

FINANCIAL PORTFOLIO MANAGEMENT SYSTEM

Group No.: Group 7

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EXECUTIVE SUMMARY:

Financial portfolio management system was designed to address the challenges faced by investors in managing their financial portfolios. The primary objective of the project financial portfolio management system is to minimize the manual efforts and enhance the efficiency of selection of stocks or any tradeable entity. This system incorporates features for efficient fundamental and technical data analysis of companies, share recommendations, portfolio creation, risk management, and post-trade analytics. The existing systems face challenges in filtering relevant financial information. The other drawbacks of traditional stock selection is that investors often struggle to balance the Risk and Return, and after executing the trade it becomes difficult for them to monitor Post-trade analytics. These problems are addressed by modern financial portfolio management system where stock selection is based on in-depth analysis of fundamental and technical aspects of company data. Moreover, the system ensures a well-diversified portfolio across sectors, enabling a balance between risk and return.

In the development of our Financial Portfolio Management System, we initiated the project by forming the Enhanced Entity-Relationship Model as a first step. This EER was the blueprint for defining the logical structure of the database. Then, we worked on the implementation of the Unified Modeling Language (UML), creating class diagrams. To ensure scalability, we then normalized the relations and formulated a relational model. This relational model, was then implemented on MySQL. Through this implementation, we conducted data insertion and manipulation to gain a understanding of market trends and portfolio dynamics. In the final phase, we extended our implementation to NoSQL databases.

The Financial portfolio management system is versatile and can be extended to cover a broader range of financial instruments beyond stocks, to the diverse needs of investors. The next stage involves continuous refinement and adaptation of the system based on user feedback, market dynamics, and technological advancements. Ongoing updates can enhance the system's analytical capabilities, potentially incorporating machine learning algorithms for predictive analytics. Additionally, expanding the system to cover a broader coverage of financial instruments and diverse set of markets and regions. Overall, the project significantly enhances the efficiency and effectiveness of the investment decision-making process.

INTRODUCTION

In an era marked by increasing financial complexities, market volatility, diverse opportunities and investors on the field of financial independence are increasing day by day. With hiking market value, people are investing their capital so that it profits them in the future reference. Likewise, people are crazily indulged in this field which may create messy circumstances for managing huge bundles of shares that they hold. Also, in this era people have no time to analyse fundamental, technical details related to the market, effective portfolio management has never been more critical.

Share Market is the aggregation of buyers and sellers of stocks (also called shares), which represent ownership claims on businesses; these may include securities listed on a public stock exchange, as well as stock that is only traded privately, such as shares of private companies which are sold to investors through equity crowdfunding platforms. Investment is usually made with an investment strategy in mind.

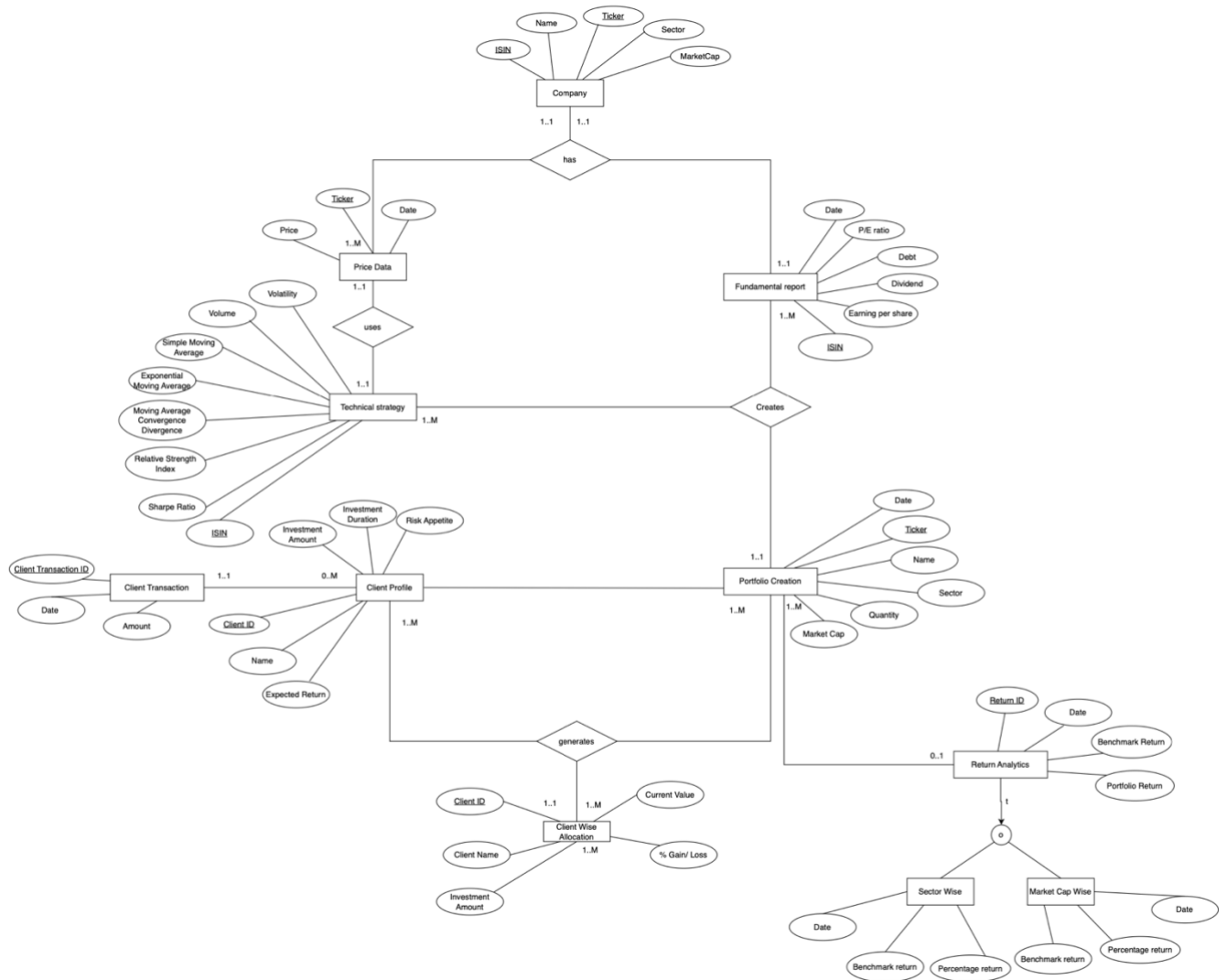
A portfolio is a collection of financial investments like stocks, bonds, commodities, cash, and cash equivalents, as well as their fund counterparts. In our project, we will often use portfolio to define only investments in stocks. Portfolio management is the art and science of selecting and overseeing a group of stocks that meet the long-term financial objectives and risk tolerance of a client, a company, or an institution.

Fundamental analysis determines a stock's fair value by examining the related company earning's with respect to investment. Fundamental analysis depends upon fundamental report. Fundamental analysts search for stocks that are currently trading at prices that are higher or lower than their real value. Technical analysis is an analysis methodology for forecasting the direction of prices through the study of market data.

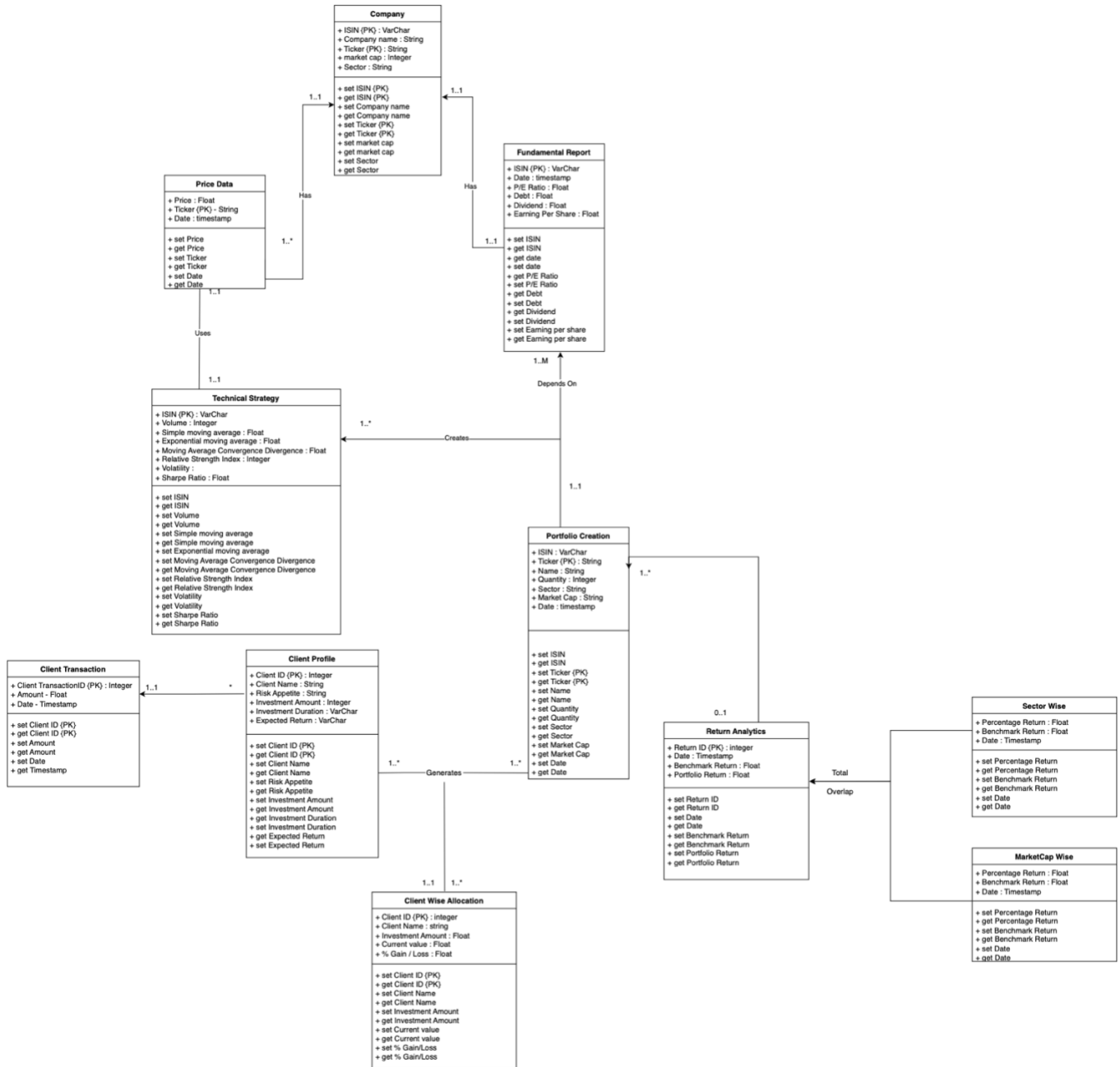
The primary purpose of this project is to develop a robust and adaptable portfolio management system that aligns with the goals and risk tolerance of our investors. This system will facilitate the creation, monitoring and optimization of investment portfolios ensuring that they remain in line with established objectives. Furthermore, it aims to enhance transparency, compliance and client communication.

CONCEPTUAL DATA MODELLING

EER Model Diagram:



UML Diagram:



MAPPING CONCEPTUAL MODEL TO RELATIONAL

- **Company**(ISIN, Ticker, Name, Sector, Market Cap)
 - Primary key: (ISIN, Ticker)
- **Price**(Ticker, Price, Date, ISIN)
 - Primary key: -
 - Foreign key: ISIN NOT NULL
- **Technical Strategy**(ISIN, Volatility, Volume, Simple Moving Average, Exponential Moving Average, Moving Average Convergence Divergence, Relative Strength Index, Sharpe Ratio, Price, Ticker)
 - Primary key: ISIN
 - Foreign key: ISIN, Ticker NOT NULL
- **Fundamental Report**(ISIN Date, P/E Ratio, Debt, Dividend, Earning per share, Ticker)
 - Primary key: ISIN
 - Foreign key: ISIN, Ticker NOT NULL
- **Portfolio Creation**(Ticker, Date, Name, Sector, Quantity, Market Cap, Return ID)
 - Primary key: Ticker
 - Foreign key: - Ticker, Return ID NOT NULL
- **Generates**(Client ID, Ticker)
 - Primary key: Client ID
 - Foreign key: Ticker Not NULL
- **Client Profile**(Client ID, Client Name, Expected Return, Investment Amount, Investment Duration, Risk Appetite, Client Transaction ID)
 - Primary key: Client ID
 - Foreign key: Client ID NOT NULL, Client Transaction ID
- **Client Transaction**(Client Transaction ID, Date, Amount)
 - Primary key: Client Transaction ID NOT NULL
 - Foreign key: -
- **Client Wise Allocation**(Client ID, Client Name, Investment Amount, Current Value, % Gain/Loss, Date)
 - Primary key: Client ID
 - Foreign key: Client ID, Date NOT NULL
- **Return Analytics**(Return ID, Benchmark Return, Portfolio Return, Date)
 - Primary key: - Return_ID
- **Sector Wise**(Return ID, Sector, Benchmark Return, Portfolio Return, Date)
 - Primary key: Return_ID
 - Foreign Key : Return_ID NOT NULL
- **Market Cap Wise Wise**(Return ID, MarketCap, Benchmark Return, Portfolio Return, Date)
 - Primary key: Return_ID
 - Foreign Key: Return_ID NOT NULL

SOL QUERIES

Query 1: Find ISIN, P_E_Ratio, Debt and Dividend of Companies from Fundamental Table where P/E Ratio less than 30?

```
SELECT ISIN, P_E_Ratio, Debt, Dividend FROM Fundamental_Report
WHERE P_E_Ratio < 30;
```

ISIN	P_E_Ratio	Debt	Dividend
1	20	600000000	2
2	25	800000000	1.5
3	18	300000000	3
4	15	200000000	2.5
5	22	400000000	1.8
6	28	400000000	1.8
7	14	150000000	2.2
8	27	600000000	
9	16	300000000	2.8
10	24	200000000	1
11	19	500000000	1.5
12	23	100000000	1
13	17	700000000	3.5
14	21	100000000	1.8

Query 2: Query 2: Find the Average Market Capital of Each Sector?

```
SELECT Sector, AVG(Market_Cap) AS Avg_Market_Cap
FROM Portfolio_Creation
GROUP BY Sector;
```

Sector	Avg_Market_Cap
Automotive	1200000
Technology	1733333.3333333333
Retail	5225000
Entertainment	1000000
Industrial	150000
Finance	1175000
Beverages	500000
Food	1250000

Query 3. Find the Total buy amount in Portfolio table ?

```
SELECT pc.Ticker, (pc.Quantity*p.price) AS total_buy_amount
FROM Portfolio_Creation pc, Price p
WHERE pc.Ticker=p.Ticker;
```

Ticker	total_buy_amo...
AAP	2400
AAPL	15000
AMZN	96000
DIS	5950
FB	10200
GE	150
GOOG	75000
GS	5000
IBM	6000

Query 4: Find the Clients who have invested in all the stocks of Portfolio Creation ?

```
SELECT cp.Client_Name FROM Client_Profile cp
JOIN Generates g
JOIN Portfolio_Creation p
WHERE cp.Client_ID = g.Client_ID AND g.Ticker = p.Ticker
GROUP BY cp.Client_Name
HAVING COUNT(distinct g.Ticker) =
(SELECT COUNT(DISTINCT p1.Ticker)
FROM Portfolio_Creation p1)
```

Client_Name

Query 5. Retrieve client name if there exists investment amount greater than 10000 and current value of investment is greater than investment amount and risk level is adjusted to low ?

```
SELECT cp.Client_Name
FROM Client_Profile cp
WHERE cp.Risk_level = 'Low'
AND EXISTS
(SELECT 1 FROM Client_Wise_Allocation ca
WHERE ca.Client_ID = cp.Client_ID AND
ca.Current_Value > ca.Investment_Amount AND
ca.Investment_Amount > 7500);
```

Client_Name
John Doe
Emily Davis
Olivia Moore

Query 6. Find the list of Customers who made transactions in Companies belonging to the 'Technology' Sector.

```
SELECT DISTINCT cw.Client_ID, cw.Client_Name
FROM Client_Wise_Allocation cw
WHERE EXISTS (SELECT * FROM Generates g
JOIN Portfolio_Creation pc ON g.Ticker = pc.Ticker
JOIN Company c ON pc.ticker = c.ticker
WHERE c.Sector = 'Technology' AND g.Client_ID = cw.Client_ID)
```

Client_ID	Client_Name
219	Michael Smith
201	John Doe
202	Jane Smith
203	Mike Johnson
204	Emily Davis
209	Daniel Taylor
206	Sara Wilson
215	James Thompson
212	Ella Harris
220	Isabella Davis

Ques 7. Find the list of Companies with stable fundamental and technical reports.

```
(SELECT f.ISIN, c.Name
FROM Fundamental_Report f, Company c
WHERE f.ISIN = c.ISIN AND
Debt < 3000000000)
UNION
(SELECT t.ISIN, c.Name FROM Technical_Strategy t, Company c
WHERE t.ISIN = c.ISIN AND t.Volatility < 0.10 AND
t.MACD = 'bull' AND t.Sharpe_ratio > 1.8);
```

ISIN	Name
6	Visa Inc.
10	General Electric Company
13	The Coca-Cola Company
14	PepsiCo Inc.
16	Walmart Inc.
17	Morgan Stanley
18	Advance Auto Parts Inc.
19	McDonald's Corporation

Ques 8. Find the Ticker, Name, and Risk_level for each client from the Generates table along with their associated risk level.

```
SELECT g.Ticker, c.Name, (SELECT Risk_level
FROM Client_Profile cp
WHERE cp.Client_ID = g.Client_ID
LIMIT 1) AS Risk_level FROM
Generates g JOIN Company c ON g.Ticker = c.Ticker;
```

Ticker	Name	Risk_level
AAPL	Apple Inc	high
AAPL	Apple Inc	Low
GOOGL	Alphabet	Moderate
GOOGL	Alphabet	Low
MSFT	Microsoft	high
AMZN	Amazon.com Inc.	Low
TSLA	Tesla Inc.	high
JPM	JPMorgan Chase & Co.	Moderate
DIS	The Walt Disney Company	high
IBM	IBM Corporation	Moderate
IBM	IBM Corporation	Moderate
IBM	IBM Corporation	Low
GE	General Electric Company	Low
GE	General Electric Company	high
NFLX	Netflix Inc.	high
NFLX	Netflix Inc.	Moderate
FB	Meta Platforms Inc.	high
FB	Meta Platforms Inc.	high
KO	The Coca-Cola Company	Moderate
PEP	PepsiCo Inc.	Moderate
GS	The Goldman Sachs Group	high
WMT	Walmart Inc.	high
WMT	Walmart Inc.	Moderate
WMT	Walmart Inc.	high
MS	Morgan Stanley	Moderate
MS	Morgan Stanley	high
AAP	Advance Auto Parts Inc.	Moderate
MCD	McDonald's Corporation	high
GOOG	Alphabet Inc.	high
GOOG	Alphabet Inc.	high
GOOG	Alphabet Inc.	Moderate

IMPLEMENTATION IN NO-SQL

Ques 1. Find all the values from Return Analytics where Benchmark Return is more than equal to 6.5 and Portfolio Return is less than equal to 10.

```
db.Return_Analytics.find({ $and:
[
  {"Benchmark_Return" : { $gte: 6.5 }},
  {"Portfolio_Return" : { $lte: 10 } } ]})
```

Ques 2. From Company display the company which has "ISIN" = 5 ?

```
db.Company.find({ ISIN:5 })
```

```
Financial_Portfolio_Management_System> db.Company.find({ISIN:5})
{
  "_id": ObjectId("656bc34c63751e2ca8ba5010"),
  "ISIN": 5,
  "Ticker": "TSLA",
  "Names": "Tesla Inc.",
  "Sector": "Automotive",
  "Market_Cap": 600000000000,
  "Mkt_cap": "Mid cap"
}
```

Ticker	Name	Risk_Level
AMPL	Apple Inc.	High
EMR	Apple Inc.	Low
GOOG	Alphabet	Moderate
GOOGL	Alphabet	Low
MSFT	Microsoft	High
AMZN	Amazon.com Inc.	Low
TSLA	Tesla Inc.	High
JP	JPMorgan Chase & Co.	Moderate
DIS	The Walt Disney Company	Moderate
IBM	IBM Corporation	Moderate
IBM	IBM Corporation	Low
IBM	IBM Corporation	Low
GE	General Electric Company	Low
GE	General Electric Company	High
NFLX	Nvidia Inc.	High
NFLX	Nvidia Inc.	Moderate
PB	Meta Platforms Inc.	High
PB	Meta Platforms Inc.	High
RO	The Coca-Cola Company	Moderate
PEP	PepsiCo Inc.	Moderate
GS	The Goldman Sachs Group	High
WMT	Walmart Inc.	High
WMT	Walmart Inc.	Moderate
WMT	Walmart Inc.	High
MS	Microsoft Corporation	Moderate
MS	Microsoft Corporation	High
MS	Microsoft Corporation	Moderate
GM	General Motors	Moderate
GOOGL	Alphabet Inc.	High
GOOGL	Alphabet Inc.	Moderate

Ques 3. Calculate the Average Market Cap of various sectors from Company?

```
db.Company.aggregate([
{
  $group: {
    _id: "$Sector",
    averageMarketCap: { $avg: "$Market_Cap" } } ]})
```

```
Financial_Portfolio_Management_System> db.Company.aggregate([
{
  $group: {
    _id: "$Sector",
    averageMarketCap: { $avg: "$Market_Cap" } } ]})
{
  "_id": "Industrial", "averageMarketCap": 100000000000,
  "_id": "Retail", "averageMarketCap": 400000000000,
  "_id": "Entertainment", "averageMarketCap": 225000000000,
  "_id": "Beverages", "averageMarketCap": 170000000000,
  "_id": "Finance", "averageMarketCap": 345000000000,
  "_id": "Food", "averageMarketCap": 200000000000,
  "_id": "Technology", "averageMarketCap": 1345714285714.2856,
  "_id": "Automotive", "averageMarketCap": 425000000000
}
```

Ques 4: Find the Total number of Stocks in the Complete Portfolio Sector Wise

```
var mapfunction = function() {emit(this.Sector, this.Quantity);};
var reducefunction = function(key, values){return
Array.sum(values);};
db.Portfolio_Creation.mapReduce(mapfunction, reducefunction,
{out: 'result'});
db.result.find()
```

```
Financial_Portfolio_Management_System> var mapfunction = function() {emit(this.Sector, this.Quantity);};
Financial_Portfolio_Management_System> var reducefunction = function(key, values){return Array.sum(values);};
Financial_Portfolio_Management_System> db.Portfolio_Creation.mapReduce(mapfunction, reducefunction, {out: 'result'});
DeprecationWarning: Collection.mapReduce() is deprecated. Use an aggregation instead.
See https://docs.mongodb.com/manual/core/map-reduce for details.
{ result: 'result', ok: 1 }
Financial_Portfolio_Management_System> db.result.find()
{ "_id": "Entertainment", value: 45 },
{ "_id": "Retail", value: 60 },
{ "_id": "Beverages", value: 60 },
{ "_id": "Food", value: 25 },
{ "_id": "Industrial", value: 15 },
{ "_id": "Finance", value: 105 },
{ "_id": "Automotive", value: 40 },
{ "_id": "Technology", value: 335 }
```

Ques 5: Count of various Risk Level opted by the clients

```
var mapFunction = function() {
  emit(this.Risk_Level, 1);};
var reduceFunction = function(key, values) {
  return Array.isArray(values) ? values.length : 1;};
db.Client_Profile.mapReduce(
  mapFunction,
  reduceFunction,
  { out: "Count_of_various_Risk_Level" });
db.Count_of_various_Risk_Level.find();
```

```
Financial_Portfolio_Management_System> var mapFunction = function() {
  emit(this.Risk_Level, 1);};
db.Client_Profile.mapReduce(
  mapFunction,
  reduceFunction,
  { out: "Count_of_various_Risk_Level" });
Financial_Portfolio_Management_System> db.Count_of_various_Risk_Level.find()
{ "_id": "Low", value: 3 },
{ "_id": "Moderate", value: 8 },
{ "_id": "High", value: 9 }
```


IMPLEMENTATION IN PYTHON

The python library `mysql.connector` is implemented to establish a connection with the MySQL database. The 'get_values' function is designed to connect python and database, and then retrieving the data from database. The retrieved data is then stored in the form of dataframes using pandas library. To visually represent and analyze the data, the Seaborn and Matplotlib libraries are employed.

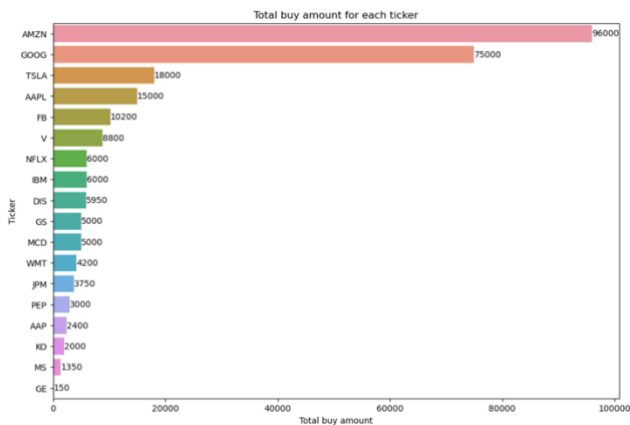


Figure 1: total amount invested in each sectors

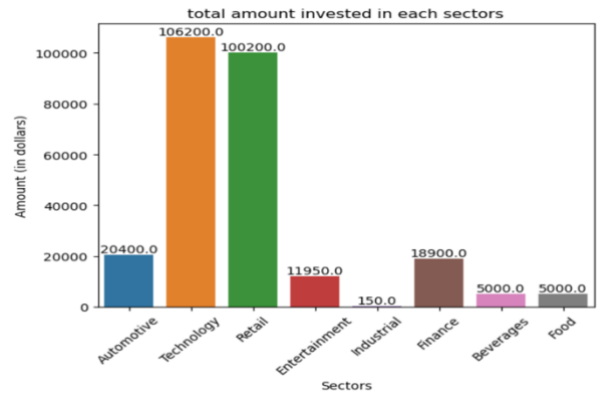


Figure 2: Total Percentage of amount of investment in each sector

Total percentage of amount invested in each sectors:

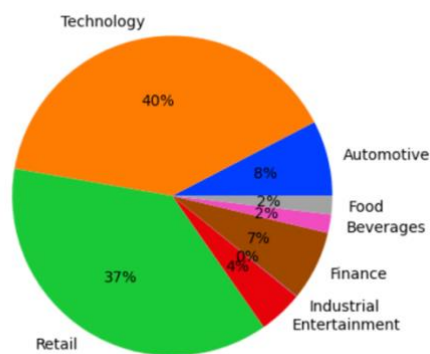


Figure 3: total amount invested in each sector

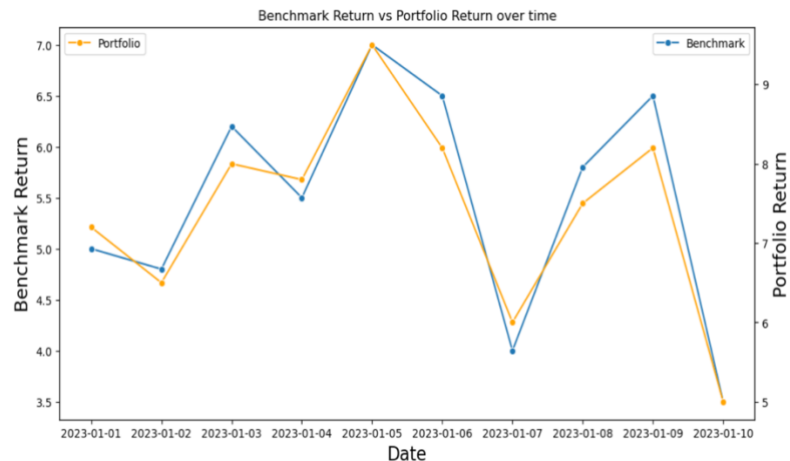


Figure 4: Benchmark Return vs Portfolio Return over time

Summary and Recommendation

The Financial Portfolio Management System is a solution designed to address the challenges faced by investors in managing their financial portfolios. By integrating efficient fundamental and technical data analysis, share recommendations, portfolio creation, risk management, and post-trade analytics, the system streamlines the investment decision-making process. The system addresses key issues such as information overload, the struggle to balance risk and return, and the complexity of post-trade analytics. With features promoting time efficiency, adaptability to market changes, the FPMS stands as a valuable tool for both novice and experienced investors in navigating the dynamic landscape of financial markets

For future enhancements, the Financial Portfolio Management System (FPMS) will add more technical indicators for better analysis. Integration of machine learning algorithms can provide predictive analytics and hence improves portfolio performance. Consideration of macroeconomic factors will add a new dimension to system. Expanding to include various tradable assets beyond stocks will offer a more comprehensive financial management system with diverse investment opportunities.