Phase-2 Submission

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Github Repository Link: githhub repository

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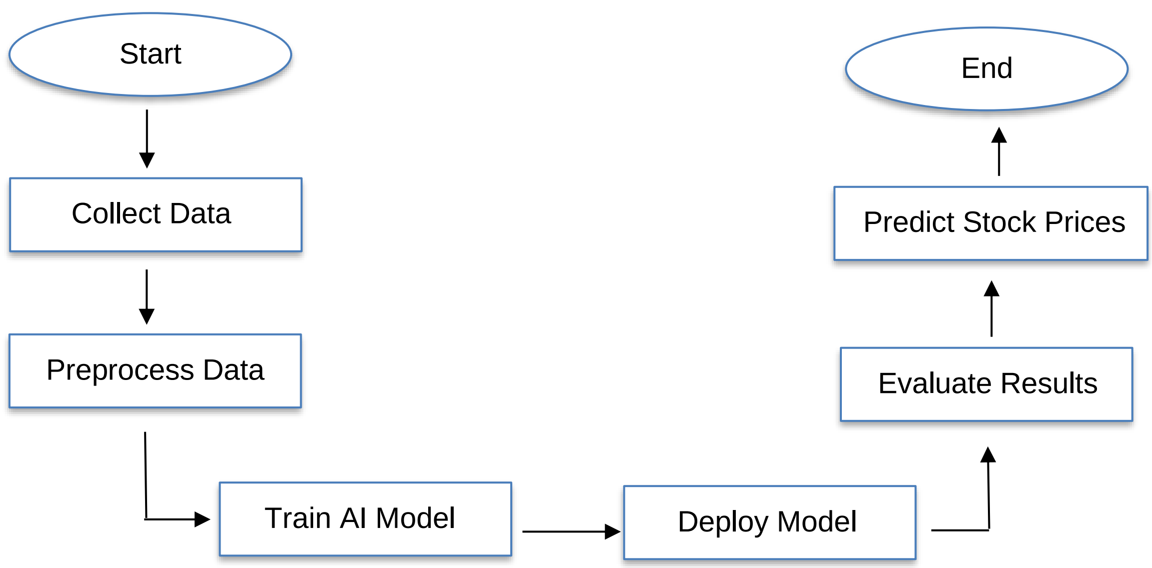
1. Problem Statement

- ***Market Volatility***: *Stock prices fluctuate due to various unpredictable factors, making accurate predictions extremely challenging.*
- ***Investment Challenges***: *Investors and businesses struggle to make informed decisions without reliable forecasting tools.*
- ***Data Complexity***: *Stock market data is nonlinear and influenced by multiple variables, requiring advanced analytical methods.*
- ***AI-Driven Solution***: *Time series analysis powered by AI can detect hidden patterns and trends that traditional methods might miss.*
- ***Impact Goal***: *Improved stock price predictions can enhance investment strategies, reduce financial risks, and support overall market stability.*

2. Project Objectives

- *The project aims to build an AI-based model for accurate stock price prediction using time series analysis.*
- *It focuses on analyzing historical data to identify trends and patterns.*
- *The objective is to assist investors in making informed decisions.*
- *It seeks to reduce investment risks caused by market volatility.*
- *Ultimately, the project promotes smarter investments and economic stability.*

3. Flowchart of the Project Workflow



4. Data Description

The dataset contains historical stock market data, including features such as ***Date, Open Price, High Price, Low Price, Close Price, Adjusted Close, and Volume****. This time-series data represents daily stock performance over a specified period. It is cleaned to handle missing values, normalized for consistency, and structured for model training. The data serves as the foundation for predicting future stock prices using AI-driven analysis.*

5. Data Preprocessing

Data preprocessing is a crucial step in preparing stock market data for accurate predictions. It starts with handling ***missing or inconsistent values*** *to ensure data quality. Relevant features like* ***Open, Close, and Volume*** *are selected, while date formats are standardized for* ***time-series analysis****. The data is then normalized to bring all values to a common scale, improving model performance. Finally, the dataset is split into training and testing sets to evaluate the model's accuracy and reliability*.

6. Exploratory Data Analysis (EDA)

- ***Univariate Analysis:***
    - *Histograms and boxplots showed that stock prices were normally distributed, while trading volumes showed a skewed distribution*
    - *Key metrics such as mean, median, standard deviation, and IQR were analyzed to understand the spread of the data.*
- *Bivariate/Multivariate Analysis:*
    - *A heatmap indicated strong correlations between certain technical indicators (like SMA and EMA) and stock prices, while trading volume had weaker correlation.*

- *Insights Summary:*
  - *Technical indicators like **SMA, EMA**, and **RSI** seemed to have a significant impact on stock price prediction.*
  - ***Volume** was a weak predictor compared to other features like **Moving Averages**.*

7. Feature Engineering

- ***Volatility Metrics:** Calculated rolling standard deviations to represent the market volatility over different time windows.*
- ***Moving Averages (SMA, EMA):** Added 50-day and 200-day Simple Moving Averages (SMA) to capture long-term trends.*
- ***Technical Indicators:** Added features like **RSI (Relative Strength Index)** and **MACD (Moving Average Convergence Divergence)**.*
- ***Date Features:** Extracted **day of the week, month, and year** to capture cyclical patterns in stock prices*

8. Model Building

- ***ARIMA:** Chosen for its effectiveness in modeling time-series data, ARIMA captures the temporal dependencies and trends in the data.*
- ***LSTM (Long Short-Term Memory):** This deep learning model is capable of capturing long-term dependencies and trends in sequential data, making it suitable for stock price predictions.*

9. Visualization of Results & Model Insights

- ***Model Performance Comparison:*** *Line plots of actual vs. predicted stock prices were generated for both ARIMA and LSTM models.*
- ***Residual Plots:*** *Analyzed residuals for both models to ensure no patterns remained unmodeled.*
- ***Feature Importance:*** *For LSTM, plots of feature importance were generated to highlight which technical indicators and features influenced the predictions the most.*

10. Tools and Technologies Used

- ***Programming Language:*** *Python*
- ***IDE/Notebook:*** *Jupyter Notebook*

LIBRARIES USED:

- *Visualization: matplotlib, seaborn, plotly*
- *Machine Learning: scikit-learn, TensorFlow (LSTM), statsmodels (ARIMA)*
- *Data Processing: pandas, numpy.*

11. Team Members and Contributions

NAME	ROLE	WORK
HARISH VK	Frontend Developer	Normalization/Standardization Feature Engineering Data Splitting
AJIN P R	Backend Developer	Data Type Conversion Categorical Encoding Backend Data Integration
GOKUL R	ML Engineer	Handling Missing Values Removing Duplicates Outlier Detection & Treatment
KIRUTHIGA M	Documentation & Presentation	Visualization of Preprocessing Documentation & Reporting Final QA & Integration
DEVADHARSHINI V	Deployment Engineer	Model Deployment Preparation Deployment Pipeline Setup Monitoring & Scaling for Deployment