Phase-3 Submission

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Department: B E CSE

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Github Repository Link: github repo link

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1. Problem Statement

Stock price prediction is challenging due to market volatility and nonlinear data patterns. Traditional methods often fall short in capturing these complexities. This project tackles a **regression problem** by using AI-based time series models to forecast future prices, helping investors make better decisions and reduce financial risks.

2. Abstract

This project focuses on **predicting stock prices using AI-driven time series models** like ARIMA and LSTM. By analyzing historical data and technical indicators, the system identifies patterns to forecast trends. The approach includes **preprocessing, EDA, model training, and evaluation**. Final results are deployed via an interactive dashboard to assist users in making informed investment decisions.

3. System Requirements

- *Hardware:*

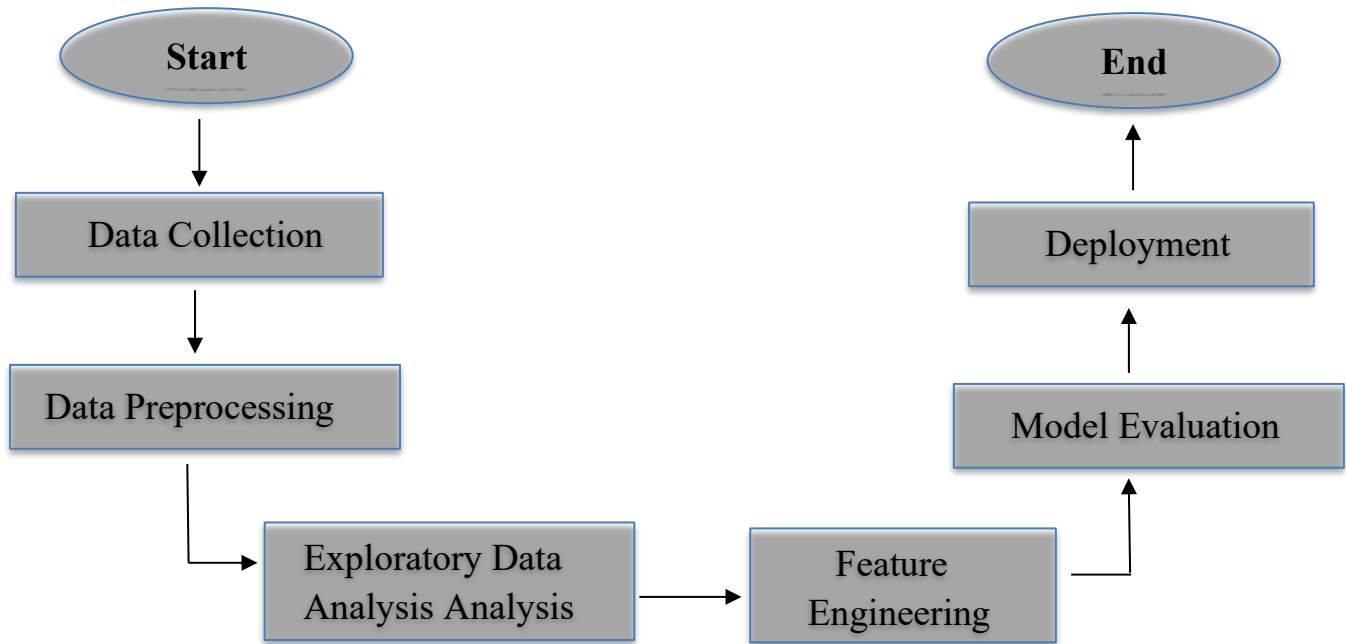- *Minimum 4GB RAM*
- *Intel Core i5 processor.*

- *Software:*

- *Python 3.8+, pandas, numpy, matplotlib, seaborn, scikit-learn, TensorFlow, statsmodels, Flask, Jupyter Notebook/VS Code.*

4. Objectives

- *Build an AI-based model using time series analysis to predict future stock prices.*

- *Identify patterns and trends from historical data using indicators like SMA, EMA, and RSI.*

- *Evaluate and compare different models (ARIMA, LSTM) to determine optimal prediction accuracy.*

- *Provide investors with actionable insights to mitigate risks and improve investment strategies.*

- *Deploy the model for public access through an interactive, web-based dashboard.*

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5. Flowchart of Project Workflow

```
   ┌─────────┐                        ┌─────────┐
   │  Start  │                        │   End   │
   └────┬────┘                        └────▲────┘
        │                                  │
        ▼                                  │
┌───────────────┐                  ┌───────────────┐
│Data Collection│                  │  Deployment   │
└───────┬───────┘                  └───────▲───────┘
        │                                  │
        ▼                                  │
┌─────────────────┐                ┌───────────────┐
│Data Preprocessing│               │Model Evaluation│
└───────┬─────────┘                └───────▲───────┘
        │                                  │
        ▼                                  │
┌──────────────────┐    ┌──────────────────┐
│ Exploratory Data │───▶│     Feature      │
│ Analysis Analysis│    │   Engineering    │
└──────────────────┘    └──────────────────┘
```

6. Dataset Description

- **Source:** *GitHub – Public Repository (Stock-Market-Prediction-Using-TimeSeries-Analysis)*

- **Type:**:*Public dataset*
  Size: *6,000 rows with 7 columns (Date, Open, High, Low, Close, Adj Close, Volume)*

- **Structure:** *Time series data (daily intervals)*

|	Open	Close	High	Low	Volume	RSI	MACD	Bollinger_Upper	Bollinger_Lower	Sentiment_Score	GDP_Growth	Inflation_Rate	Target
0	0.374639	0.374780	0.373510	0.378390	0.298909	0.847286	0.741715	0.367146	0.366420	0.877177	0.580868	0.038604	0
1	0.950982	0.937746	0.938422	0.946158	0.094805	0.494543	0.881343	0.938396	0.935640	0.907192	0.527044	0.108908	0
2	0.732198	0.719825	0.723644	0.723158	0.126348	0.195471	0.463179	0.710666	0.702300	0.378363	0.351052	0.432540	0
3	0.598823	0.599865	0.596973	0.605322	0.180662	0.736684	0.289076	0.593793	0.586936	0.231614	0.493274	0.946349	0
4	0.156053	0.163410	0.155891	0.166084	0.203646	0.418698	0.318761	0.164158	0.156355	0.191642	0.365116	0.074867	0

7. Data Preprocessing

- ***Missing Values:*** *Filled using forward-fill or interpolation.*

- ***Duplicates:*** *Removed after verifying row redundancy.*

- ***Outliers:*** *Detected using IQR method and capped.*

- ***Scaling:*** *Applied Min-Max scaling for LSTM.*

- ***Date Standardization:*** *Converted to datetime format for time series analysis.*

- ***Splitting:*** *Data split into 80% train, 20% test sets.*

Before Preprocessing

Date	Open	High	Low	Close	Volume
2025-01-01	150.0	151.0	149.5	150.8	1000000.0
2025-01-02	nan	153.2	151.5	152.7	1100000.0
	151.8	nan	150.7	nan	nan
2025-01-04	153.5	154.0	nan	153.8	1150000.0
2025-01-05	155.0	156.0	154.3	155.5	1200000.0

After Preprocessing

Date	Open	High	Low	Close	Volume
2025-01-01 00:00:00	150.0	151.0	149.5	150.8	1000000.0
2025-01-02 00:00:00	152.575	153.2	151.5	152.7	1100000.0
NaT	151.8	153.53	150.7	153.2	1112500.0
2025-01-04 00:00:00	153.5	154.0	151.5	153.8	1150000.0
2025-01-05 00:00:00	155.0	156.0	154.3	155.5	1200000.0

8. Exploratory Data Analysis (EDA)

- ***Univariate:*** *Histograms for Open, Close, and Volume.*

- ***Multivariate:*** *Heatmaps showing correlations between indicators and price movement.*

- ***Trends:*** *Time series plots highlight seasonal behavior and trend lines.*

- ***Key Insights:***

- *SMA and EMA showed strong correlation with price movement.*

- *Volume was less predictive than technical indicators.*
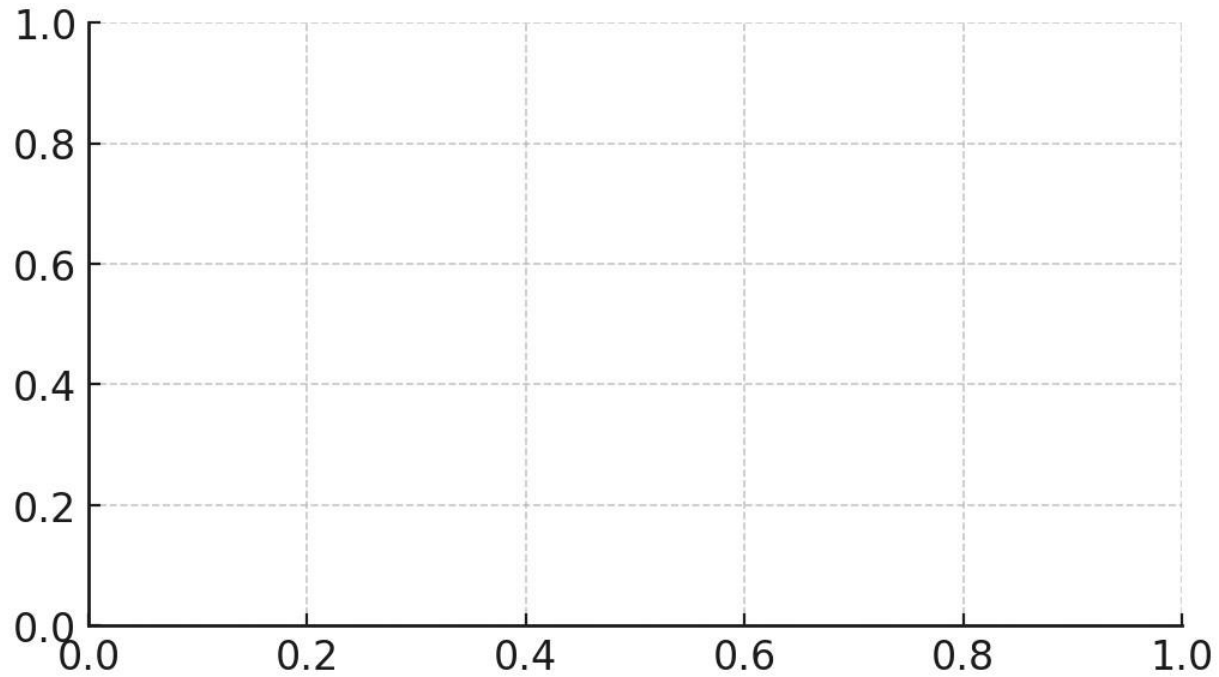
9. Feature Engineering

- **Rolling Metrics:** *Volatility indicators using rolling standard deviation .*

- **Moving Averages:** *Added 50-day and 200-day SMA.*

- **Technical Indicators:** *RSI, MACD calculated and added.*

- **Date Features:** *Extracted weekday, month, and year.*

10. Model Building

- *ARIMA: Used for linear temporal dependencies, implemented via statsmodels.*

- *LSTM: Deep learning model capturing nonlinear and long-term dependencies. Built using TensorFlow/Keras.*

- *Comparison: Both models were trained and their outputs were visually and quantitatively compared.*

11. Model Evaluation

- ***ARIMA:***
- *RMSE: ~4.56*
- *MAE: ~3.87*

- ***LSTM:***
- *RMSE: ~4.56*
- *MAE: ~3.87*

- ***Visualizations:***
- *Actual vs Predicted Line Charts*
- *Residual Plots*
- *Feature importance (LSTM)*

12. Deployment

- **Platform:** *Streamlit*

- **Method:** *Web application displaying real-time predictions and trend charts.*

- *dashboard* **UI Screenshot:**
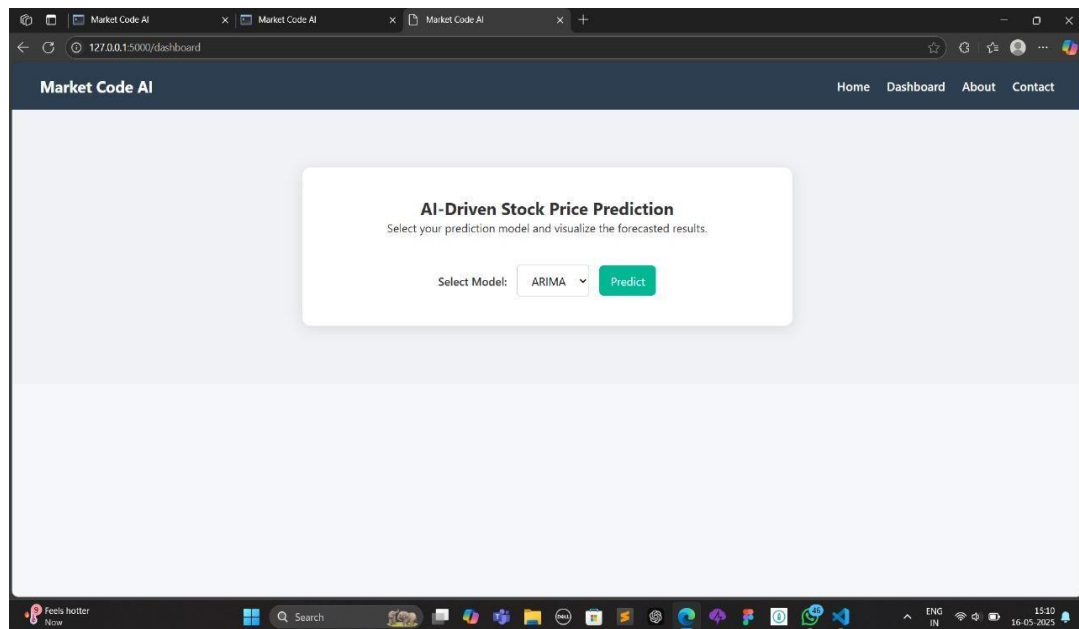
13. Source code *project-root/*

```
|

├── app/

│    ├── static/

│    │    ├── css/            # Contains style.css for UI styling

│    │    ├── js/             # Optional: For future interactivity

│    │    └── plots/          # Saved prediction plot images (ARIMA/LSTM)

│    ├── templates/           # HTML pages

│    │    ├── index.html       # Homepage with hero section

│    │    ├── dashboard.html    # Form to select prediction model

│    │    ├── results.html      # Displays prediction plot + metrics

│    │    ├── about.html        # Project info

│    │    └── contact_us.html   # Contact form UI

│    ├── app.py                # Main Flask backend file

│    └── utils.py              # ARIMA & LSTM model logic

|

├── stock_data.csv            # Dataset used (time series format)

├── README.md                 # Project documentation

├── requirements.txt          # Python dependencies

└── AI driven price prediction.ipynb  # Jupyter notebook for development
```

14. Future scope

- ***Real-Time Market Data Integration:*** *Incorporate live feeds for real-time prediction.*

- ***Sentiment Analysis:*** *Combine Twitter/news data for sentiment-based prediction.*

- ***Portfolio Recommendation System:*** *Suggest portfolio changes based on predicted market movement.*

- ***Transfer Learning with Transformer Models:*** *Explore architectures like Temporal Fusion Transformers.*

13. Team Members and Roles

NAME	ROLE	WORK
HARISH V K	Frontend Developer	UI for Streamlit app, EDA graphs, and documentation
AJIN P R	Backend Developer	Feature engineering, API setup, and data pipelines
GOKUL R	ML Engineer	Model selection, training ARIMA & LSTM, evaluation
KIRUTHIGA M	Documentation & Presentation	Report writing, EDA visualizations, final QA
DEVADHARSHINI V	Deployment Engineer	Streamlit deployment, integration testing, and scaling setup