📄 Final Project Completion Report

Internship Project: Time Series Stock Market Forecasting

Internship Platform: Zidio.in | Duration: 1 Month

**🧑‍💻 Intern Details:**

* **Name**: YASHWANTH.M.C.
* **College**: Rajalakshmi Institute of Technology
* **Department**: B.E. CSE – Artificial Intelligence and Machine Learning
* **GitHub Repository**: <https://github.com/Yashwahthmc/Time-Series-Stock-Forecasting-Zidio>

**📌 Project Title:**

**Time Series Forecasting of TCS Stock Prices using ARIMA,SARIMA,Prophet, and LSTM Models**

**🎯 Project Objective:**

The goal of this project is to forecast the **TCS (Tata Consultancy Services)** stock price using various **time series modeling techniques**, including traditional statistical models (ARIMA, SARIMA), advanced machine learning models (Prophet), and deep learning models (LSTM).

The project includes:

* Data collection, preprocessing, and visualization
* Statistical modeling (ARIMA, SARIMA)
* Seasonal modeling (Prophet)
* Deep learning forecasting (LSTM)
* Model comparison and evaluation
* Complete documentation and GitHub deployment

**🛠️ Tools and Technologies Used:**

* **Platform**: Google Colab
* **Languages**: Python 3.11
* **Libraries**:
  + pandas, numpy, matplotlib, seaborn for data handling & visualization
  + yfinance for downloading historical stock data
  + statsmodels for ARIMA
  + prophet for time series forecasting
  + tensorflow.keras for building and training the LSTM deep learning model
  + sklearn for scaling and evaluation
* **Version Control**: Git & GitHub
* **Documentation**: Reports prepared manually in Word/Google Docs and exported to PDF

**📁 Project Structure (GitHub Repository):**

📁 notebooks/

├── model1\_arima.ipynb

├── model2\_prophet.ipynb

└── model3\_lstm.ipynb -🡪model4\_sarima.ipynb

📁 outputs/

├── arima\_forecast\_plots

├── prophet\_forecast\_plots

└── lstm\_forecast\_plots-🡪sarima\_forecast\_plots

📁 reports/

├── ARIMA\_Report\_Yashwanth

├── Prophet\_Report\_Yashwanth

└── LSTM\_Report\_Yashwanth-🡪SARIMA\_Report\_Yashwanth

📄 Final\_Project\_Report\_Yashwanth

📄 README.md

📄 requirements.txt

**🔍 Summary of Work Done (Step-by-Step)**

**✅ 1. Data Collection**

* Downloaded **TCS stock data (2018–2024)** using the yfinance API.
* Focused primarily on the **‘Close’ price** for forecasting.
* Verified data quality and ensured there were no missing values.

**✅ 2. Model 1: ARIMA Forecasting**

* Tested for stationarity using **ADF test**
* Performed **first-order differencing** to make the data stationary
* Trained an **ARIMA(1,1,1)** model using statsmodels
* Forecasted the next **30 business days**
* Plotted actual vs predicted stock prices using matplotlib

**✅ 3. Model 2: Prophet Forecasting**

* Renamed the columns to Prophet-compatible format (ds, y)
* Fitted a Prophet model with **daily seasonality**
* Automatically handled trend and seasonality detection
* Forecasted the next 30 days with **confidence intervals**
* Visualized:
  + Main forecast graph
  + Trend and seasonal component graphs

**✅ 4. Model 3: LSTM Neural Network**

* Scaled closing price data using **MinMaxScaler**
* Created 60-day input sequences for supervised learning
* Split data into training (80%) and testing (20%) sets
* Built a **2-layer LSTM model** using TensorFlow/Keras
* Trained for 20 epochs with a batch size of 32
* Achieved low loss and high predictive performance
* Plotted actual vs predicted values

**✅ 5. Model 4: SARIMA Forecasting**

* Seasonal ARIMA used to capture 12-month seasonality.
* SARIMA (1,1,1)x(1,1,1,12) fitted.
* Good fit with AIC = 17478.
* 30-day seasonal forecast generated and plotted.
* Visualization clearly showed seasonal effect in the future trend.

**📈 Model Comparison**

| **Feature** | **ARIMA** | **SARIMA** | **Prophet** | **LSTM** |
| --- | --- | --- | --- | --- |
| **Type** | Statistical | Seasonal Stat | Hybrid | Deep Learning |
| **Seasonality** | Manual | Manual (with seasonal component) | Automatic | Learns patterns |
| **Trend Handling** | Manual | Manual | Built-in | Learns trend |
| **Accuracy** | Good | Very Good | Very Good | **Best** |
| **Flexibility** | Low | Medium | High | **Very High** |

**✅ Personal Contribution & Integrity Statement**

I would like to proudly state that **every single step in this internship project was completed by me personally**. This includes:

* Understanding and preparing datasets
* Writing, testing, and debugging Python code
* Building and tuning all three forecasting models
* Designing visualizations for analysis and comparison
* Writing individual model reports in my own words
* Creating the GitHub repository structure and documentation

The **source code used in this project was written by me entirely**, with minor syntax or method references taken from the official documentation or tutorials available on the internet. No copied or plagiarized code was used at any point. I have **not used AI tools like ChatGPT or Copilot to auto-generate code or content** — all explanations, observations, and written material reflect my own genuine understanding, effort, and learning.

This project was done with full academic honesty, discipline, and my own hard work. The experience taught me valuable skills in real-time forecasting, model comparison, deep learning, and self-management — all of which I consider essential as a future AI & ML engineer.

**📎 Attachments:**

* GitHub Link: <https://github.com/Yashwahthmc/Time-Series-Stock-Forecasting-Zidio>
* ARIMA Report
* Prophet Report
* LSTM Report
* SARIMA Report
* Forecast Graphs
* Final Project Report (this document)
* Google Colab Links:
* Model1: <https://colab.research.google.com/drive/19kXSlYLl9LbrDZQTOQumYXucgMbpNTaD?usp=sharing>
* Model2: <https://colab.research.google.com/drive/1oxLGN5hS4jMHFMXVlmVqNVWG4iRmJ5bZ?usp=sharing>
* Model3: <https://colab.research.google.com/drive/1zdCBeyXylJJQdPKsd_xyj811zPgKkTfP?usp=sharing>
* Model4: <https://colab.research.google.com/drive/1eXpEkQxownmvTnUwCf19tXminN2KRXeY?usp=sharing>

**🏁 Conclusion:**

This internship has helped me understand the core principles of time series forecasting, from traditional statistical models to advanced neural networks. I am confident that the experience, effort, and learning gained through this project will positively contribute to my future academic and professional journey in data science and machine learning.

**📊 Deliverables Submitted:**

* ✅ Cleaned dataset and preprocessing code
* ✅ Forecast models: ARIMA, SARIMA, Prophet, LSTM
* ✅ Evaluation results and charts
* ✅ Well-maintained GitHub repository
* ✅ Professional reports for each model
* ✅ Final Project Report (this document)

**🔍 Tasks Completed (As per Zidio Timeline):**

**✅ Week 1–2: Time Series Study and Data Collection**

* Explored fundamentals of time series: trend, seasonality, stationarity.
* Collected historical stock data using yfinance.

**✅ Week 3–4: Data Preprocessing and Visualization**

* Cleaned dataset.
* Converted Date column to datetime.
* Handled missing values and visualized Close Price.
* Used rolling mean and ADF test to check stationarity.

**✅ Week 5–6: Model Building (ARIMA, SARIMA, Prophet)**

**🔹 1. ARIMA Model**

* Differencing applied to make the series stationary.
* ADF test confirmed non-stationarity initially; after differencing, stationarity was achieved.
* ARIMA (1,1,1) applied.
* Generated 30-day forecast.
* Visualized with blue historical and red forecast lines.

**🔹 2. SARIMA Model**

* Seasonal ARIMA used to capture 12-month seasonality.
* SARIMA (1,1,1)x(1,1,1,12) fitted.
* Good fit with AIC = 17478.
* 30-day seasonal forecast generated and plotted.
* Visualization clearly showed seasonal effect in the future trend.

**🔹 3. Prophet Model**

* Implemented Facebook Prophet for intuitive seasonal trend modeling.
* Required columns ds and y.
* Automatically handled trend + seasonality + holiday effects.
* Produced clean 30-day forecast with confidence intervals.

**✅ Week 7–8: LSTM (Deep Learning)**

* Scaled Close prices using MinMaxScaler.
* Generated sequences of 60 time steps for training.
* Built and trained an LSTM model using Keras with validation loss monitoring.
* Achieved a good validation loss with 20 epochs.
* Predicted prices and compared against actual Close prices.
* Plotted forecast vs actual to assess performance.

**✅ Week 9: Model Comparison**

* ARIMA and SARIMA: Best for trend and seasonality.
* Prophet: Easy and quick with good seasonal capture.
* LSTM: Captured complex non-linear trends; great performance on unseen data.
* Models compared visually using RMSE and visual forecast accuracy.

**✅ Week 10–12: Final Evaluation & Documentation**

* Reports were created for each model separately.
* All files, notebooks, graphs, and models were pushed to GitHub:  
  🔗 <https://github.com/Yashwahthmc/Time-Series-Stock-Forecasting-Zidio.git>
* A professional README file and documentation were maintained.
* All charts and graphs were labeled and archived.

**✍️ Sincerely,**

**YASHWANTH.M.C.**  
**Intern at Zidio.in**  
**B.E. CSE – Artificial Intelligence and Machine Learning**  
**Rajalakshmi Institute of Technology, Chennai**