TEAM MEMBERS:

1. Sobhiya T   921921104046

2. Uva Sri K   921021104053

3. Sri Hari Preetha M 921021104048

4. Dharani B   921021104301

SMART PUBLIC RESTROOM (Using IOT)

Objectives:

Hygiene and cleanliness:

- Improved hygiene and cleanliness: Smart public restrooms use sensors and other technologies to automatically monitor and control various functions, such as flushing toilets, dispensing soap and water, cleaning and sanitizing surfaces, and detecting and removing waste. This helps to reduce the spread of germs and bacteria, and to create a more hygienic and pleasant environment for users.

Efficiency and sustainability

- Reduced water and energy consumption: Smart public restrooms use smart technologies to reduce the amount of water and energy they consume. For example, they may use sensors to turn on lights and flush toilets only when they are in use, and they may use energy-efficient lighting and ventilation systems. Additionally, some smart public restrooms collect and recycle rainwater to reduce their reliance on municipal water supplies.

Accessibility and user satisfaction

- Increased accessibility and user satisfaction: Smart public restrooms offer a variety of features to make them more accessible and user-friendly for all users, including people with disabilities. For example, they may provide real-time information on the availability and cleanliness of restrooms, offer hands-free controls and automatic doors, and have adjustable fixtures. Additionally, smart public restrooms may be designed to create a more inviting and comfortable environment for users, with features such as comfortable seating, adequate lighting and ventilation, and calming music.

IoT Sensor Setup :

- **Occupancy sensors:** These sensors can be used to detect when a stall or room is occupied, and can be used to control lighting, toilets, and other devices.
- **Motion sensors:** These sensors can be used to detect movement, and can be used to control faucets, soap dispensers, and other devices.
- **Temperature sensors:** These sensors can be used to monitor the temperature of the restroom, and can be used to control HVAC systems.
- **Humidity sensors:** These sensors can be used to monitor the humidity of the restroom, and can be used to control ventilation systems.
- **Gas sensors:** These sensors can be used to detect harmful gases, such as methane and carbon dioxide.
- **Water level sensors:** These sensors can be used to monitor the water level in toilets and sinks, and can be used to prevent overflows.

Mobile App Development :

A smart public restroom using Flutter can work in a few different ways, depending on the specific features that are implemented. Here is a general overview of how it might work:

1. The user opens the smart public restroom app on their mobile device.
2. The app uses the device's GPS location to identify the nearest smart public restrooms.
3. The app queries a smart restroom API to get information about the occupancy, cleanliness, and accessibility of the restrooms.
4. The app displays this information to the user in a list or on a map.
5. The user selects a restroom and the app provides directions to the restroom.
6. Once the user arrives at the restroom, they can use the app to open the door, flush the toilet, and control other features of the restroom.
7. The app can also be used to submit feedback on the restroom's cleanliness, accessibility, and other features.

Raspberry Pi Integration :

The Raspberry Pi is integrated into the Smart Parking project in two ways:

1. The Raspberry Pi is used to collect and process data from the ultrasonic sensors.

2. The Raspberry Pi is used to send the data from the sensors to the cloud or mobile app server.

➢ To collect data from the ultrasonic sensors, the Raspberry Pi uses a GPIO library. The GPIO library allows the Raspberry Pi to read and write to the GPIO pins on the board. The ultrasonic sensors are connected to the GPIO pins on the Raspberry Pi, so the Raspberry Pi can read the distance from the sensors by reading the voltage on the GPIO pins.

➢ To send the data from the sensors to the cloud or mobile app server, the Raspberry Pi uses a networking library. The networking library allows the Raspberry Pi to connect to the internet and send and receive data. The Raspberry Pi can be configured to periodically send the data from the sensors to the cloud or mobile app server.

Code Implementation :

The following programming languages can be used for smart public restrooms based on IoT:

- **Python:** Python is a popular programming language for IoT development because it is easy to learn and use. It has a large community of developers and a wide range of libraries and frameworks available for IoT development.
- **JavaScript:** JavaScript is a versatile programming language that can be used for both front-end and back-end IoT development. It is also popular for developing mobile apps, which can be used to control and interact with smart public restrooms.
- **Java:** Java is a robust and reliable programming language that is well-suited for developing enterprise-grade IoT applications. It is also widely supported by hardware manufacturers, making it a good choice for developing smart public restroom systems.
- **C/C++:** C/C++ are low-level programming languages that offer more performance and control than higher-level languages.

Example Code:

```python
import paho.mqtt.client as mqtt
import time

# Define the MQTT broker address and topic
broker_address = "localhost"
topic = "smart_public_restroom"

# Create an MQTT client
client = mqtt.Client()

# Connect to the MQTT broker
client.connect(broker_address)

# Subscribe to the MQTT topic
client.subscribe(topic)

# Define a function to handle incoming messages
def on_message(client, userdata, msg):
    # Get the message payload
    payload = msg.payload.decode()

    # Parse the message payload
    data = {}
    for line in payload.splitlines():
        key, value = line.split(":")
        data[key] = value

    # Print the data to the console
    print(data)

# Register the message callback function
client.on_message = on_message
```
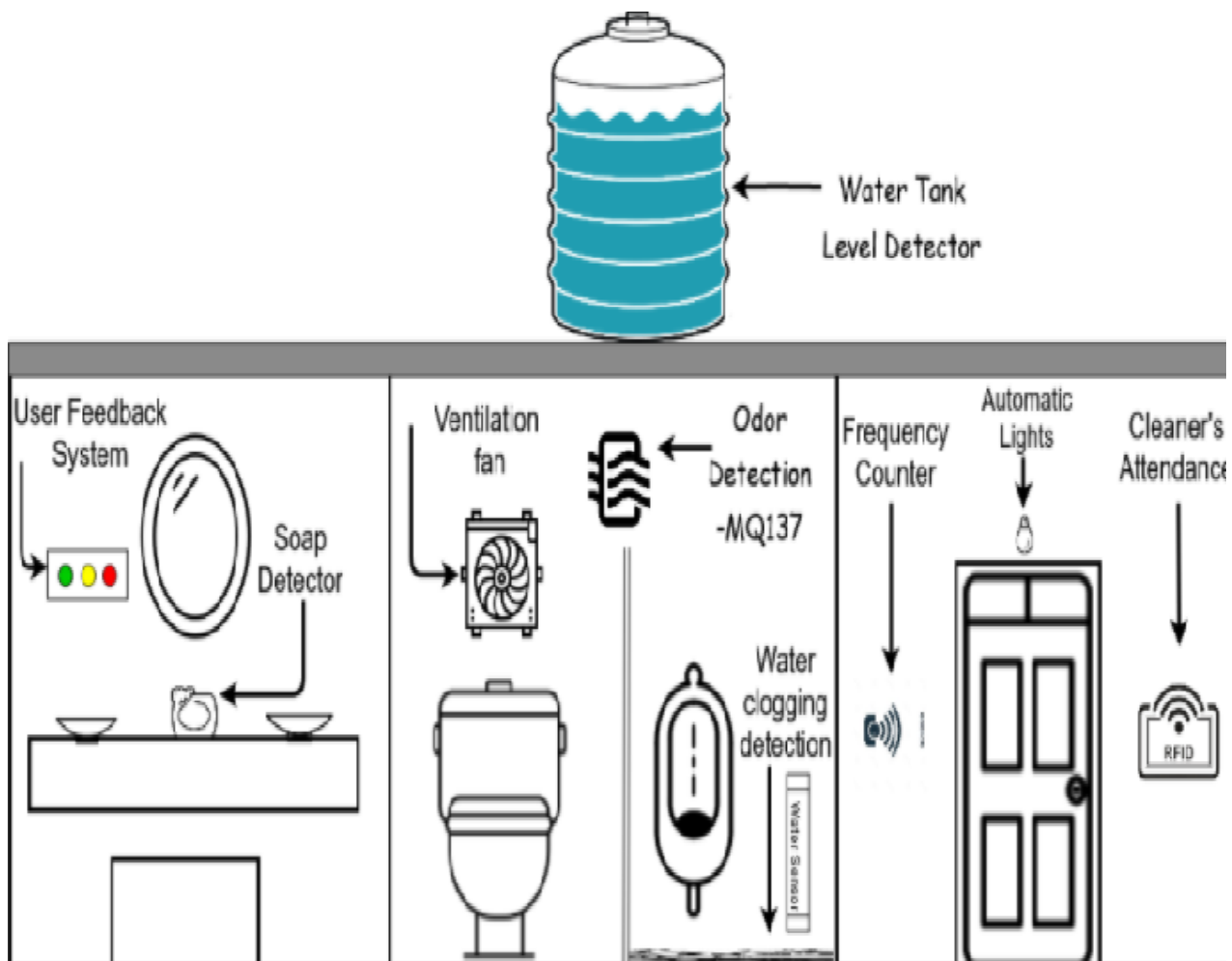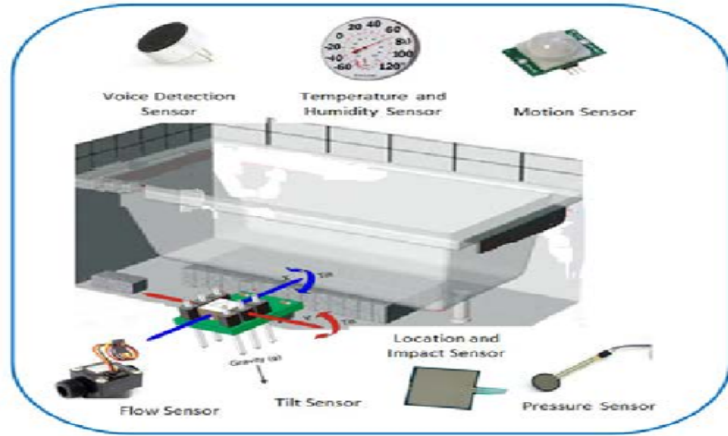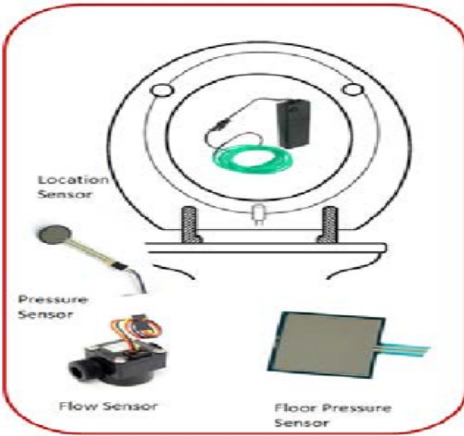
```
# Start a loop to listen for incoming messages
while True:
    # Wait for a message
    client.loop()

    # After receiving a message, sleep for 1 second
    time.sleep(1)

# Disconnect from the MQTT broker
client.disconnect()
```

The following diagram shows the overall architecture of the
Smart Public Restroom:

The real-time smart restroom availability system can benefit and issues in the following ways:

- **Improved hygiene and cleanliness:** Smart public restrooms can help to improve hygiene and cleanliness by automatically flushing toilets, dispensing soap and water, and cleaning and sanitizing surfaces. This can help to reduce the spread of germs and bacteria, and make public restrooms more pleasant and inviting for users.
- **Increased efficiency and sustainability:** Smart public restrooms can help to reduce water and energy consumption by controlling the flow of water to toilets and faucets and using energy-efficient lighting and ventilation systems. This can help to save money on utilities and reduce the environmental impact of public restrooms.
- **Enhanced accessibility:** Smart public restrooms can make public restrooms more accessible to people with disabilities by providing features such as hands-free controls, automatic doors, and adjustable fixtures. This can help to ensure that everyone has equal access to clean and well-maintained public restrooms.
- **Improved user satisfaction:** Smart public restrooms can improve the user experience by providing features such as real-time information on the availability and cleanliness of restrooms.

Conclusion:

● Smart public restrooms are still in their early stages of development, but they have the potential to revolutionize the way we use public restrooms. By using IoT technology to monitor and automate various aspects of the restroom, smart restrooms can help to improve hygiene, reduce costs, and improve the user experience.

● As the technology continues to develop and become more affordable, we can expect to see more and more smart public restrooms popping up in cities and businesses around the world.

● In conclusion, smart public restrooms using IoT are a promising technology that has the potential to make public restrooms cleaner, more efficient, and more user-friendly.