(6115)MAHENDRA INSTITUTE OF ENGINEERING AND TECHNOLOGY

SMART PUBLIC RESTROOM

TEAM CODE : Proj_223289_Team_3

TEAM MEMBERS:

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ABSTRACT:

In the cutting edge world, the advances are definitely grown, yet at the same time the cleanliness in our
nation is under risk.The abstract of this paper is to deliver clean and

hygiene
toilets. All the public toilets
should be clean and hygiene. In our country, our government has introduced the scheme called “Swachh
Bharat” (Clean India). Keeping the toilets uncontaminated is the one of the objective of Clean India scheme.
Thispaper can be helpful to encourage the clean India project. In future, it can show the major part in clean

India scheme. In an Existing system, they are focused only on identifying the dirt in the toilets. In our proposed

system, we have determined on keeping clean toilets, observing the sweeper's working activities. It can dodge
many syndromes. It may create the consciousnessamongst people about the toilet management. Therefore, our
development is to use safe and hygienic toilets. This paper is based on IOT and image-processing concepts
using different sensors like smell sensor, IR sensor, sonic sensor, RFID

reader.
By using these sensors, we can
create the smart toilets.

INTRODUCTION:

In our country, people do not have enough knowledge of using toilets. This leads to
several diseases, such as Malaria, Hepatitis, Flu, Cholera, Streptococcus, Typhoid,
etc. Hence we introduce the concept in the IOT called "Swachh Shithouse" The term
Swachh means 'Clean'. Then the term Shithouse means 'Toilet'. It is introduce to use
and maintain the toilets in the clean and hygienic way. The project is based on IOT
concepts using different sensors like smell sensor, dirt sensor, sonic sensor, RFID

reader,Database. Using these materials we are trying to provide the clean toilets

and create the awareness among the people**.**

SCOPE OF THE PROJECT:

In this paper we are going to provide the clean toilet. This paper can create the
awareness among the people about the clean and hygienic toilets. This paper
can ensure the responsibilities of the sweeper. Finally, this concept is the one of the
stepping stone to the“Clean and disease free India”.

LITERATURE REVIEW:

KitisakOsathanunkul, KittikornHantrakul, Part Pramokcho(2017) has proposed
“Configurable Automatic Smart Urinal Flusher based on MQTT Protocol”, This paper
examines one probable way to cut the wastage of clean water used in a public toilet.
[1].

The system uses MQTT as an underlying communication protocol. The protocol is used

in gathering, governing, powerful and correcting the system. The results in the testing

environment show that using a flushing duration for 2.5 seconds is enough to satisfy

most users while wasting clean water as less as possible.

There are two part are involved here. They are,

1. Automatic Flusher Part (AFP)

2. Server part

The AFP detects if there is an object in front of its infrared sensor. When a user stands
in front of the urinal, an infrared sensor can detect the user. If the user keeps staying in
front of the sensor for 3 seconds continuously, it is considered that a user

is
currently
using a urinal. After the urinal has been flushed AFPunit also sends a MQTT message
about it usage data to the server part. In server part, it receives the usage data from AFP
unit. The usage data will be stored into a database for a future use. A. D. Kadge, A. K.
Varute, P. G. Patil, P. R. Belukhi(2016) has proposed “Automatic Sewage Disposal
System for Train”, Indian railways have 114,500 km of total track over a route of 65000
km and 7500 stations. While travelling by the train everyone expect

healthy
and hygienic

surrounding. Feel uncomfortable due to the waste on the platform and the allied

foulsmell.[2]Creates bad impression on foreign tourist .sanitation problem cause due to
system in which train toilets dispose human waste openly on to tracks. In this system,
they are using two mechanisms. They are sewage disposal mechanisms trackchanging
mechanisms.

In the sewage disposal mechanisms, the ultrasonic sensor and position sensor is used.

The ultrasonic sensor can detects the depth of the sewage tank and the position sensor
detects the proper place to dispose the sewage. After the proper

detection
of particular
place, the solenoid valve on. Then the sewage is
done.PandyaChintan,YadavJatin,
KareliyaSanket 2015 has proposed “Automatic working bio-toilet tank for railway
coaches”, Bio toilet tank is human waste disposal mechanism in area with noi
nfrastructure facilities. That is easy to operate alternative to the tradition waste
disposal system. In that project are two doors in tank, the one input door and second

exit door.[3] The input door is on top of the tank and exit door is assembling inside the

tank. The doors are open and close by using pneumatic cylinder. RPM controller is used
to measure the speed of the train and transfer those details to proximity sensor,which
can send scontrol over the train, Pneumatic cylinder is control by using

RPM
controller,
Proximity sensor, and Compressed air tank. So, whole system is controlled with train
speed. If the train speeds exceed 30 km/h then exit door will open and

total
waste
depositor drop in tracks and input door is close. Input door is openwhen train is under 30
km/h speed.ImanMorsia, Mohamed Mansour, MohamedMostafa 2013 has proposed
“Wireless Gas Detector System Using Microcontrollers, PLC and SCADA System for
Monitoring Environmental Pollution”,

identification represents a big challenge for improving detection and pattern recognition

of each gas by using inexpensive gas sensor. This paper presents a gas detector system
which is built to monitor, and measure gas pollutant emissions in the air and also used

to detect different gases. The pollutants are ethane (C2H6) and methane (CH4) which

are located beside the fertilizer factories in Alexandria Egypt and someother gases as
hydrogen (H2), propane (C3H8) and iso-butane (C4H10).The gas sensors [4].

The system is controlled and monitored by using programmable logic controller PLC Step

7-200 from Siemens and Supervisory Control and Data Acquisition SCADA systems
respectively. The principal component analysis PCA method is applied for clustering and
distinguishing among different gases.Thomas Schlebusch, Steffen Leonhardt 2011 has
proposed “Intelligent Toilet System for Health Screening”, Home monitoring isa
promising technology to deal with the increasing amount of chronically ill patients while
ensuring quality of medical care. [5]Most systems available today depend on a high
degree of interaction between the user and the device.Especially for people relying on
advanced levels of care, this scheme is impracticable. In this paper we are presenting an
“intelligent toilet” performing an extensive health check while being as simple to use as

a conventional toilet. Main focus of the system is to support the treatment of diabetes

and chronic heart failure, but additional applications are possible.Here

the
sensors like
PT1000sensor,Pressuresensor,andRFIDreaderareusedhere.PT1000
sensor used to
measure the thigh temperature. Pressure sensor is used measure the
pressure of the
base portion of the toilet. Using RFID reader is used to sense the

particular
person
result. It needs designing of the base portion of the toilet. It can sense all
test results
patients through the toilet usage.

EXISTING SYSTEM:

In an existing system, they concentrate more on organizing sewages from the railway
system. They are trying to taking all the medical tests through the usage of toilets. They
are concentrated on reducing water wastage on toilets, by the
implementation of
automatic flusher.

Disadvantages:

1. They are not focussed on providing clean and hygienic toilets.

2. The medical test can have chance to produce fault results.

WORKING PRINCIPLE:

 In the first phase, IR sensor is used to discover the dirt present in the toilet.

 Here the set of sample images are given as input.

 After using the toilet, the sensor senses the basin of the toilet.

 Then it relates the sensed image with the input image.

 If the dirt present, it increases the alarm.

 Then the user wants to be clean the waste. Through this activity, people can get the
awareness about the toilet management.

 In the second phase, Figaro sensor is used to perceive the unwanted gases present in the toilet.

 In the Figaro sensor, a particular range is to be stableearlier manner. If the range gets
extended, it can send the alert message to the sweeper. Then they cleaned it by using proper fragrant.

 In the third phase, RFID reader (Radio Frequency Identification) is used to observe the
sweeper's activities (absence and presence in the toilet cleaning).

 Initially, the sweeper wants to show his/her individuality tag in front of RFIDreader.Itcanbeshownbeforeandaftercleaningthetoilet.

 Then the first phase gets initiated and senses for the dirt presence in the toilet.

If the dirt gets noticed, it raises the alarm.

Through this monitoring activity, the sweeper can realize their roles and responsibilities. Then they protect the people by disposing all the unwanted materials (dirt, unwanted gases) present in the toilet.

 In the final phase, the sonic sensor is used to detect the depth of the septic tank.
 Here, the range of septic tank is fixed prior manner.

 If the sewage reached with the range, then it directs message to an organization.

 All the message transfer can be done by the GSM (Global System for Communication).

DESCRIPTION OF ARCHITECTURE HARDWARE REQUIREMENTS:

1. Microcontroller
2. Powersupply
3. LCDdisplay
4. Buzzer
5. Infraredsensor
6. Sonicsensor
7. Gassensor
8. RFID
9. GSMmodem

SOFTWARE

REQUIREMENTS: Embedded

C

CONCLUSION:

Our proposed project will create awareness among the people about the proper sanitation. It makes use of Internet of things, which is a rapidly growing technology. Our proposed system will make everyone to strictly follow the cleanliness and proper sanitation in the toilets. It prevents the many new contagious diseases that spread due to improper sanitation of the toilets. Thus by using technologies in the smarter way, we can maintain the cleanliness which is next to the -godliness. Keep Clean, Be Safe.

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SMART PUBLIC RESTROOM

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DOMAIN: INTERNET OF THINGS (IOT)

TEAM MEMBERS:

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N. Harish

Faculty Mentor Name:

A. Aruna

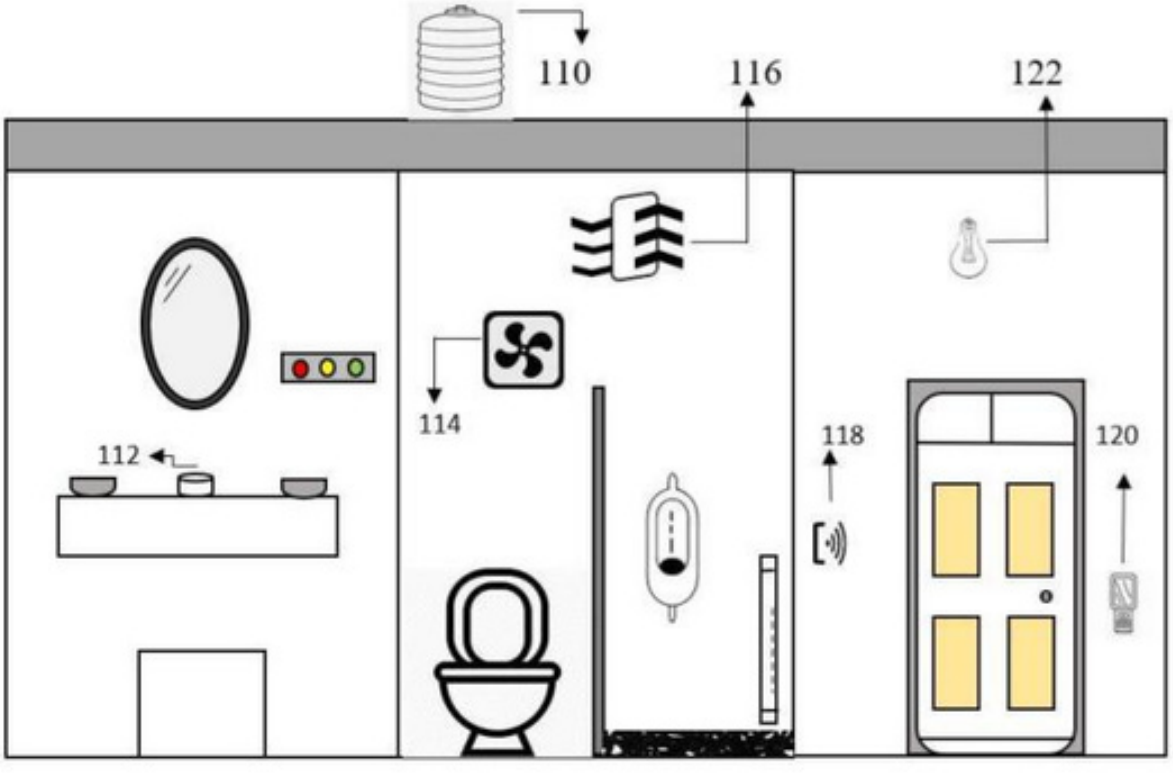
PHASE-2

Innovation:

It demonstrates a practical and sustainable use of technology for public benefit. Also, the solar panels generate electricity during daylight hours, which powers the ventilation system and charges the battery. Air quality sensors continuously monitor the restroom's air for any deterioration in quality. If the sensors detect unpleasant odors or poor air quality, the ventilation system activates to circulate and refresh the air. The automatic air freshener releases a burst of pleasant scent when needed, keeping the restroom smelling fresh.

Concept of working:

IoT Device to Monitor the Toilet The MQ-135 sensor detects the stench of the toilet. The presence of ammonia gas in the atmosphere is detected by this sensor. The presence of Ammonia is responsible for the toilet's foul odor. Ammonia has a pungent odor that can only be perceived at a concentration of 5 parts per million (parts per million). Fans automatically turn on when the ammonia content in the toilet exceeds the set threshold of 5 ppm, while levels below 5 ppm have no impact. Moving on to the next component, an infrared sensor is used to check for the presence of soap in the toilet.



110- Water Tank.

120- Odor detection MQ-135.

112- Soap detector.

122- Automatic lights.

116- Ventilation fan

124- Frequency counter.

126- Cleaners attendance.

Conclusion:

The initiative met its goal of creating an economical, user-friendly interface between the cleaning company and public restrooms, allowing for more effective staffing. This program's installation is straightforward. Time series forecasts can be utilized to conduct simultaneous toilet research. If this toilet condition is utilized in the toilet, it assists in keeping the toilet clean before it becomes unclean. The mobile app is considerably easier to use now that the data display has been updated. The Internet of Things device is both inexpensive and portable. In future, this study might be enhanced by employing sensitive and modern sensors to generate more precise data. By learning from sample data and increasing the amount of test data, machine learning increases prediction accuracy. When this approach is used on a large scale, better storage systems and cloud servers can be used.

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PHASE-3

Process and data:

Hardware Setup:

- Install sensors like occupancy sensors, motion sensors, temperature sensors, humidity sensors, etc., in the restroom.
- Connect these sensors to an Arduino Uno board.

Arduino Programming:

- Write an Arduino sketch to read data from the sensors.
- Process and format the sensor data.
- Use a serial connection to send the data to a connected computer.

Python Script:

- Develop a Python script to run on a computer (or a Raspberry Pi) connected to the Arduino Uno.
- Configure the script to read data from the Arduino Uno via a serial connection.

ThingSpeak Integration:

- Create a ThingSpeak channel to receive and store the sensor data.
- Obtain an API key for your ThingSpeak channel.

Python Script for ThingSpeak:

- Modify the Python script to format the sensor data
- Send an HTTP POST request to ThingSpeak with the formatted data, using the ThingSpeak API key.

ThingSpeak Data Storage:

- ThingSpeak will store the data sent by your Python script.

Data Analysis and Visualization:

- ThingSpeak provides built-in tools for data visualization and analysis.
- You can create charts, graphs, and triggers based on the data to monitor restroom usage and conditions.

Alerts and Notifications (Optional):

- Configure ThingSpeak to send alerts or notifications when certain conditions are met, like low soap levels or high restroom occupancy.

Document Creation:

- Document your project, including hardware setup, Arduino code, Python script, and ThingSpeak configuration.
- Explain how the system works, the sensors used, and the benefits of having a Smart Public Restroom.
- Share this document for assessment as mentioned in your original request.

Maintenance and Monitoring:

- Regularly monitor the system and perform maintenance on sensors and hardware as needed.
- Review and analyze data to make improvements in restroom management.

Used Sensors:

- Occupancy Sensors: These can detect if someone is inside the restroom and help manage lighting and ventilation based on occupancy.
- Motion Sensors: Useful for detecting movement, ensuring lights and water fixtures are activated when someone enters.
- Ultrasonic Sensors: They can measure water levels in toilets and urinals, helping to monitor usage and maintenance needs.
- Temperature and Humidity Sensors: These sensors help control the climate within the restroom for user comfort.
- CO2 Sensors: To monitor air quality and trigger ventilation systems when needed for odor and health reasons.
- Door Sensors: Indicate when restroom doors are opened or closed, useful for occupancy tracking.
- Water Quality Sensors: To monitor the quality of water in sinks and toilets, ensuring cleanliness and detecting issues.
- Toilet Paper Dispenser Sensors: To monitor and report on the availability of essential supplies.
- Soap Dispenser Sensors: To keep track of soap levels and refill requirements.
- Hand Dryer Sensors: To monitor usage and maintenance needs for hand dryers.
- Waste Bin Sensors: Indicate when the trash bins need emptying.

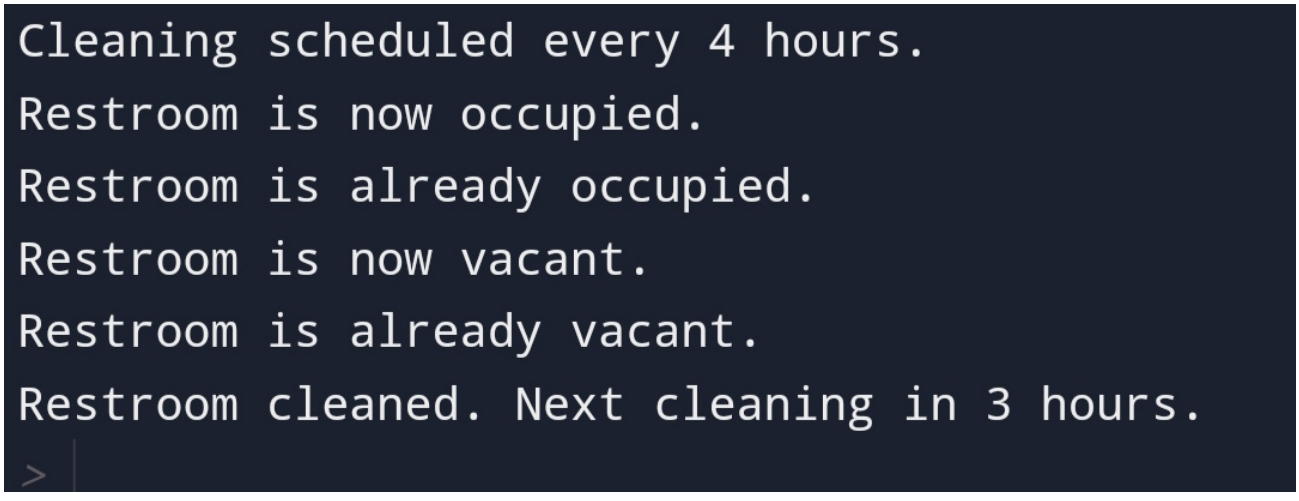
Python script for smart public restroom:

```
class Restroom:
    def __init__(self):
        self.occupancy = False
```

```
        self.cleaning_schedule = 0

    def enter(self):
        if not self.occupancy:
            self.occupancy = True
            print("Restroom is now occupied.")
        else:
            print("Restroom is already occupied.")

    def exit(self):
        if self.occupancy:
            self.occupancy = False
            print("Restroom is now vacant.")
        else:
            print("Restroom is already vacant.")

    def clean(self):
        if self.cleaning_schedule > 0:
            self.cleaning_schedule -= 1
            print(f"Restroom cleaned. Next cleaning in {self.cleaning_schedule} hours.")
        else:
            print("No cleaning needed right now.")

    def set_cleaning_schedule(self, hours):
        self.cleaning_schedule = hours
        print(f"Cleaning scheduled every {hours} hours.")


# Example Usage:
restroom = Restroom()
restroom.set_cleaning_schedule(4)
```

```
restroom.enter()  # Occupied
restroom.enter()  # Already occupied
restroom.exit()   # Vacant
restroom.exit()   # Already vacant
restroom.clean()  # No cleaning needed right now
```

Output :



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PHASE-4

Feature Engineering:

- **Definition**: Feature engineering involves creating new features (variables) from the existing data to help the model better understand the underlying patterns. It's about selecting and transforming the right variables to improve the model's performance.
- **Examples**:
  - Creating interaction terms between existing variables.
  - Binning or discretizing continuous variables.
  - One-hot encoding categorical variables.
  - Extracting meaningful information from text or images.

1. **Model Training**:
   - **Definition**: Model training involves using a dataset to teach a machine learning algorithm to recognize patterns and make predictions. During training, the

model learns to adjust its internal parameters to minimize the difference between its predictions and the actual target values.

- **Steps**:
  - **Data Preparation**: The dataset is typically split into training and validation sets.
  - **Initialization**: Model parameters are initialized randomly or using pre-trained weights (in transfer learning).
  - **Forward Propagation**: Data is passed through the model to make predictions.
  - **Loss Calculation**: The difference between predictions and actual targets (loss) is computed.
  - **Backpropagation**: Gradients are computed with respect to the loss, and parameters are updated to minimize it.
  - **Iterations (Epochs)**: The process is repeated for multiple iterations (epochs) until convergence.
  - **Validation**: Model performance is evaluated on a separate validation set to avoid overfitting.

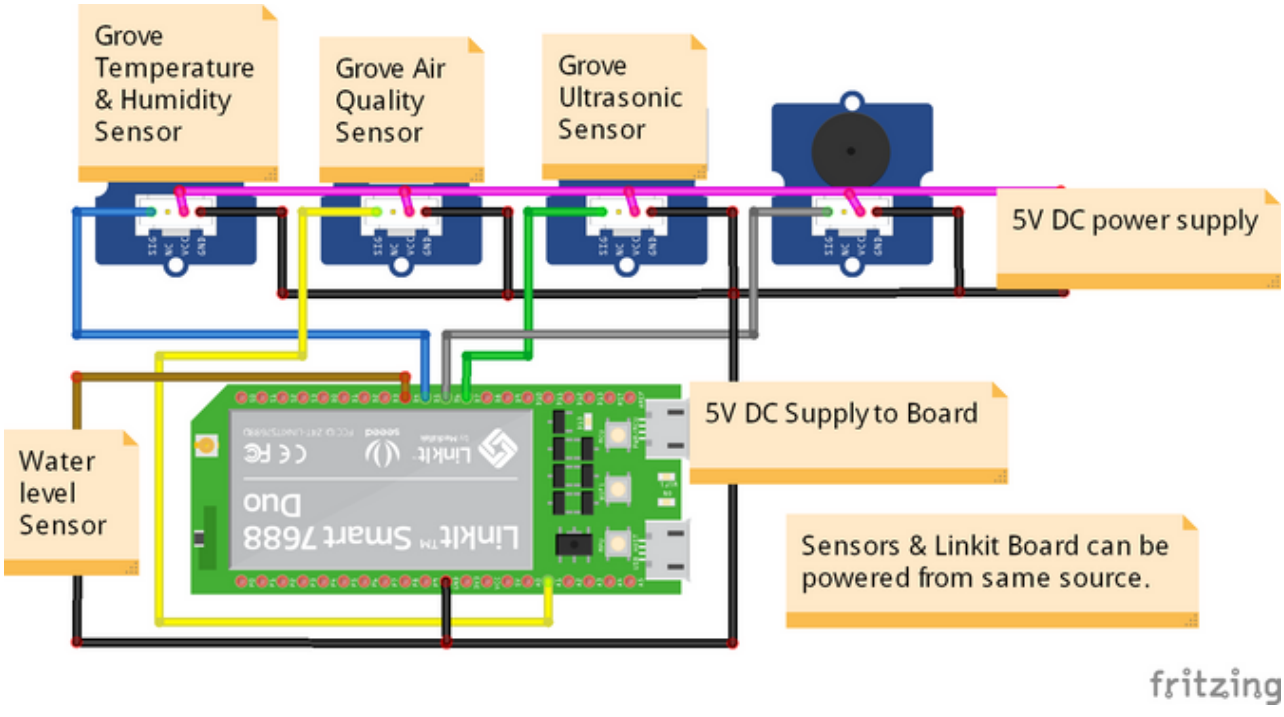
1. **Model Evaluation**:

- **Definition**: Model evaluation assesses how well the trained model generalizes to unseen data. It helps to understand how the model will perform on new, unseen examples.
- **Metrics**:
  - **Classification**:

        - Accuracy, precision, recall, F1-score, ROC-AUC, etc.
    - **Regression**:
        - Mean Absolute Error (MAE), Mean Squared Error (MSE), R-squared, etc.
  - **Cross-Validation**: Splitting the data into multiple subsets and training/evaluating the model on each subset to get a more robust estimate of its performance.
  - **Bias-Variance Tradeoff**: Assessing the balance between underfitting and overfitting.
1. **Hyperparameter Tuning**:
  - **Definition**: This activity involves finding the best set of hyperparameters for a machine learning model. Hyperparameters are settings that are not learned during training (e.g., learning rate, regularization strength).
  - **Methods**:
    - Grid Search, Random Search, Bayesian Optimization, etc.
2. **Deployment** (optional):
  - **Definition**: If the model performs well, it can be deployed in a production environment to make real-time predictions.
  - **Considerations**:
    - Integration with existing systems.
    - Monitoring for performance and drift.

These activities collectively form the core of building and deploying machine learning models. Remember that this is an iterative process, and you might need to go back and refine earlier steps based on the results of later steps.

Top of Form

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