom users and deter vandalism or criminal activities. These systems provide a safe and secure environment for visitors, boosting their confidence and trust in the facility.
- IoT technology can facilitate the inclusion of accessibility features for differently-abled individuals, such as automated doors, adjustable fixtures, and personalized settings, ensuring that the restroom is accessible and user-friendly for all.

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