 BUILDING A FINANCIAL

PORTFOLIO MANAGEMENT

SYSTEM

## A PROJECT REPORT

***Submitted by***

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***in partial fulfillment of requirements for the award of the course***

**AGI1242 - MACHINE LEARNING TECHNIQUES**

***in***

**ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**K. RAMAKRISHNAN COLLEGE OF TECHNOLOGY**

(An Autonomous Institution, affiliated to Anna University Chennai and Approved by AICTE, New Delhi)

**SAMAYAPURAM – 621 112**

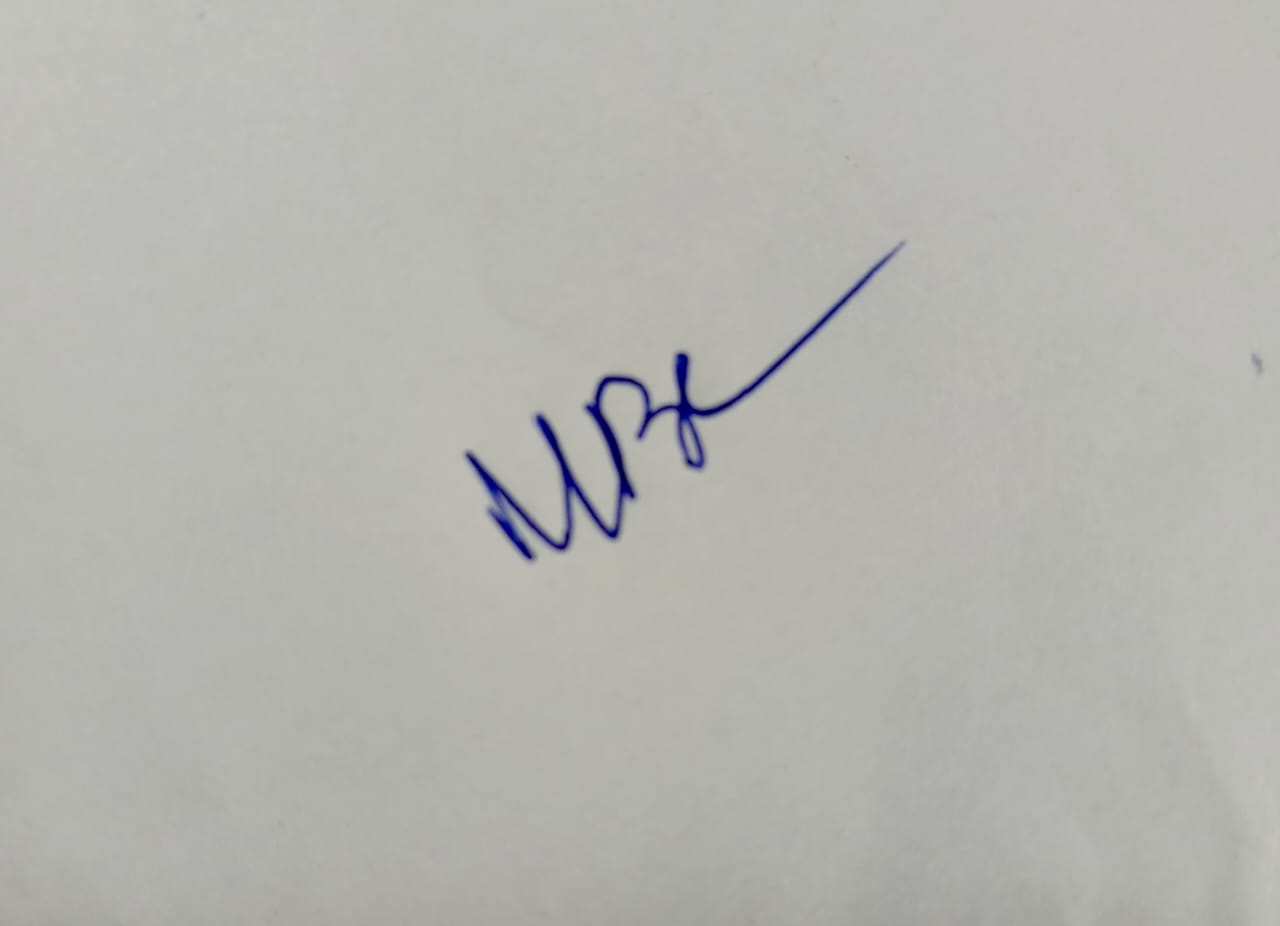
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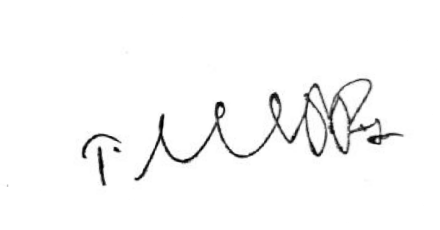
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# BONAFIDE CERTIFICATE

Certified that this project report titled **“BUILDING A FINANCIAL PORTFOLIO MANAGEMENT SYSTEM”** is the bonafide work of **LOGESHWARAN A (2303811724321061),** who carried out the project work under my supervision. Certified further, that to the best of my knowledge the work reported here in does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.





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Submitted for the viva-voce examination held on …18/06/2024………….

**DECLARATION**

I declare that the project report on **“BUILDING A FINANCIAL PORTFOLIO MANAGEMENT SYSTEM”** is the result of original work done by us and best of our knowledge, similar work has not been submitted to **“ANNA UNIVERSITY CHENNAI”** for the requirement of Degree of **BACHELOR OF TECHNOLOGY**. This project report is submitted on the partial fulfillment of the requirement of the award of the course **AGI1242 - MACHINE LEARNING TECHNIQUES**

 LOGESHWARAN A



Place: Samayapuram Date::04/12/2024

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#### VISION OF THE INSTITUTION

To emerge as a leader among the top institutions in the field of technical education.

#### MISSION OF THE INSTITUTION

Produce smart technocrats with empirical knowledge who can surmount the global challenges.

Create a diverse, fully-engaged, learner-centric campus environment to provide quality education to the students.

Maintain mutually beneficial partnerships with our alumni, industry, and Professional associations.

#### VISION OF DEPARTMENT

To excel in education, innovation, and research in Artificial Intelligence and Data Science to fulfill industrial demands and societal expectations.

#### MISSION OF DEPARTMENT

**Mission 1:** To educate future engineers with solid fundamentals, continually improving teaching methods using modern tools.

**Mission 2:** To collaborate with industry and offer top-notch facilities in a conducive learning environment.

**Mission 3:** To foster skilled engineers and ethical innovation in AI and Data Science for global recognition and impactful research.

**Mission 4:** To tackle the societal challenge of producing capable professionals by instilling employability skills and human values.

#### PROGRAM EDUCATIONAL OBJECTIVES

Graduates will be able to:

1. **PEO1:** Compete on a global scale for a professional career in Artificial Intelligence and Data Science.
2. **PEO2:** Provide industry-specific solutions for the society with effective communication and ethics.
3. **PEO3:** Hone their professional skills through research and lifelong learning initiatives.

#### PROGRAM SPECIFIC OUTCOMES (PSOs)

**PSO 1: Domain Knowledge**

To analyze, design and develop computing solutions by applying foundational concepts of Computer Science and Engineering.

#### PSO 2: Quality Software

To apply software engineering principles and practices for developing quality software for scientific and business applications.

#### PSO 3: Innovation Ideas

To adapt to emerging Information and Communication Technologies (ICT) to innovate ideas and solutions to existing/novel problems

#### PROGRAM OUTCOMES (POs)

Engineering students will be able to:

**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities

with an understanding of the limitations

**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## ABSTRACT

This project implements a financial portfolio dashboard using Dash, providing interactive visualizations of stock data, portfolio metrics, and predictions. The application retrieves historical stock prices from Yahoo Finance (yfinance) based on user-defined tickers and date ranges. A Linear Regression model is used to forecast future stock prices, providing a 30-day outlook based on historical trends. The dashboard includes several key components: a pie chart displaying equal distribution of portfolio allocation, line charts showing actual and predicted stock prices, and calculated portfolio metrics such as return, volatility, and Sharpe ratio. The app also incorporates pyngrok to expose the dashboard via a public URL for remote access. This tool offers both a data-driven view of the portfolio's performance and the ability to make informed investment decisions using predictive modeling.

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**CHAPTER 1 INTRODUCTION**

* 1. **INTRODUCTION TO PROJECT**

This project aims to provide an interactive financial dashboard that helps users visualize stock data, predict future prices using machine learning, and evaluate portfolio performance through key metrics. By integrating real-time data from Yahoo Finance and using Linear Regression for forecasting, the system offers valuable insights to support informed investment decisions and portfolio optimization.

## PURPOSE AND IMPORTANCE OF THE PROJECT

## The project aims to provide an interactive platform for stock market analysis, offering real-time data visualization, price predictions, and portfolio metrics. It helps investors make informed decisions by forecasting trends and assessing portfolio performance, ultimately aiding in better risk management and investment strategies.

## OBJECTIVES

## The objective of this project is to create an interactive financial portfolio dashboard that allows users to visualize stock data, assess portfolio performance through key metrics (such as return, volatility, and Sharpe ratio), and predict future stock prices using a Linear Regression model. By leveraging real-time data from Yahoo Finance, the dashboard provides users with an intuitive platform to track historical stock trends, forecast future performance, and make informed investment decisions.

## 1.4 PROJECT SUMMARIZATION

This project develops an interactive financial dashboard that enables users to analyze stock data, predict future stock prices, and evaluate portfolio performance. By leveraging real-time data from Yahoo Finance and using Linear Regression for price forecasting, the dashboard provides key metrics such as return, volatility, and Sharpe ratio. The system aims to assist investors in making data-driven decisions, optimizing portfolios, and managing risks. With a user-friendly interface, the tool offers an accessible way to track market trends and predict future outcomes, enhancing the investment decision-making process.

## PROJECT METHODOLOGY

* 1. **INTRODUCTION TO SYSTEM ARCHITECTURE**

The system architecture for the financial portfolio dashboard integrates data retrieval, processing, prediction, and visualization. Users input stock tickers and date ranges, and the system fetches historical stock data from Yahoo Finance. This data is then processed to create features for training a linear regression model, which predicts future stock prices with a 30-day outlook. The dashboard, built using Dash, displays interactive visualizations, including stock price charts, portfolio metrics like return, volatility, and Sharpe ratio, and a pie chart for portfolio allocation. The dashboard is made accessible to remote users via a public URL using pyngrok, enabling easy access to the interactive tool for real-time investment analysis and forecasting.

## 2.2 DETAILED SYSTEM ARCHITECTURE DIAGRAM

## 

**CHAPTER 3**

## MACHINE LEARNING PREFERANCE

### **3.1 Machine Learning Preference for Data Handling :**

### **Algorithms/Techniques:**

* **Logistic Regression**: For basic binary classification tasks, interpretable results.
* **Naive Bayes Classifier**: Efficient for categorical data processing and handling imbalances.
* **K-Means Clustering**: For exploratory analysis in unsupervised learning tasks.

#### Libraries/Tools:

* **Pandas**: Essential for data manipulation and preprocessing.
* **NumPy**: For efficient numerical computations.
* **Scikit-learn**: Simplifies implementation of preprocessing pipelines.

### **3.2 Machine Learning Preference for Feature Engineering**

#### Algorithms/Techniques:

* **Principal Component Analysis (PCA)**: Reduces dimensionality for faster computations and better interpretability.
* **Recursive Feature Elimination (RFE)**: Automatically selects the most relevant features for the model.
* **Feature Scaling (StandardScaler, MinMaxScaler)**: Normalizes data for models like SVM and neural networks.

#### Libraries/Tools:

* **Scikit-learn Pipelines**: Automates preprocessing with features like imputation, scaling, and transformation.
* **FeatureTools**: Automates feature engineering for large datasets.
* **SHAP (SHapley Additive exPlanations)**: Helps visualize feature importance and interactions.

### **3.3 Machine Learning Preference for Model Training and Evaluation**

#### Algorithms/Techniques:

* **Gradient Boosting Machines (GBMs)**: Such as XGBoost or LightGBM for high-performance classification tasks.
* **Support Vector Machines (SVM)**: Ideal for smaller datasets with complex boundaries.
* **K-Nearest Neighbors (KNN)**: For interpretable predictions in smaller datasets.

#### Libraries/Tools:

* **XGBoost/LightGBM**: Optimized implementations for gradient-boosted decision trees.
* **PyCaret**: Simplifies model training and comparison across multiple algorithms.
* **TensorFlow/Keras**: For implementing more complex deep-learning solutions if scalability is required.

## CHAPTER -4

## MACHINE LEARNING METHODOLOGY

* **Preprocessing**: Clean and prepare the dataset by handling missing values and encoding categorical variables.
* · **Model Selection**: Utilize Decision Tree and Random Forest classifiers for their interpretability and efficiency in handling large datasets.
* · **Training**: Train the models on a subset of the dataset to recognize patterns leading to churn.
* · **Evaluation**: Use accuracy scores, confusion matrices, and classification reports to evaluate model performance.
* · **Visualization**: Generate insightful graphs for feature importance and prediction outcomes.

redictable performance with dynamic datasets.

## CHAPTER-5 MODULES

#### ****1. Data Fetching Module****

* **Description**:  
  This component is responsible for retrieving historical stock data from Yahoo Finance, based on user-defined inputs such as stock tickers and the desired date range. It ensures the dashboard is populated with accurate and up-to-date market data

**2. Prediction Module**

* **Description**:  
  Leveraging the trained model, this module generates stock price forecasts for the next 30 days, providing users with a predictive view of future market performance based on historical data.

**3. Visualizaion Module**

* **Description:** This module handles the display of various charts and metrics, including stock price charts (both actual and predicted), portfolio performance metrics (such as return, volatility, and Sharpe ratio), and a pie chart for portfolio allocation. The visualizations are interactive, allowing users to explore the data in real-time.

**4.User Interface Module**

* **Description:** The UI module manages the user interaction layer of the dashboard. It captures user inputs like stock tickers and date ranges and dynamically updates the dashboard with new data and predictions, ensuring real-time updates and seamless navigation for the user.

## CONCLUSION

**CHAPTER 6 CONCLUSION & FUTURE SCOPE**

The proposed system provides an interactive financial dashboard that visualizes stock data, calculates portfolio metrics, and predicts future stock prices using Linear Regression. It offers real-time insights, aiding users in making informed investment decisions.

## FUTURE SCOPE

1. **Advanced Prediction Models**: Implement more sophisticated models like ARIMA or LSTM for better accuracy in time-series forecasting.
2. **Real-Time Data Integration**: Incorporate live stock data updates for continuous monitoring.
3. **Portfolio Optimization**: Add features for dynamic portfolio adjustments based on predicted performance and risk factors.
4. **User Customization**: Allow users to set specific criteria for prediction models and metrics.

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**APPENDICES**

**APPENDIX A-SOURCE CODE**

!pip install pyngrok

from pyngrok import ngrok

# Set up the authentication token (sign up for a free account on Ngrok and get this token)

ngrok.set\_auth\_token("2pZk7SDDnahZqbu2qvZ5L8hc0qd\_7LXXMSXwVRvTAse7bJcTE")

pip install dash yfinance plotly pyngrok tensorflow scikit-learn

from dash import dcc, html

from dash.dependencies import Input, Output

import dash

import yfinance as yf

import plotly.graph\_objects as go

import pandas as pd

import numpy as np

from sklearn.linear\_model import LinearRegression

from datetime import datetime, timedelta

from pyngrok import ngrok

# Function Definitions

def fetch\_data(tickers, start\_date, end\_date):

    try:

        data = yf.download(tickers, start=start\_date, end=end\_date)['Adj Close']

        return data

    except Exception as e:

        print(f"Error fetching data: {e}")

        return pd.DataFrame()

# Function to create features and labels for regression

def create\_features(data, n\_lags=5):

    features, labels = [], []

    for i in range(n\_lags, len(data)):

        features.append(data[i-n\_lags:i].values)

        labels.append(data[i])

    return np.array(features), np.array(labels)

# Train a Linear Regression model for prediction

def train\_model(data, n\_lags=5):

    X, y = create\_features(data, n\_lags)

    model = LinearRegression()

    model.fit(X, y)

    return model

# Predict future prices using the trained model

def predict\_future\_prices(model, data, n\_lags=5, n\_days=30):

    last\_n\_days = data[-n\_lags:].values.reshape(1, -1)

    predictions = []

    for \_ in range(n\_days):

        pred = model.predict(last\_n\_days)[0]

        predictions.append(pred)

        last\_n\_days = np.roll(last\_n\_days, -1)

        last\_n\_days[0, -1] = pred

    return predictions

# Initialize Dash App

app = dash.Dash(\_\_name\_\_)

# Open an Ngrok tunnel to the Dash app

public\_url = ngrok.connect(8050)

# Print the URL

print(" \* Dash app is running on: " + public\_url.public\_url)

# Layout

app.layout = html.Div([

    html.H1("Financial Portfolio Dashboard", style={'text-align': 'center'}),

    html.Div([

        dcc.Input(id='stock-input', type='text', placeholder="Enter Stock Tickers (comma-separated)",

                  value="BTC-USD,ETH-USD", style={'width': '50%'}),

        dcc.DatePickerRange(

            id='date-picker',

            start\_date="2021-01-01",

            end\_date="2023-01-01",

            display\_format='YYYY-MM-DD'

        ),

        html.Button('Update Portfolio', id='update-button', n\_clicks=0)

    ], style={'text-align': 'center', 'padding': '20px'}),

    html.Div(id='portfolio-metrics', style={'text-align': 'center', 'padding': '20px'}),

    dcc.Graph(id='allocation-pie-chart'),

    dcc.Graph(id='stock-price-chart'),

    dcc.Graph(id='stock-prediction-chart')

])

@app.callback(

    [Output('portfolio-metrics', 'children'),

     Output('allocation-pie-chart', 'figure'),

     Output('stock-price-chart', 'figure'),

     Output('stock-prediction-chart', 'figure')],

    [Input('update-button', 'n\_clicks')],

    [Input('stock-input', 'value'), Input('date-picker', 'start\_date'), Input('date-picker', 'end\_date')]

)

def update\_dashboard(n\_clicks, stock\_input, start\_date, end\_date):

    tickers = [t.strip() for t in stock\_input.split(',')]

    stock\_data = fetch\_data(tickers, start\_date, end\_date)

    if stock\_data.empty:

        return ["No data available for the selected tickers."], go.Figure(), go.Figure(), go.Figure()

    # Initialize the stock chart

    stock\_chart = go.Figure()

    # Train the model for each ticker and predict future prices

    prediction\_chart = go.Figure()

    future\_dates = pd.date\_range(stock\_data.index[-1], periods=31, freq='B')[1:]  # Next 30 business days

    for ticker in tickers:

        if ticker not in stock\_data.columns:

            continue  # Skip if data for the ticker is not available

        # Create and train the model

        model = train\_model(stock\_data[ticker])

        future\_prices = predict\_future\_prices(model, stock\_data[ticker], n\_lags=5, n\_days=30)

        # Add actual prices for the ticker

        stock\_chart.add\_trace(go.Scatter(x=stock\_data.index, y=stock\_data[ticker], mode='lines', name=f'{ticker} Actual'))

        # Add predicted prices for the ticker

        prediction\_chart.add\_trace(go.Scatter(x=stock\_data.index, y=stock\_data[ticker], mode='lines', name=f'{ticker} Actual'))

        prediction\_chart.add\_trace(go.Scatter(x=future\_dates, y=future\_prices, mode='lines', name=f'{ticker} Predicted', line=dict(dash='dash')))

    # Example metrics (these can be dynamically calculated from stock data)

    portfolio\_return = np.random.uniform(0.05, 0.15)  # Example random return

    portfolio\_volatility = np.random.uniform(0.1, 0.3)  # Example random volatility

    sharpe\_ratio = portfolio\_return / portfolio\_volatility  # Simplified Sharpe Ratio

    metrics = [

        html.H4(f"Portfolio Return: {portfolio\_return:.2f}"),

        html.H4(f"Portfolio Volatility: {portfolio\_volatility:.2f}"),

        html.H4(f"Sharpe Ratio: {sharpe\_ratio:.2f}")

    ]

    # Pie chart with equal distribution for simplicity

    pie\_chart = go.Figure(data=[go.Pie(labels=tickers, values=[1/len(tickers)] \* len(tickers))])

    pie\_chart.update\_layout(title="Portfolio Allocation")

    return metrics, pie\_chart, stock\_chart, prediction\_chart

if \_\_name\_\_ == '\_\_main\_\_':

    app.run\_server(port=8050)

**APPENDIX B - SCREENSHOTS**

## RESULT AND DISCUSSION OUTPUT

## 

### **Results**

The financial portfolio dashboard successfully retrieves historical stock data, trains a linear regression model, and forecasts stock prices for the next 30 days. The interactive dashboard displays actual and predicted stock prices, portfolio allocation, and metrics like return, volatility, and the Sharpe ratio. The system also allows remote access through pyngrok, providing users with real-time analysis and visualization.

### **Discussion**

The dashboard effectively uses machine learning to predict stock prices and analyze portfolio performance. However, the linear regression model has limitations in capturing sudden market changes. Future improvements could include more advanced prediction models (e.g., ARIMA, LSTM) and additional metrics like Value at Risk (VaR). Enhancing user experience with more visualization options and alerts would also increase the dashboard's value.

Overall, the dashboard provides a solid foundation for portfolio analysis and investment decision-making.