**SMART PUBLIC RESTROOM USING IOT**

**(Internet Of Things)**

**Phase-3:INNOVATION**

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**INTRODUCTION**

A smart public restroom is a restroom that uses technology to improve the user experience and make the restroom more efficient. Raspberry Pi is a small, affordable computer that can be used to create a variety of smart devices, including smart public restrooms.

Raspberry Pi Sensor Python Program



**The following Python program can be used to create a smart public restroom that uses a sensor to detect when a user is present and then turns on the lights and flushes the toilet:**

|  |
| --- |
| Python  import RPi.GPIO as GPIO  import time  # Set up the GPIO pins  GPIO.setmode(GPIO.BCM)  GPIO.setup(18, GPIO.IN) # PIR sensor  # Define a function to turn on the lights  def turn\_on\_lights():  GPIO.output(23, GPIO.HIGH)  # Define a function to turn off the lights  def turn\_off\_lights():  GPIO.output(23, GPIO.LOW)  # Define a function to flush the toilet  def flush\_toilet():  GPIO.output(24, GPIO.HIGH)  time.sleep(5)  GPIO.output(24, GPIO.LOW)  # Start a loop to monitor the PIR sensor  while True:  if GPIO.input(18):  turn\_on\_lights()  flush\_toilet()  else:  turn\_off\_lights()  time.sleep(1) |

The PIR sensor is connected to GPIO pin 18 on the Raspberry Pi. When a user enters the restroom, the PIR sensor will detect their presence and send a signal to the Raspberry Pi. The Raspberry Pi will then run the Python program above, which will turn on the lights and flush the toilet. After a few seconds, the Raspberry Pi will turn off the lights again.

When designing the hardware setup for your smart public restroom, it is important to consider the specific needs of your users and the budget that you have available. It is also important to select hardware components that are compatible with each other and that can be easily integrated into your overall smart restroom system.

**HARDWARE SETUP**

This hardware setup would allow you to collect data on a variety of factors in the restroom, such as occupancy, temperature, humidity, air quality, and odor levels. This data could then be used to control the restroom environment and improve the user experience. For example, the intelligent controller could use data from the occupancy sensors to turn off the lights and ventilation when the restroom is empty, or to flush the toilet automatically when someone leaves. The data analysis platform could be used to identify trends, patterns, and anomalies in the data. For example, the data analysis platform might be used to identify restrooms that are frequently being used or restrooms that are in need of maintenance.

You could also add other hardware components to this basic setup, such as smart mirrors, digital signage, and an emergency call system, depending on your specific needs and budget.

**SOFTWARE SETUP**

The software setup for a smart public restroom will vary depending on the specific features and functionality that are desired. However, there are some common elements that would be included in most setups.

One important component is a central database that stores all of the data collected from the various sensors and devices in the restroom. This data can include information such as occupancy, water usage, and supply levels. The database can be used to generate reports and analytics that can help to improve the efficiency and management of the restroom.

Another important component of the software setup is a user interface that allows facility managers to monitor and control the restroom. This interface can be web-based or mobile-based, and it should provide easy access to all of the relevant data and functionality.

The specific features and functionality that are included in the software setup will depend on the specific needs of the facility. However, some common features include:

\* \*\*Occupancy sensors:\*\* These sensors can be used to track how many people are using the restroom at any given time. This information can be used to optimize cleaning and maintenance schedules, and to identify any potential problems with overcrowding.

\* \*\*Water usage sensors:\*\* These sensors can be used to track how much water is being used in the restroom. This information can be used to identify areas where water conservation can be improved, and to detect any potential leaks.

\* \*\*Supply level sensors:\*\* These sensors can be used to track the levels of soap, toilet paper, and other supplies in the restroom. This information can be used to ensure that supplies are always available, and to reduce the need for manual restocking.

\* \*\*Fault detection:\*\* The software can be used to monitor the various sensors and devices in the restroom for any faults or problems. If a fault is detected, the software can generate an alert so that it can be addressed promptly.

In addition to these basic features, some smart public restrooms may also include more advanced features such as:

\* \*\*Touchless controls:\*\* These controls can be used to operate faucets, toilets, and other fixtures without having to touch them. This can help to reduce the spread of germs.

\* \*\*Voice control:\*\* This feature allows users to control the restroom using voice commands. This can be especially useful for people with disabilities.

\* \*\*Wayfinding:\*\* This feature can help users to find the restroom and to navigate their way inside. This can be especially useful in large or complex facilities.

Data collection for smart public restrooms using IoT (Internet of Things) can be done using a variety of sensors, including:

**DATA COLLECTION**

Occupancy sensors

Water flow sensors

Air quality sensors

Soap and paper dispenser sensor

Feedback sensors

The data collected from these sensors can be transmitted to a central cloud-based platform using a variety of communication protocols, such as Wi-Fi, Bluetooth, or cellular networks. Once the data is in the cloud, it can be analyzed to identify trends and patterns, and to generate insights that can be used to improve the management and operation of the restroom.

Overall, data collection for smart public restrooms using IoT can help to improve the efficiency, cleanliness, and overall user experience of public restrooms.

**DATA TRANSMISSION**

Data transmission for smart public restrooms using IoT using Python can be done in a number of ways. One common approach is to use a MQTT broker. MQTT is a lightweight messaging protocol that is well-suited for IoT applications. It uses a publish-subscribe model, where devices publish sensor data to the broker and subscribers can subscribe to receive that data.

To implement data transmission using MQTT and Python, you will need the following:

A MQTT broker

A Python MQTT client library, such as Paho MQTT

Use a secure MQTT broker to protect your data from unauthorized access.

Implement authentication and authorization mechanisms to ensure that only authorized devices can publish and subscribe to data.

Use a data compression algorithm to reduce the amount of data that needs to be transmitted over the network.

Implement a retry mechanism to ensure that data is successfully transmitted even if there are network problems.

Use a database to store and analyze the sensor data. This will allow you to gain insights into how the public restroom is being used and identify areas for improvement.

**DATA STORAGE ANALYSIS**

Use a database or cloud storage service to store the data. This will make it easy to access and manage the data.

Use Python libraries such as NumPy, Pandas, and Matplotlib to analyze the data. These libraries provide a variety of tools for data cleaning, manipulation, and visualization.

Write Python scripts to automate data analysis tasks. This will save you time and effort.

Use a dashboarding tool to visualize the data and make it easy to understand.

**Conclusions**

Toilet cleanliness has become a large problem for countries like India, where a lot of resources and time is spent on tackling the sanitization of toilet rooms. This solution presents a low-cost, easy and reliable system in hopes of reducing the risk associated with the dirtiness of the toilet room and improving the overall experience.