SMART PUBLIC TOILET USING IOT

[CHLORINE DETECTION FLOOR CLEANING MONITORING AND AUTOMATIC DOOR OPENING]

INTRODUCTION:

A smart public toilet using IoT (Internet of Things) is a modern and innovative sanitation facility that leverages IoT technology to enhance user experience, improve cleanliness, and optimize maintenance.

These advanced public toilets are equipped with various sensors and connectivity features to offer real-time monitoring, control, and data collection for efficient operation.

IoT-enabled smart public toilets aim to provide a more convenient and hygienic experience for users while enabling cities to better manage and maintain their public restroom infrastructure.

TOPIC INTRO:

A smart public toilet harnessing the power of IoT technology, featuring capabilities such as chlorine detection, automatic door opening, and floor clean sensors, represents a pioneering advancement in urban sanitation infrastructure.

This innovative facility integrates IoT sensors and connectivity to create a responsive and efficient public restroom system. By incorporating chlorine detection, it ensures the presence of clean and safe water. Automatic door opening enhances user convenience, while floor clean sensors maintain a high standard of hygiene.

These features collectively make smart public toilets using IoT a cornerstone in improving public health and convenience, redefining the standards for modern urban sanitation.

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OBJECTIVES:

The objectives of implementing a smart public toilet using IoT with chlorine detection, automatic door opening, and floor clean sensors are as follows:

1. Enhance Hygiene and Safety: Ensure the presence of clean and safe water through chlorine detection, preventing waterborne diseases. Maintain a high level of sanitation in the restroom, safeguarding public health.

2. User Convenience: Improve the user experience by automatically opening the restroom door, providing a touchless entry, and enhancing accessibility for all, including those with mobility issues.

3. Efficient Resource Management: Optimize resource usage by automatically opening and closing doors, conserving energy and maintaining a controlled environment inside the toilet.

4. Real-time Monitoring: Continuously monitor and collect data on water quality, door status, and restroom cleanliness to provide real-time information for maintenance and decision-making.

5. Cost Savings: Reduce maintenance costs by enabling timely cleaning based on floor clean sensor data and preventing water contamination through chlorine detection.

6. Sustainability: Promote eco-friendliness by reducing water wastage and energy consumption, contributing to a more sustainable urban environment.

7. Public Health Promotion: Create an environment that encourages the use of public restrooms by ensuring cleanliness and safety, which in turn supports overall public health and wellbeing.

8. Data-Driven Insights: Utilize the data collected from these sensors to gain insights into restroom usage patterns, helping in urban planning and infrastructure optimization.

9. Smart City Integration: Integrate these smart public toilets into a broader smart city infrastructure, enabling efficient resource allocation and enhancing the overall quality of urban life.

By achieving these objectives, a smart public toilet using IoT with chlorine detection, automatic door opening, and floor clean sensors can significantly improve public sanitation, resource management, and overall urban quality of life.

COMPONENTS REQUIRED:

1. Chlorine Detection System:

- Chlorine sensors: These sensors can detect the presence and concentration of chlorine in the water supply to ensure water quality.

2. Automatic Door Opening System:

- Proximity sensors: These sensors detect the presence of a person approaching the restroom door and trigger the automatic door-opening mechanism.

- Actuators: Mechanisms to physically open and close the restroom door, controlled by the proximity sensors.

- Microcontroller or IoT device: To process data from the sensors and control the door mechanism.

3. Floor Clean Sensors:

- Floor sensors: These can be moisture or cleanliness sensors to detect the condition of the restroom floor.

- Microcontroller or IoT device: To collect data from the floor sensors and trigger alerts or actions based on cleanliness levels.

4. Internet of Things (IoT) Platform:

- IoT gateway or hub: Acts as a central point for data collection and communication between sensors, actuators, and the cloud.

- Connectivity modules: Wi-Fi, cellular, or other communication modules to connect the IoT system to the internet.

5. Cloud-based Server:

- Cloud infrastructure for data storage, processing, and analysis.

- Database for storing sensor data and historical records.

- Data processing and analytics tools for real-time and historical data analysis.

6. User Interface:

- Touchscreen display or mobile app for users to interact with the restroom and receive information on water quality and restroom status.

- User interface for administrators to monitor and manage the smart toilet system.

7. Power Supply:

- Power sources for sensors, actuators, and IoT devices, which may include batteries, solar panels, or a reliable electrical connection.

8. Security Measures:

- Security protocols and encryption to protect user data and ensure the system's security.

9. Maintenance and Servicing Tools:

- Tools and equipment for routine maintenance and servicing of the smart public toilet.

10. Backup Systems:

- Backup power supply to ensure the toilet remains operational during power outages.

- Redundant or fail-safe mechanisms to handle sensor or system failures.

11. Compliance and Regulations:

- Ensure that the system complies with local sanitation and safety regulations.

These components work together to create a smart public toilet using IoT that incorporates chlorine detection, automatic door opening, and floor clean sensors to provide a safe, clean, and convenient restroom experience for users.

I. CHLORINE DETECTION:

Chlorine detection using IoT typically involves a gas sensor to detect the presence and concentration of chlorine gas. Below is a simplified Python program outline to give you an idea of how you can set up a basic IoT-based chlorine detection system. Note that in a real-world application, you would need to consider specific sensor models and IoT platforms, as well as safety precautions for handling chlorine gas.

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PROGRAM

```
import time
import RPi.GPIO as GPIO
import smtplib
CHLORINE_SENSOR_PIN = 18
GPIO.setmode(GPIO.BCM)
GPIO.setup(CHLORINE_SENSOR_PIN, GPIO.IN)
def detect_chlorine():
    try:
        while True:
            if GPIO.input(CHLORINE_SENSOR_PIN):
                print("Chlorine gas detected!")
                send_alert()
            time.sleep(5)
    except KeyboardInterrupt:
        GPIO.cleanup()
# Function to send email alert (optional)
def send_alert():
    email = "youremail@gmail.com"
    password = "yourpassword"
    to_email = "recipient@example.com
    subject = "Chlorine Gas Detected!"
    message = "Chlorine gas has been detected in the area.
```

```
try:
        server = smtplib.SMTP("smtp.gmail.com", 587)
        server.starttls()
        server.login(email, password)
        server.sendmail(email, to_email, f"Subject: {subject}\n\n{message}")
  server.quit()
        print("Alert sent via email.")
    except Exception as e:
        print(f"Failed to send email alert: {str(e)}")
if name == "main":
    detect_chlorine()
```

EXPLANATION

1. This program is a simplified example for educational purposes. In a real application, you would use an actual chlorine gas sensor and integrate it with an IoT platform for more comprehensive functionality.

2. Ensure you have the necessary hardware components, like the chlorine gas sensor, and proper safety measures in place when working with chlorine gas.

3. You may need to adjust the GPIO pin, sensor calibration, and other parameters to match your specific setup.

4. Sending email alerts in the `send_alert` function is optional. You can implement different alert mechanisms based on your needs.

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II. FLOOR MONITORING

A floor clean detection system can use various sensors, such as moisture or cleanliness sensors, to determine the condition of the restroom floor. Below is a simplified Python program outline for a basic IoT-based floor clean detection system. Note that you'll need to adapt it to your specific sensor and hardware setup.

PROGRAM:

```
import time
import RPi.GPIO as GPIO  # If you're using a Raspberry Pi
import smtplib
FLOOR_SENSOR_PIN =
GPIO.setmode(GPIO.BCM)
GPIO.setup(FLOOR_SENSOR_PIN, GPIO.IN)
def detect_floor_cleanliness():
    try:
        while True:
            if GPIO.input(FLOOR_SENSOR_PIN):
                print("Floor is dirty!")
                send_alert()
            time.sleep(5)
    except KeyboardInterrupt:
        GPIO.cleanup()
# Function to send email alert (optional)
def send_alert():
```

```
        email = "youremail@gmail.com"
        password = "yourpassword
        to_email = "recipient@example.com"
        subject = "Dirty Floor Detected!"
        message = "The restroom floor is dirty and needs cleaning."
        try:
            server = smtplib.SMTP("smtp.gmail.com", 587)
            server.starttls()
            server.login(email, password)
            server.sendmail(email, to_email, f"Subject:
{subject}\n\n{message}")
            server.quit()
            print("Alert sent via email.")
        except Exception as e:
            print(f"Failed to send email alert: {str(e)}")
    if name == "main":
        detect_floor_cleanliness()
```

EXPLAINATION:

1. This program is a simplified example for educational purposes. In a real application, you would use actual cleanliness sensors and integrate them with an IoT platform for more comprehensive functionality.

2. Ensure you have the necessary hardware components, like the cleanliness sensor, and proper safety measures in place when working with sensors.

3. You may need to adjust the GPIO pin, sensor calibration, and other parameters to match your specific setup.

4. Sending email alerts in the `send_alert` function is optional. You can implement different alert mechanisms based on your needs.

5. Make sure the sensor is capable of detecting floor cleanliness or moisture accurately. Different sensors may require different code and calibration.`

III. AUTOMATIC DOOR OPENING:

Creating an automatic door opening system using IoT involves various components like proximity sensors and IoT devices. Below is a simplified Python program outline to give you an idea of how to set up a basic IoT-based automatic door opening system. This example uses a Raspberry Pi and a PIR (Passive Infrared) sensor for proximity detection.

PROGRAM:

```
import time

PIR_SENSOR_PIN = 17

DOOR_ACTUATOR_PIN = 18

GPIO.setmode(GPIO.BCM)

GPIO.setup(PIR_SENSOR_PIN, GPIO.IN)

GPIO.setup(DOOR_ACTUATOR_PIN, GPIO.OUT)

def open_door():
```

```
    GPIO.output(DOOR_ACTUATOR_PIN, GPIO.HIGH)
    print("Door is open")
def close_door():
    GPIO.output(DOOR_ACTUATOR_PIN, GPIO.LOW)
    print("Door is closed")
def detect_motion():
    try:
        door_opened = False
        while True:
            if GPIO.input(PIR_SENSOR_PIN):
                print("Motion detected!")
                if not door_opened:
                    open_door()
                    door_opened = True
            else:
                if door_opened:
                    close_door()
                    door_opened = False
            time.sleep(1)
    except KeyboardInterrupt:
        GPIO.cleanup()
if name == "main":
    detect_motion()
```

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EXPLAINATION:

1. This program is a simplified example for educational purposes. In a real application, you would use actual sensors, an actuator, and integrate them with an IoT platform for more comprehensive functionality.

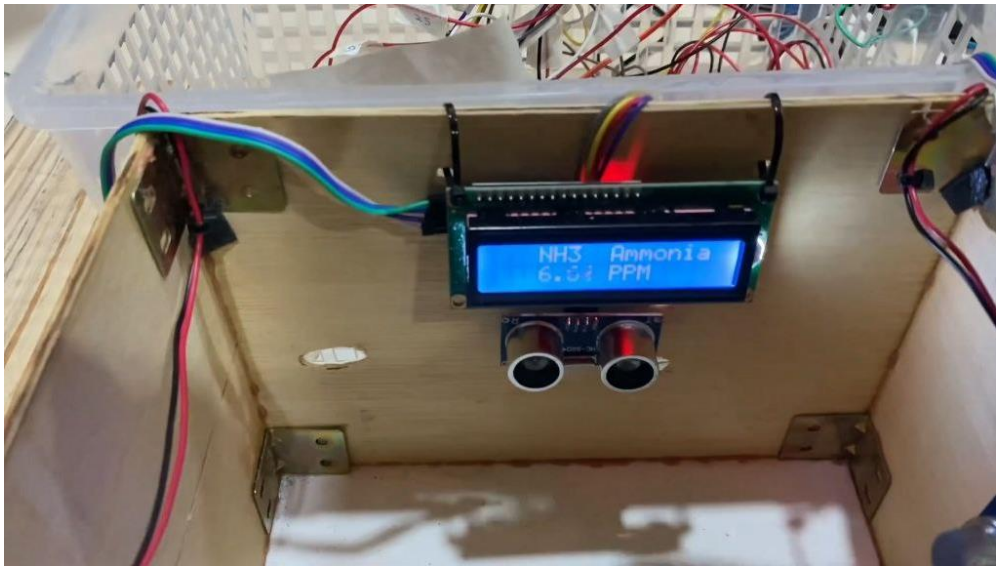
2. Ensure you have the necessary hardware components, like the PIR sensor and door actuator, and proper safety measures in place.

3. You may need to adjust the GPIO pin numbers and sensor calibration to match your specific setup.

4. Make sure to use the appropriate actuator and control mechanism for your door.

5. For a more advanced system, you can integrate this with an IoT platform to control and monitor the door remotely, receive notifications, and collect data.

PROJECT CLIPS:



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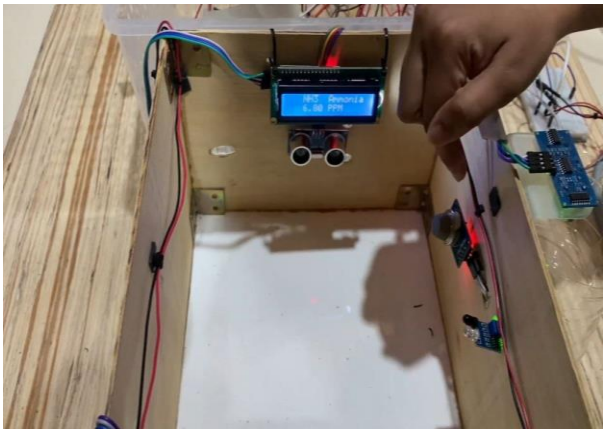

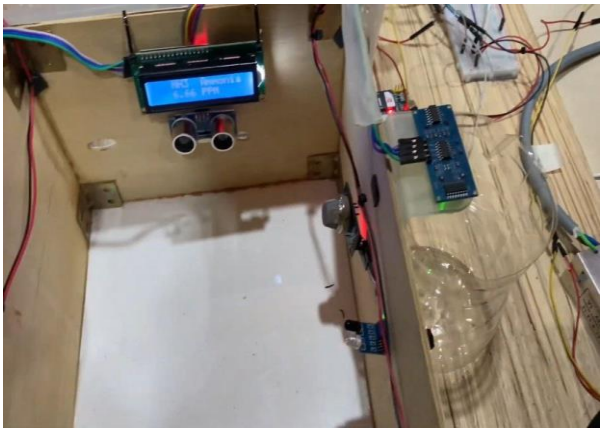

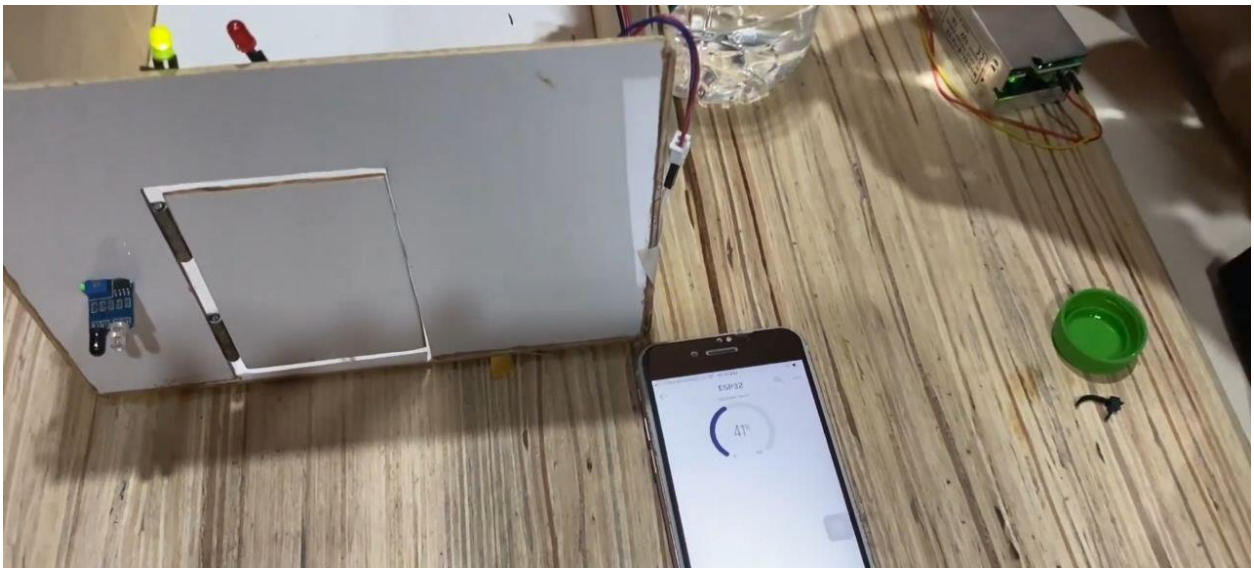

WEB APPLICATION FOR PUBLIC TOILET:

- A web application for a smart public toilet using IoT represents a powerful tool to enhance user experience, maintenance, and monitoring of public restroom facilities.

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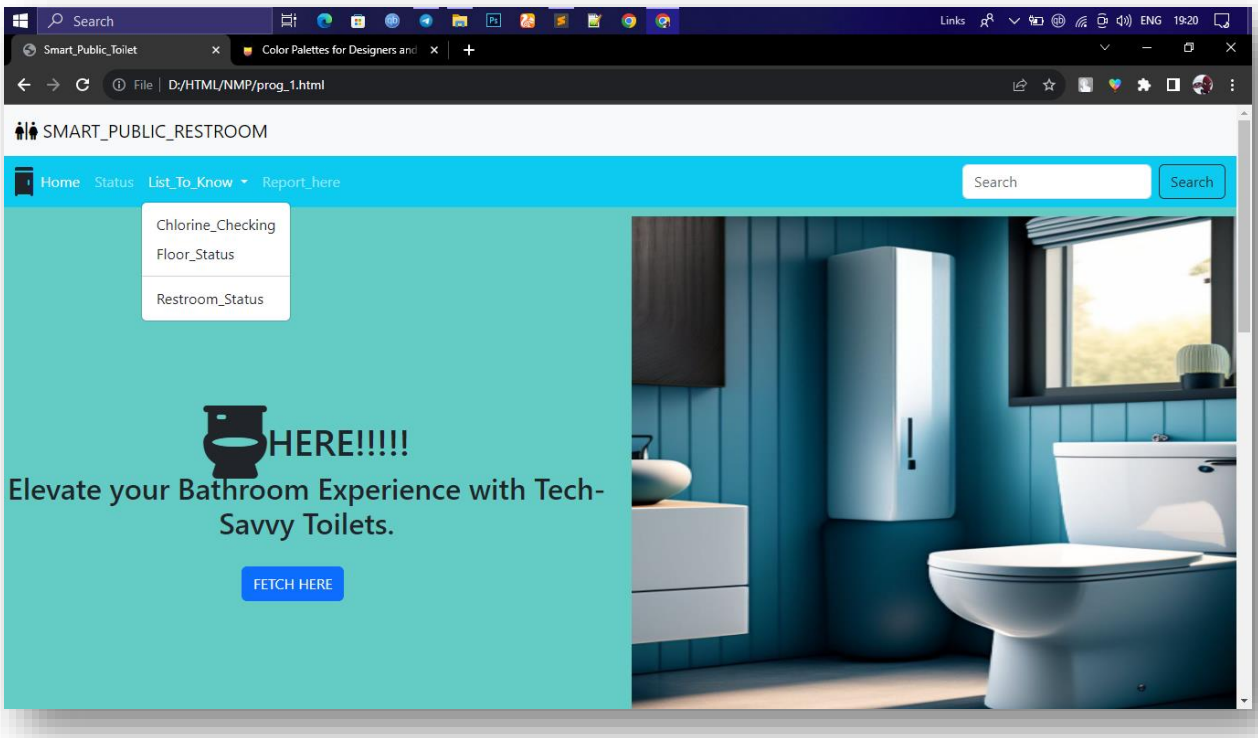
- This innovative digital solution leverages IoT technology to create a seamless and convenient experience for users while offering efficient management for city authorities.
- Users can access the web application to find nearby smart public toilets, check their availability, and even access real-time data on cleanliness and water quality.
- On the administrative side, city officials can remotely monitor and manage these facilities, ensuring timely maintenance, resource optimization, and improved public health. In this way, the web application serves as a bridge between cutting-edge IoT infrastructure and the needs of urban populations, redefining the standards for modern public sanitation.



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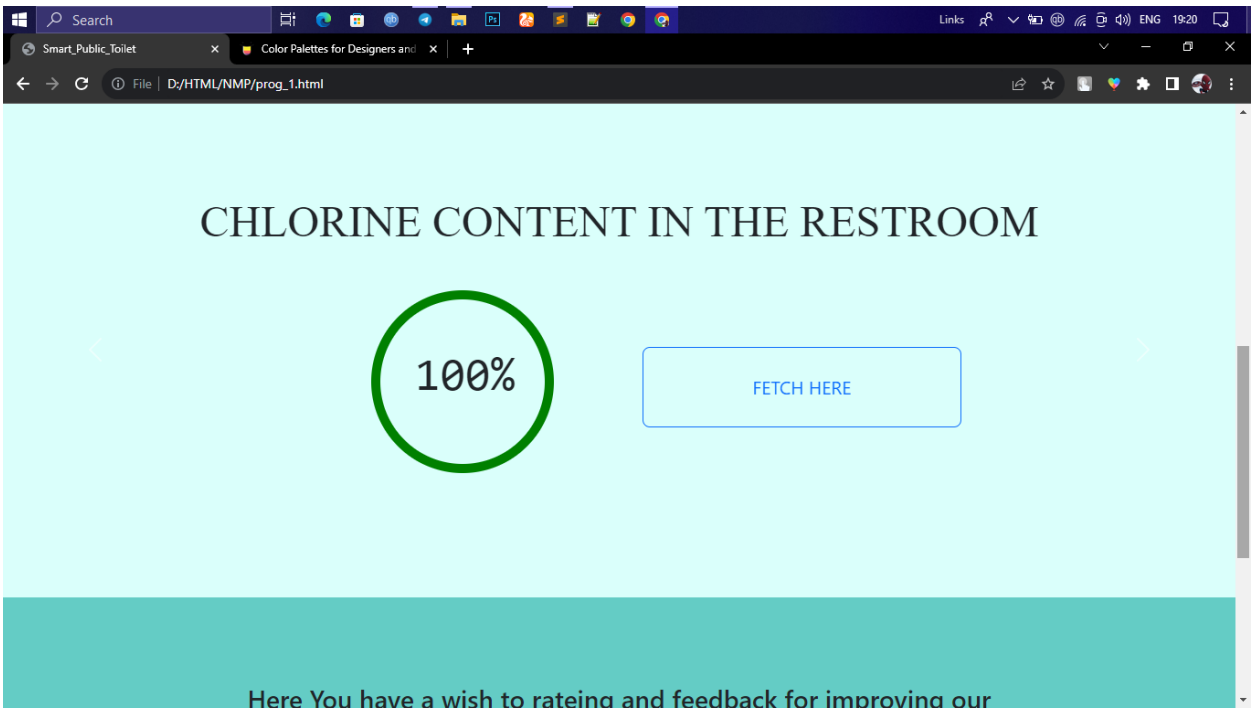

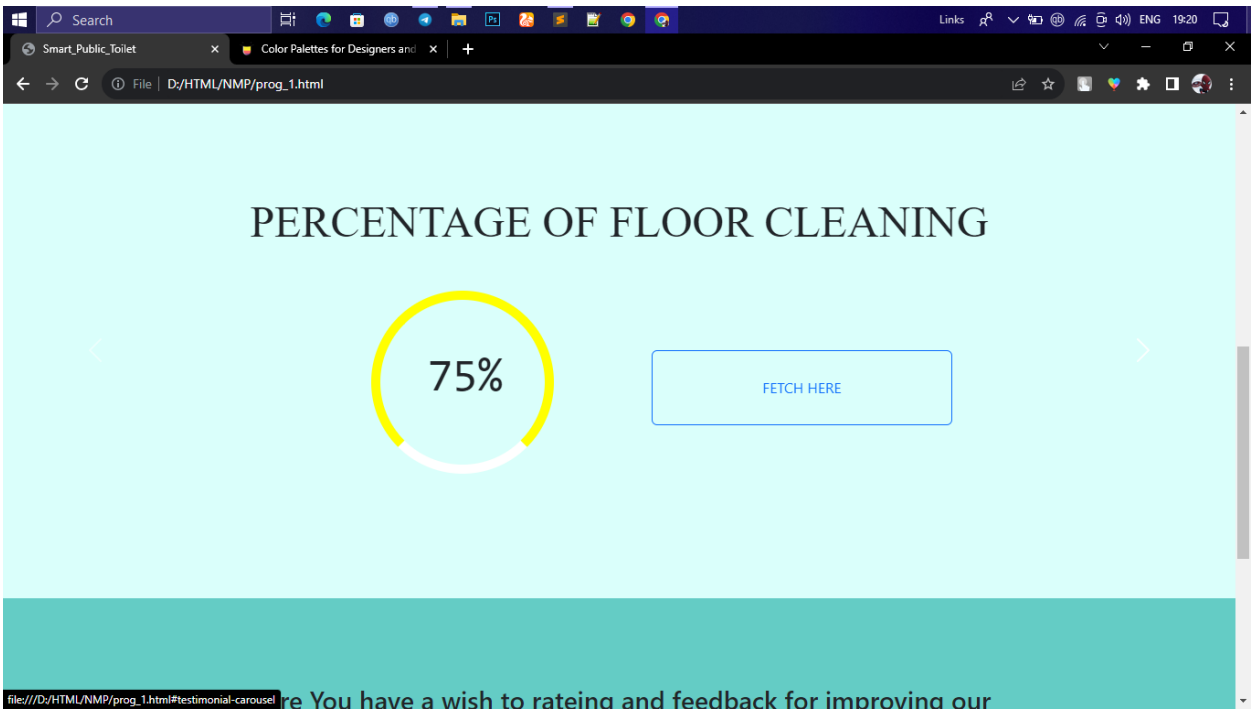

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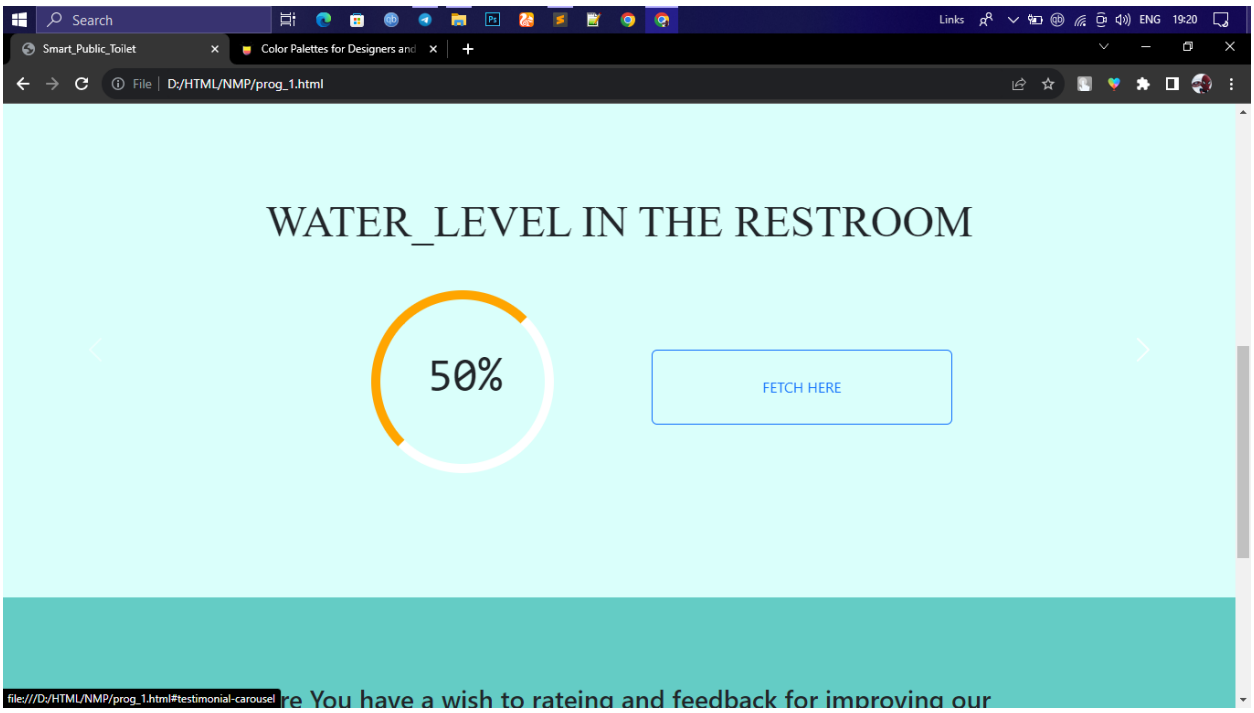

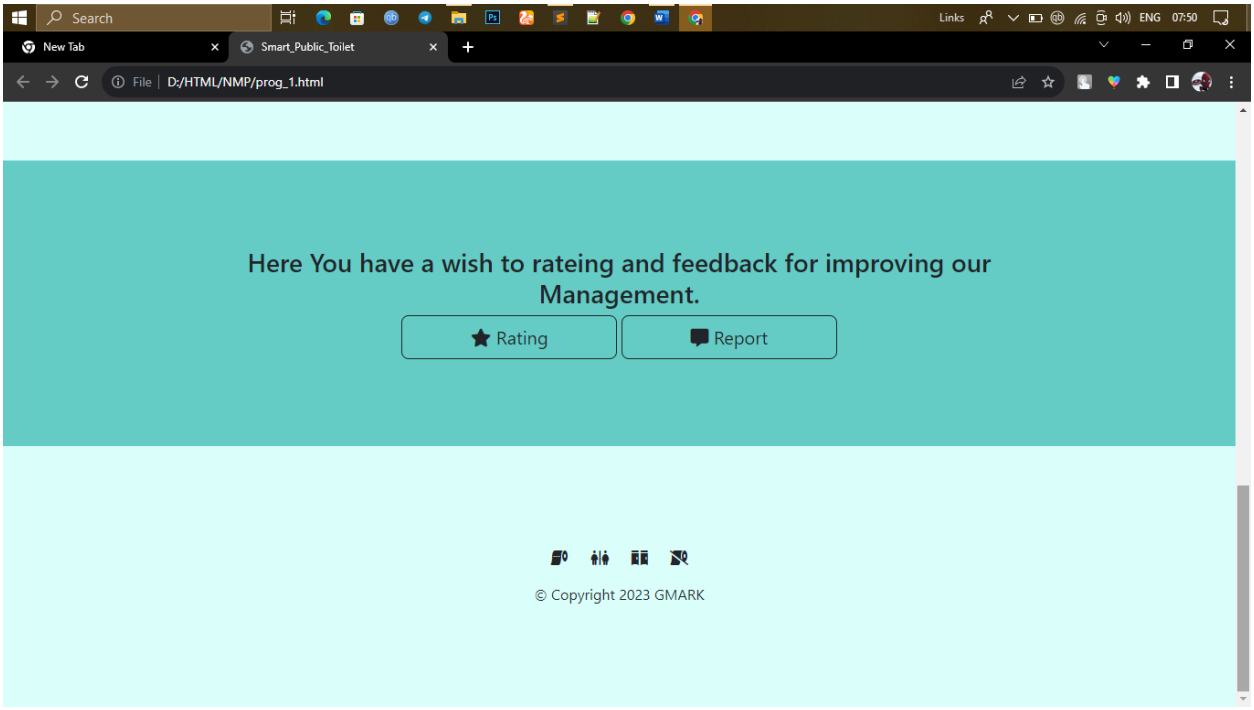

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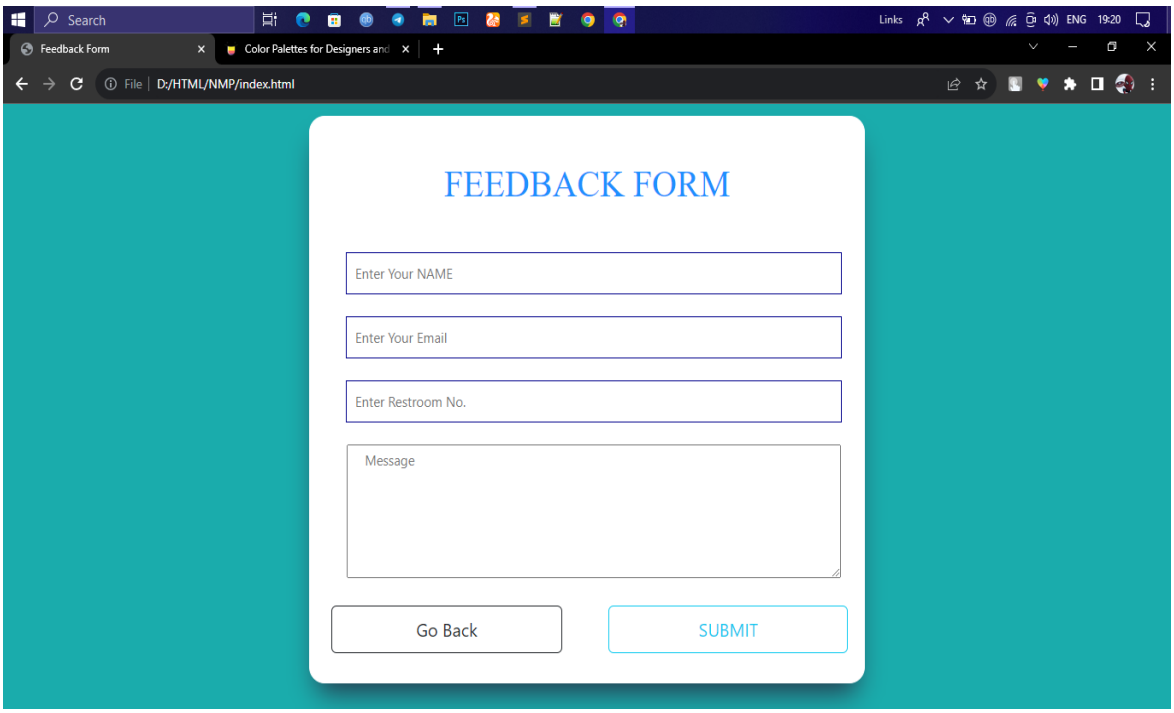

CONCLUSION:

In conclusion, the concept of a smart public toilet using IoT technology, incorporating chlorine detection, automatic door opening, and floor clean sensors, represents a significant leap forward in modern urban sanitation infrastructure. This innovative solution combines the power of the Internet of Things with the practical needs of public sanitation, offering a host of benefits for both users and city authorities.

By ensuring the presence of clean and safe water through chlorine detection, these smart public toilets prioritize public health and safety. The automatic door opening mechanism not only enhances user convenience but also promotes accessibility and touchless interactions, a particularly crucial feature in a post-pandemic world.

Furthermore, the integration of floor clean sensors maintains a consistently high level of restroom hygiene, ensuring a pleasant and healthy experience for all users. Real-time monitoring, data collection, and remote control capabilities make maintenance and resource management more efficient, reducing costs and optimizing the use of resources.

Ultimately, the concept of a smart public toilet using IoT transcends the conventional restroom experience. It redefines public sanitation by enhancing user convenience, promoting sustainability, contributing to smart city development, and prioritizing public health. As cities continue to grow and evolve, such innovative solutions become increasingly vital in improving the quality of urban life.