# PANEL SUMMARY SHEET

## Tradable Assets Navigator

**Enrolment No:** 22103236, 22103225, 22103231

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**DEPARTMENT OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY**

**JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY, NOIDA**

## Motivation Behind the Project

The motivation for this project arises from the increasing complexity and volatility of cryptocurrency markets, particularly Bitcoin. With Bitcoin's price being subject to rapid fluctuations influenced by variety of factors ranging from market sentiment to regulatory changes, investors often face challenges in making informed decisions about whether to hold or sell their assets. Traditional prediction methods fail to address these challenges effectively, leaving a gap in actionable and reliable investment guidance.

This project is inspired by the need to bridge the gap between advanced forecasting technologies and practical decision-making. By leveraging state-of-the-art statistical and machine learning models, our goal is not just to predict Bitcoin price trends but to provide clear, actionable recommendations that empower users to navigate market volatility with confidence. The system is designed to act as a trusted assistant, delivering hold or sell advice tailored to both short-term market fluctuations and long-term trends.

## Type of Project

This project is classified as a Development cum Research Project as it integrates practical development with research to address the challenges in the cryptocurrency trading space.

- **Development Aspect:** The project focuses on designing a system that uses machine learning (LSTM) and statistical techniques (ARIMA) to provide actionable investment advice (hold or sell) based on Bitcoin's upcoming market variations. The development includes implementing advanced forecasting models, data processing pipelines, and interactive dashboards for user-friendly decision-making.
- **Research Aspect:** The research involves studying existing methodologies for time-series forecasting, analysing their limitations, and identifying optimal strategies for integrating short-term and long-term prediction models. This includes understanding the volatility of cryptocurrency markets and tailoring the system to balance real-world applicability with model precision.

## Critical Analysis of research paper

### *1.* Long Short-Term Memory

- Authors**:** J. Hochreiter and S. Schmidhuber (1997).
- Summary**:** This foundational work introduces the LSTM model, which effectively captures long-term dependencies and non-linear patterns in sequential data. LSTM is particularly suitable for time-series forecasting in highly dynamic environments, such as cryptocurrency markets.
- Gaps**:** The paper does not explore the application of LSTM in real-world financial datasets or its computational complexity when applied to large-scale and rapidly changing markets.

### 2. Time-Series Forecasting of Cryptocurrency Prices Using ARIMA

- Authors**:** A. Yaya, S. O. Alawode, and I. O. Okedayo (2020)
- Summary: This paper demonstrates the effectiveness of the ARIMA model in predicting cryptocurrency price trends by leveraging its ability to model linear relationships and stable patterns in historical time-series data. The study highlights ARIMA's suitability for long-term trend analysis due to its statistical robustness.
- Gaps: The model assumes data stationarity and fails to account for the non-linear and volatile nature of cryptocurrency markets. It lacks integration with machine learning approaches for enhanced predictive accuracy.

## Programming Language, Technologies, tools, and Software used

**Programming Languages**:

1. Python

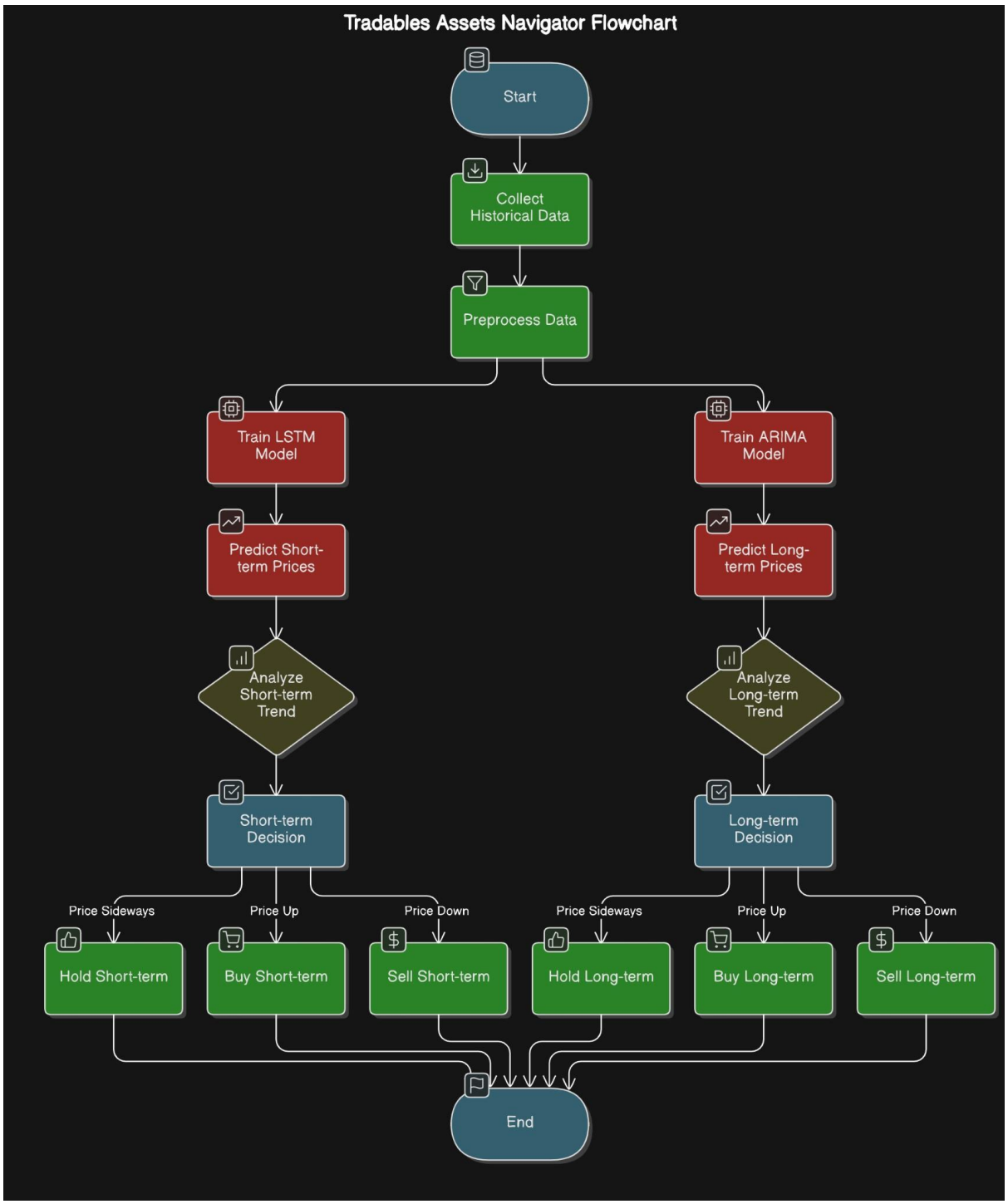
**Libraries:**

1. Pandas, NumPy (data preprocessing and numerical computations)
2. Scikit-learn (model evaluation, scaling, and data preparation)
3. TensorFlow/Keras (LSTM implementation)
4. Statsmodels (ARIMA implementation)
5. Matplotlib, Plotly (data visualization and interactive dashboards)
6. YFinance (data collection for Bitcoin historical prices)

**Tools and Software:**

1. Jupyter Notebook
2. Git/GitHub

# Control Flow Diagram



## Proposed Methodology Summary

The methodology for the Bitcoin decision-support project involves the following steps:

- **Data Collection:** Acquired historical Bitcoin data spanning 6–7 years from reliable sources using YFinance. Key features include opening price, closing price, high, low, and adjusted prices.
- **Data Preprocessing:** Cleaned the dataset by addressing missing values and outliers, ensured consistency, and normalized the data using MinMaxScaler for optimal model performance.
- **Exploratory Data Analysis (EDA):** Visualized historical trends, price distributions, and market fluctuations using interactive plots.
- **Model Development:** Designed a dual-model prediction framework:
    1. LSTM for short-term predictions (daily/weekly trends).
    2. ARIMA for long-term predictions (monthly trends).
- **Model Training:** Split the dataset into training and testing sets with an 80:20 ratio.
- **Model Evaluation:** Evaluated model accuracy using metrics like Mean Squared Error (MSE), Mean Absolute Error (MAE), and $R^2$ Score for both LSTM and ARIMA models
- **Decision-Making Logic**: Combined outputs from both models to generate actionable recommendations (buy, sell, or hold) based on predicted price trends and variations.
- **Result Visualization:** Developed trend graphs to display predictions and actionable insights. Alongside these graphs, actionable recommendations in a user-friendly format are provided based on observed patterns. This approach ensures that traders receive clear, data-driven suggestions for buying, selling, or monitoring stocks

## Algorithm/Description of the Work:

The project implements several models and algorithms to provide actionable recommendations (hold/sell) for Bitcoin based on predicted market trends:

- ARIMA (AutoRegressive Integrated Moving Average):
  A statistical model used for long-term trend analysis, capturing stable patterns in time-series data. It is effective in identifying seasonal and linear trends in Bitcoin prices.
- LSTM (Long Short-Term Memory):
  A type of recurrent neural network (RNN) designed to handle sequential data and capture short-term price fluctuations. It effectively models the non-linear and volatile nature of cryptocurrency markets.

- LSTM + ARIMA Hybrid Model:
  Combines the strengths of ARIMA for stable long-term trend forecasting with LSTM's ability to capture rapid market fluctuations. This hybrid approach ensures a robust and balanced recommendation system.
- Decision-Making Logic:
  A custom algorithm processes the outputs from both ARIMA and LSTM models. If short-term forecasts indicate volatility and long-term trends suggest stability, the model advises holding. Conversely, if both models predict a decline, a sell recommendation is generated.

## Division of work:

- Kshitij: Data collection, preprocessing, and initial ARIMA model implementation.
- Nandini: LSTM model implementation and prediction logic.
- Ashish: Visualization, Model implementation and Research

## Conclusion

This project successfully demonstrated the application of time series forecasting using ARIMA and LSTM for Bitcoin price prediction. By combining both models, we effectively addressed the need for accurate predictions over different time horizons:

- Long-Term: ARIMA was well-suited for providing stable, long-term trend predictions.
- Short-Term: LSTM captured volatile price movements, making it useful for short-term forecasting.

The trading logic based on these predictions provided actionable insights for Bitcoin investors, offering clear recommendations on whether to buy, sell, or hold based on expected price movements. The combination of statistical modeling and deep learning techniques in forecasting has shown strong potential in financial markets, especially for volatile assets like Bitcoin.