IOT-Based Automated Cleaning and Maintenance System for Public Restrooms:

INTRODUCTION:

* In an increasingly urbanized world, public restrooms play a vital role in maintaining the health, hygiene, and comfort of city dwellers and visitors. However, ensuring the cleanliness and proper maintenance of public restrooms can be a significant challenge, often requiring constant human intervention. This is where the integration of the Internet of Things (IoT) technology steps in, revolutionizing the way we manage and maintain these essential facilities.

* The "IoT-Based Automated Cleaning and Maintenance System for Public Restrooms" project represents a cutting-edge solution to address the challenges of maintaining public restrooms efficiently and effectively. This innovative system leverages IoT technology to transform traditional restrooms into smart, self-monitoring, and self-maintaining facilities.

OBJECTIVES:

1. Enhanced Hygiene: To improve the cleanliness and sanitation of public restrooms, reducing the risk of disease transmission and enhancing the overall user experience.

2. Resource Optimization: To optimize the use of cleaning supplies, water, and energy, making public restrooms more eco-friendly and cost-effective to operate.

3. Real-time Monitoring: To enable real-time monitoring of restroom usage, cleanliness, and supply levels, allowing for immediate response to maintenance needs.

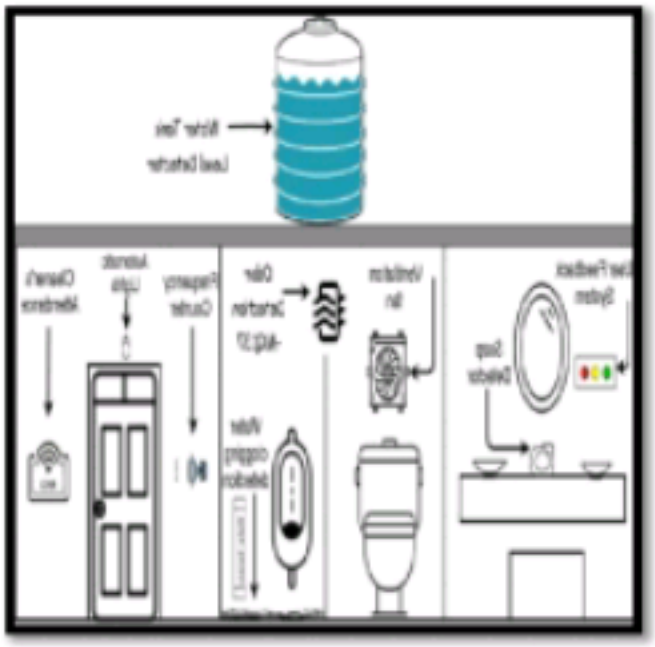
4. User Feedback: To provide a user-friendly interface for restroom visitors to report issues, provide feedback, and receive notifications about the status of the facilities.

5. Data Analytics: To collect and analyze data on restroom usage patterns, maintenance history, and user feedback to make informed decisions and further improve restroom operations.

COMPONENTS:

The IoT-Based Automated Cleaning and Maintenance System includes components such as occupancy sensors (ARDUINO), supply level sensors, automated cleaning equipment, centralized control software, and user interfaces. These components work in harmony to create a smart restroom ecosystem that responds dynamically to usage and maintenance requirements.

PROJECT MODEL:



WORKING:

An Automated Cleaning and Maintenance System using IoT (Internet of Things) technology works by integrating a network of sensors, devices, and software to monitor, manage, and automate the cleaning and maintenance of a facility, such as public restrooms. Here's how such a system typically works:

1. Sensors and Data Collection:

- IoT sensors are strategically placed throughout the facility, including in restroom stalls, near supply dispensers, and in environmental locations.
- These sensors collect data on various parameters, such as occupancy, supply levels, environmental conditions (temperature, humidity, air quality), and even equipment status (e.g., the state of cleaning machines).

2. Data Transmission:

- The sensor data is transmitted to a central control system or cloud platform via the Internet. This data can be transmitted wirelessly using Wi-Fi, cellular networks, or other IoT communication protocols (e.g., MQTT).

3. Data Processing and Analysis:

- The central control system processes the incoming data in real-time or periodically.
- It uses algorithms and rules to analyze the data and make decisions based on predefined thresholds or patterns. For example, it can identify restroom stalls that need cleaning, detect low supply levels, or assess environmental conditions.

4. Decision Making:

- Based on the data analysis, the system makes decisions on various actions:
  - Cleaning: When occupancy sensors detect that a stall is unoccupied for a certain duration, it triggers cleaning equipment to sanitize the stall.
  - Supply Management: When supply level sensors indicate low levels, the system can send automated alerts for restocking.
  - Environmental Control: The system can adjust temperature or ventilation settings for energy efficiency and user comfort.

5. User Interaction:

- Many IoT-based systems include user interfaces, such as mobile apps or digital displays outside restrooms.
- Users can provide feedback, report issues, or check the availability and cleanliness status of restroom stalls.

6. Alerts and Notifications:

- The system can send alerts and notifications to maintenance staff or administrators when issues requiring human intervention are detected, such as equipment malfunctions or critical supply shortages.

7. Data Storage and Analytics:

- Data collected over time is stored in databases for historical analysis.
- Analytics tools can extract insights from this data, such as usage patterns, peak usage hours, and maintenance trends.

8. Remote Access and Control:

- Maintenance staff can access the system remotely through secure connections, allowing them to monitor conditions, receive alerts, and control equipment as needed.

9. Continuous Improvement:

- Based on historical data and user feedback, the system can be fine-tuned and optimized for efficiency, cost-effectiveness, and user satisfaction.

BASIC AND SAMPLE CODE:

Creating a complete Arduino code for an automated cleaning and maintenance system for public restrooms is a complex and extensive task that requires detailed planning and development. It's not feasible to provide a full code for such a system in a single response. However, I can provide you with a simplified example of Arduino code to control a basic automated cleaning system as a starting point:

```
const int occupancySensorPin = 2;
const int cleaningMotorPin = 3;
const int supplyLevelSensorPin = 4;
const int occupancyThreshold = 500;
const int supplyThreshold = 800;
void setup() {
  pinMode(occupancySensorPin, INPUT);
  pinMode(cleaningMotorPin, OUTPUT);
  pinMode(supplyLevelSensorPin, INPUT);
}
void loop() {
  int occupancyLevel = analogRead(occupancySensorPin);
  if (occupancyLevel > occupancyThreshold) {
    digitalWrite(cleaningMotorPin, HIGH);
    int supplyLevel = analogRead(supplyLevelSensorPin);
    if (supplyLevel < supplyThreshold) {
      // Replenish supplies (e.g., refill soap, toilet paper, etc.)
    }
  } else {
    digitalWrite(cleaningMotorPin, LOW);
  }}
```

/*ANOTHER CODE*/

```
const int occupancySensorPin = 2;
const int cleaningActuatorPin = 9;

// Define threshold values
const int occupancyThreshold = 500;
void setup() {
  pinMode(occupancySensorPin, INPUT);
  pinMode(cleaningActuatorPin, OUTPUT);
  digitalWrite(cleaningActuatorPin, LOW); }
void loop() {
  int occupancyLevel = analogRead(occupancySensorPin);

  if (occupancyLevel < occupancyThreshold) {
    // Start the cleaning process (turn on the cleaning actuator)
    digitalWrite(cleaningActuatorPin, HIGH);
       delay(5000); // 5 seconds for demonstration
    digitalWrite(cleaningActuatorPin, LOW);
  }
}
```

In a real-world application, you would need to integrate various sensors, actuators, and additional logic for data storage, communication, and user interaction. The exact code would depend on the specific hardware components you're using and your project requirements.

For a comprehensive automated cleaning and maintenance system, consider working with a professional development team or IoT solution provider who can tailor the code to your specific needs and hardware setup.

Here, this is the above code for the basic knowledge and working progress of the automatic processing and maintaining the public toilet with the help of the Internet Of Things and Arduino sensors.

BENEFITS:

Improved Public Health:By maintaining high standards of cleanliness and hygiene.

Cost Savings:By optimizing resource usage and reducing labor costs.

Enhanced User Experience: Through real-time information and user feedback mechanisms.

Sustainability: By reducing water and energy consumption.

CONCLUSION:

- This project envisions a future where public restrooms become intelligent, self-sustaining facilities, offering users a higher level of convenience and cleanliness while reducing the burden on maintenance staff. By embracing IoT technology, we can transform the way we manage these essential urban amenities, making them more efficient, sustainable, and user-centric.

- In the following sections, we will delve deeper into the design, implementation, and benefits of this IoT-based Automated Cleaning and Maintenance System, offering insights into how it can be tailored to meet the specific needs of different public restroom facilities.

Phase 2: Innovation

In this phase you need to put your design into innovation to solve the problem.

Explain in detail the complete steps that will be taken by you to put your design that you thought of in previous phase into transformation.

Create a document around it and share the same for assessment.

NOTE:

File Naming Convention: **TechnologyName_Phase2**

After completion upload your file to your private GitHub account. Please give access to your faculty evaluators[facultyevaluator@gmail.com] and industry evaluator [IndustryEvaluator@skillup.online] to your private GitHub repository for evaluation process.