Project Planning Phase
Technology Stack (Architecture & Stack)

Date	27 September 2023
Team ID	TEAM -593038
Project Name	ML Model For Occupancy Rates And Demand In The Hospitality Industry
Maximum Marks	5 Marks

Technical Architecture:

"Technical architecture involves structuring systems like software and networks to meet specific technical objectives. Technical architects oversee the design, ensuring efficiency, security, and alignment with project goals. This includes making decisions about hardware, software, data flow, and communication protocols, serving as a blueprint for complex technical solutions."

Table-1 : Components & Technologies:

S.No	Components	Description	Technology
1.	Data Collection	Gathering data including temperature, humidity, light, CO2 levels, occupancy status, and humidity ratio from various sensors and sources.	IoT sensors, data integration tools
2.	Data Preprocessing	Cleaning, normalizing, and transforming collected data into a suitable format for modeling.	Python (Pandas), data cleaning techniques
3.	Feature Engineering	Creating new features and modifying existing ones to incorporate environmental variables.	Feature selection techniques, domain knowledge
4.	Exploratory Data Analysis (EDA)	Visualizing and analyzing data to uncover patterns and relationships among variables.	Data visualization tools (Matplotlib, Seaborn)
5.	Model Selection	Choosing regression models for precise demand forecasting considering environmental factors.	Scikit-Learn, regression modeling techniques
6.	Training and Testing	Splitting the dataset into training and testing sets to train and evaluate model performance.	Cross-validation, model evaluation metrics
7.	Hyperparameter Tuning	Optimizing model hyperparameters to improve predictive accuracy.	Grid search, random search, hyperparameter optimization tools
8.	Model Evaluation	Assessing model performance using metrics like Mean Absolute Error (MAE) and R-squared.	Scikit-Learn, custom evaluation scripts
9.	Deployment	Implementing the model for real-time predictions, potentially through APIs or within hotel management systems.	Flask, python, HTML, CSS, JS, Bootstrap, (OR) Streamlit
10.	Monitoring and Maintenance	Continuously monitoring the model's performance and making updates to maintain accuracy.	Logging, alerting systems, automated pipelines via AWS CloudWatch
11.	Visualization and Reporting	Creating dashboards and reports for interpreting model results and environmental impact.	Data visualization tools (AWS QuickSight, Power BI)

Table-2: Application Characteristics:

S.No.	Characteristics	Description	Technology
1.	Environmental Factors (Sensor Data)	Data from environmental sensors, e.g., temperature, humidity, CO2 levels, light levels, humidity ratio.	IoT sensors, data communication capabilities.
2.	Occupancy Status (Categorical Data)	Represents hotel occupancy status, binary or multiclass.	Automated booking systems, occupancy detection methods.
3.	Demand Forecasting (Predictive Models)	Output of predictive models used for forecasting demand.	Machine learning regression models (e.g., linear regression, decision trees).
4.	Sustainability Metrics (Environmental Impact Data)	Tracks sustainability metrics and environmental impact.	Calculations based on environmental data, external sustainability data.
5.	Continuous Monitoring (Real-time Data)	Ensures real-time monitoring of data for quick adaptation.	Real-time data streaming and processing (e.g., Apache Kafka).
6.	Interpretability (Model Explanations)	Enhances model interpretability for predictions.	Model explainability techniques (e.g., SHAP values, feature importance scores).

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