PROBLEM STATEMENT:

Development of Explainable AI (XAI) based model for prediction of heavy /high impact rain events using satellite data.

PROBLEM DESCRIPTION:

Nowcasting of heavy precipitation rainfall events with an understanding of the most important predictors and also an idea as to why a certain model can fail. Desired Outcome- The developed system shall provide the following: 1. AI based model to predict particular rain episodes of greater impact using satellite data (INSAT-3D/3DR) . 2. An explainable module into the AI model (XAI) 3. The final output should be in terms of a web application, with associated accuracy of the models worked on and an explainable component of the outputs.

OUR APPROACH:

**Data Collection and Preprocessing**

1. Gather satellite data from INSAT-3D/3DR covering a sufficient time period to capture historical patterns of heavy rainfall events.
2. Preprocess the satellite data to extract relevant features, such as cloud cover, precipitation intensity, and atmospheric temperature.
3. Label the data by identifying instances of heavy rainfall events based on ground truth observations or weather station data.

**Model Development and Training**

1. Choose an appropriate machine learning algorithm for predicting heavy rainfall events. Deep learning algorithms, such as convolutional neural networks (CNNs), have shown promising results in satellite image analysis.
2. Divide the preprocessed data into training, validation, and testing sets.
3. Train the machine learning model on the training set, optimizing its hyperparameters using the validation set.

**Explainability Integration**

1. Incorporate explainable AI (XAI) techniques into the trained machine learning model to provide insights into its decision-making process.
2. Consider using XAI methods like SHapley values, Local Interpretable Model-Agnostic Explanations (LIME), or Deep Taylor Decomposition (DTD) to explain the model's predictions.
3. Integrate the XAI explanations into the web application to provide users with an understanding of the model's reasoning.

**Web Application Development**

1. Develop a user-friendly web application to interact with the trained model and its explainability features.
2. Implement a map interface to visualize the satellite data and rainfall predictions.
3. Integrate the XAI explanations into the web application, allowing users to explore the factors influencing the model's predictions.

**Evaluation and Deployment**

1. Evaluate the model's performance on the testing set, measuring its accuracy, precision, recall, and other relevant metrics.
2. Analyze the XAI explanations to identify potential biases or limitations in the model.
3. Refine the model and XAI techniques based on the evaluation results.
4. Deploy the web application to a production environment, allowing users to access the rainfall prediction and explanation features.

**Continuous Monitoring and Improvement**

1. Continuously monitor the model's performance on new data to ensure its accuracy and relevance.
2. Regularly update the model with new satellite data to capture evolving weather patterns.
3. Enhance the XAI explanations to provide deeper insights into the model's decision-making process.
4. Gather user feedback to improve the web application's usability and effectiveness.