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LIST OF ABBREVIATIONS

FCFF	Free Cash Flow to Firm
FCFE	Free Cash Flow to Equity
DDM	Dividend Discount Model
DCF	Discounted Free Cash Flow
ANBV	Adjusted Net Book Value
SVM	Support Vector Machines
CART	Classification and Regression Trees
EV	Enterprise Value
WACC	Weighted Average Cost of Capital
HTML5	Hypertext Markup Language revision 5

1. OVERVIEW

We make financial decisions every day in our lives and managing our money is a key role in our daily life. In our project, we will focus on creating a software application that can be useful for a lot of customers, such as investors, governmental entities, etc. we will be relying on financial statements, such as balance sheets and income statements, to evaluate a company's worth, estimate their future earnings, and will have key indicators for that specific company's stock.

Our application will give suggestions and feedback to the user and will return key financial indicators, to make the customer better understand the situation of the company. Moreover, the algorithm will give a suggestion about the current value of the stock of a specific company.

The algorithm will be able to make the above-mentioned tasks by reading a given company's balance sheet and income statement and will evaluate and make many complex financial calculations, in a matter of seconds, to give the needed outputs.

Our team will consist of the following members:

1. Person 1, Management Engineering department, will be responsible for the financial valuation of this project.
2. Person 2, Management Engineering department, will also be responsible for the financial valuation of the project, alongside coordination between the two sub-teams, and reporting to the advisors.
3. Person 3, Software Engineering, will be responsible for developing and mostly dealing with the front-end part of the website.
4. Person 4 (Me), Software Engineering, also will be responsible for mostly the creating methods in the back-end and helping with the front-end development part of the project.

1.1. Identification of the need

Many investors and governmental entities have a hard time figuring out some financial specifics about companies or firms, whether they will be more or less profitable, and how exactly they are operating.

Our product will focus on investors and governmental entities that will be willing to take a deeper look into the current and future financials of the given company or firm. It will offer them an all-in-one experience, where they will be able to see all the financial results about a certain firm or company, and it will also offer future forecasts, along with financial analysis and predictions and suggestions about the company's stock value.

1.2. Definition of the problem

Since the investment world is becoming bigger and costing lots of money and time to evaluate

flourishing companies, not only that, but the decision that the investors will take before taking this step needs lots of thinking, time, and processing.

The application that we will provide in this project will be a guide or helper for the investors to make their decisions easier for investing in the future in a firm or company. The value of this system will be to provide the investors with a deep evaluation of the company or firm, based on their needs, that they will invest in, and later give them some financial results, such as future forecasts, and fair stock price, that could be helpful for them to be sure about the next decision that will they make [1].

This application will be a web-based application, which will have a response time of a matter of seconds, and will be accessible to all users who have access to the web. Using the financial calculations done in the back-end part of the website and the machine learning algorithm, some suggestions and recommendations will be provided to users. The general structure of the page and template will consist of some parts that are monitoring existing information of companies from various sectors through the database we have, entering new information to give suggestions about a company's stock price.

1.2.1. Functional requirements

The software that we will be providing will be giving financial data as an output, which will help in the decision-making process while buying, selling, or holding onto a stock of the given firm or company.

It will be able to give financial forecasts for the next 4 years, by conducting financial analysis in the background, and will also provide the client with potential changes in the financial ratios that will be important and necessary for an investor to make a decision. Furthermore, it will identify the priority areas for future investors which will help to maximize the value of profitability and guarantee feasible investments.

1.2.2. Performance requirements

The program will have to make a lot of calculations in around 5 seconds and will be required to give outputs at a click of a button.

It has to also provide a pleasant experience to the user and should have a nice appealing design, along with precise and accurate calculations and results.

During the developing phase, this program will be required to analyze pre-installed companies' data, which will be from different sectors and will be aiming to achieve different goals. This will add to its reliability and will offer vast room for improvements in the future. In addition to that, the quality of the performance will be monitored to minimize the possible calculation errors to give the best outputs [2].

1.2.3. Constraints

A few constraints will be limiting our project's progress, those constraints are as follows:

A constraint that will stop the development of our project is the fact that some companies keep their financial data private, which will limit us from reaching a bigger and more diverse pool of companies.

Another one could be the huge fluctuation of some companies which will lead to instability or non-liquidity enough to give a precise output that could be assured [3]. Also, with the complex amount of the financial calculation, there will be a small number of errors which might make it difficult to achieve full accurate outputs.

- Since users will take action according to the website's predictions and suggestions, the reliability of the algorithm to be used is an important constraint.
- Another software constraint might be a scope-time constraint as developers could be misunderstood the logic of the process and they may miss some little features of generating prediction because having great knowledge about financial and statistical parts requires much more time than the time period developers have.
- The website's UI/UX should be simple and understandable, as the content and overall purpose of the website are highly numerical and statistical, and its own nature is quite complex. Therefore, usability is another software limitation.

1.3. Conceptual solutions

As in the meantime most the investors are tending to use old traditional ways as taking the consultant from the experiences of some financial analysts which is too costly and time-consuming and is not an available option all the time.

Through our system, there will be a combination of financial opinions with an excessively wide variety of options, not only that but with the technological progress nowadays it's better and easier to do the work on application rather than doing it manually. These concepts contain lots of financial concepts that will be provided as a professional evaluation for a specific company when and wherever the investors are with one click fully evaluation with high-quality outputs under an accurate and precise process will be available to facilitate the decision making [4].

1.3.1. Literature Review

1.3.1.1. Literature Review for Management Engineering

The market and especially the stock market is huge and needs lots of prediction and forecasting with many techniques that could be helpful, which should work well to give nice and accurate results that can be satisfying for the investors. Furthermore, some of these used techniques are the Machine Learning techniques and the Artificial Neural Network [5] which inspired us in our

project and helped us to use some techniques to find the financial evaluation program.

Nowadays the technology sector is increasing rapidly in the firms around the world at the same time, Turkey is one of the countries that use technology in its firms to provide better improvements and to enhance the quality, also it has been stated that the firms in Istanbul Exchange Market are showing an increase between the years 2005 and 2010 of around 10%, which also shows the impact of the technology on the performance of the firms and the optimism for the investors when they need to evaluate some firms [6].

While there is no real 100% way to know the real value of a firm, the only way to know the real value, or the fair market value of a company is when a real arrangement happens, at which a party buys, and another sells [7]. However, there are a number of widely known and acceptable valuation methods that could be used for evaluating a company, one of which is income approaches, such as Free Cash Flow to Firm (FCFF), Free Cash Flow to Equity (FCFE), and the Dividend Discount Model (DDM), which can be used in calculating the Discounted Free Cash Flow (DCF) of a firm [7]. Another way could be Book Value, which involves Adjusted Net Book Value (ANBV), Liquidity Value, and Replacement Value [7].

With that being said, another valuation method is the Residual Income model, which dates back to Alfred Marshall in the late 1800s, and was used in evaluating some business segments by General Motors [8]. This method is a mixture of both the income and the cost approach, where it includes the book value of the company, with the addition of the discounted future revenues [9]. The residual income model can be compared with both the dividend discount model, as well as some discounted cash flow models, with the key difference of replacing the dividend payments with future revenues in the calculations [10].

Lastly, we will also be mentioning the Enterprise Valuation Model, this model relies on the future forecasts of a company, such as net income, expected earnings, etc [11]. It measures the company's value by including the market capitalization and the net debts [12].

1.3.1.2. Literature Review for Software Engineering

Machine learning is a term that we've been hearing a lot recently. Machine learning is a branch of data science that makes predictions and insights using statistical models [13]. It is used in many areas of life, from sales and marketing to health, from human resources to finance. When we take a look at its use in finance, software applications that include machine learning strengthen investment management decisions.It can help real-time financial decisions by giving early warnings of social trends and unexpected occurrences.It can also be used to predict stock prices. Building efficient and good infrastructures, gathering sufficient data sets, and using the right algorithms are all required for financial machine learning to succeed [13]. Here are some machine learning models and algorithms

for successful financial analysis:

- **Classification**

Classification is one of the machine learning techniques used for financial analysis.

In machine learning, *Support Vector Machines(SVM)* are supervised learning models with associated learning algorithms that analyze data used for classification and regression analysis.

As a recursive component of the instance space, *decision trees* are one of the classification algorithms. Decision trees are classifiers expressed as a recursive part of the instance space and the Classification and Regression Trees (CART) model is a flexible method to describe how the variable Y distributes after assigning the forecast vector X of the metric [14].

- **Clustering**

The data mining techniques used to classify as variable or split into tiny groups of two or more are known as cluster analysis groups [14].

K-Means algorithm is an unsupervised learning and clustering algorithm. K-means clustering intends to divide a dataset into K subsets as {X1, X2,…, XN} to reduce the distortion measure stated by the function below [14]

$$\sum_{n=1}^{n}\sum_{k=1}^{k} \hat{\imath}_{nk} \left\| X_n - \quad_k \right|^2$$

Damrongsakmethee and Neagoe (2017) states that the SVM algorithm and the Decision Tree algorithm are two potential classification approaches for financial applications. With the development of new models and algorithms in the future, the quality and accuracy of financial software will improve, and it will play a significant role in lowering the time, budget, and burden on individuals, industries, and companies.

Finally, we searched the market for an application with similar features to our project and as a result of our research, we have found 2 applications that are similar to our project:

1) App4Finance (Appforfinance)

App4finance has a robust feature set for gathering, spreading, and evaluating financial statement data. The software can calculate financial ratios, assign ratings, and generate financial analysis reports automatically. Trend and peer-group analysis can be included in these reports to compare counter-parties to similar companies in the same market or industry.

That application is evaluating the business performance through the financial reports, as an output, it gives profitability, solvency, capital structure, and liquidity reports with ratios and charts. This website takes some information about the user's company.Then software produces a financial analysis of company. To improve performance,it gives recommendations to users as a report.

2) Equidam (Equidam)

Equidam asks to its users 37 multiple-choice questions covering topics such as team experience, market competition, and barriers to entry. Also users need to enter financial estimates for the next three years to capture the worth of their company's future financial performance. The application provides necessary parameters such as multiples and discount rates. Users' inputs and the application's data are merged into five valuation methodologies to provide users with a full and reliable assessment of their company's valuation.

1.3.2. Concepts

	FCFE	Residual Income	Enterprise Valuation
Complexity	High	Medium	Low
Constraints	High	High	Low
Usage	High	Low	Low

Table 1. Comparison of the 3 conceptual solutions

1.4. Software architecture

As this product is a software application it has no physical architecture but a functional architecture which is shown below. Firstly, the user must log in to the application with verified information, and then she/he should select his/her actions that are checking the existing companies with the analysis or uploading new documents to make new calculations and getting recommendations from the algorithm, either way, the system displays output to the user. The detailed software Architecture Diagram will be shown in the 3.2.4 part of this proposal.

2. WORK PLAN

In this section of this paper, you will find the complete work plan of the project in detail.

Both teams, Management Engineering and Software Engineering will be describing their work plan in this section, in the form of diagrams, tables, and charts..

2.1. Work Breakdown Structure (WBS)

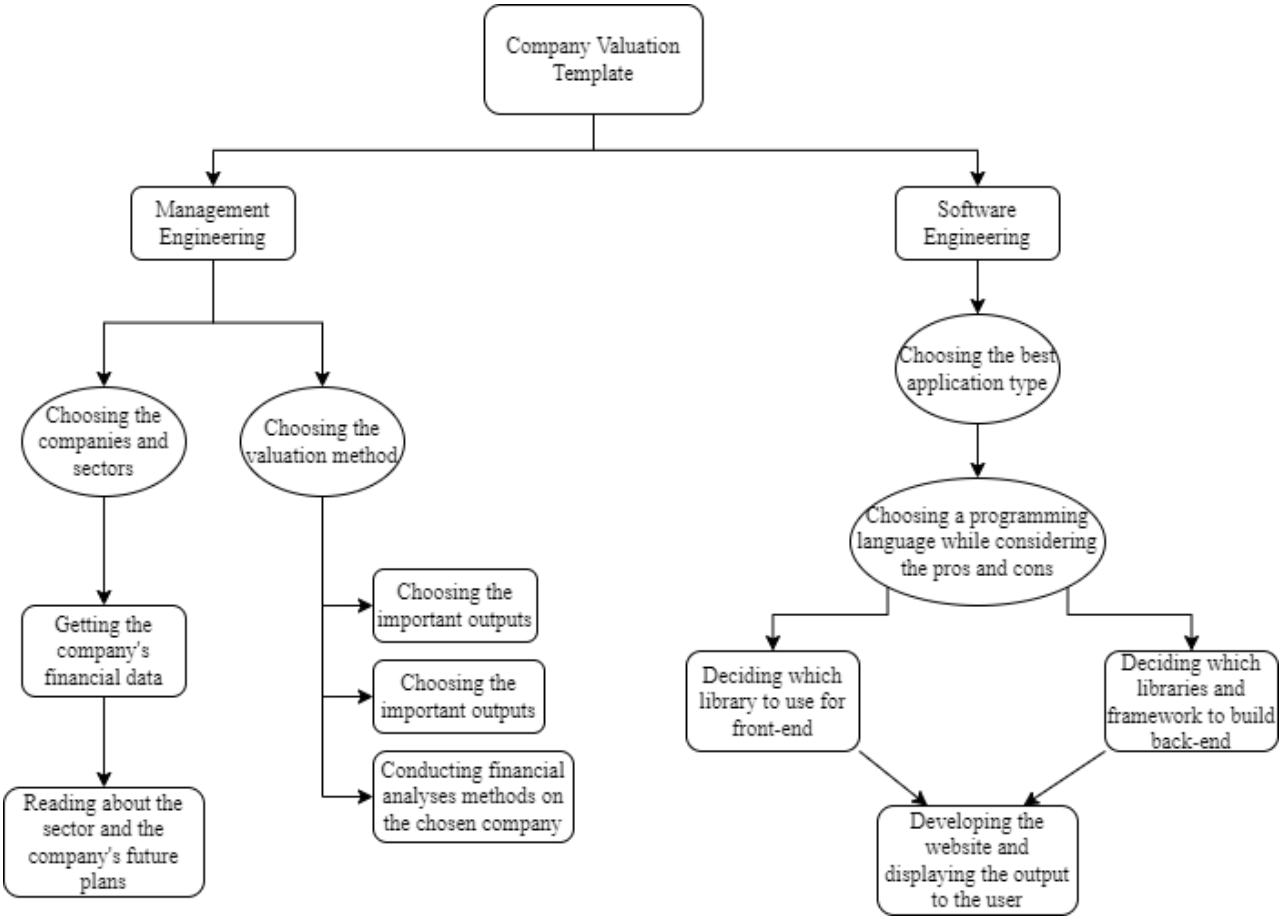


Figure 1. Work Breakdown Structure for the Project

2.2. Responsibility Matrix (RM)

Responsibility Matrix				
Task	**Yakupağa**	**Abdelaal**	**Bektaş**	**Balın**
Financial Data Collection	**R**	**R**		
Financial Analysis	**R**	**R**		
Financial Decisions	**R**	**R**		
Financial Calculations	**R**	**R**		
Programming			**R**	**R**
Front End			S	**R**
Back End			**R**	S
Algorithm Writing			**R**	**R**
Website Creation			S	**R**
Planning	**R**	S		
Reporting	**R**	S	S	S
Coordination	**R**	S	S	S

R=Responsible; S=Support

Table 2. Responsibility Matrix for the Project

2.3. Project Network (PN)

This schema shows all the tasks and steps from the planning phase to finish with relationships each other

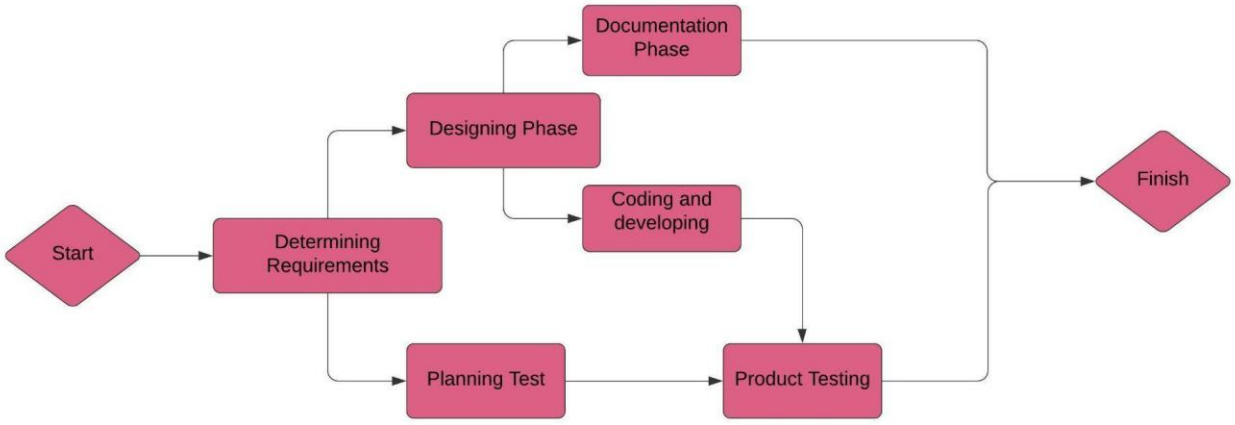


Figure 2. The Project Network of the Project

2.4. Gantt chart

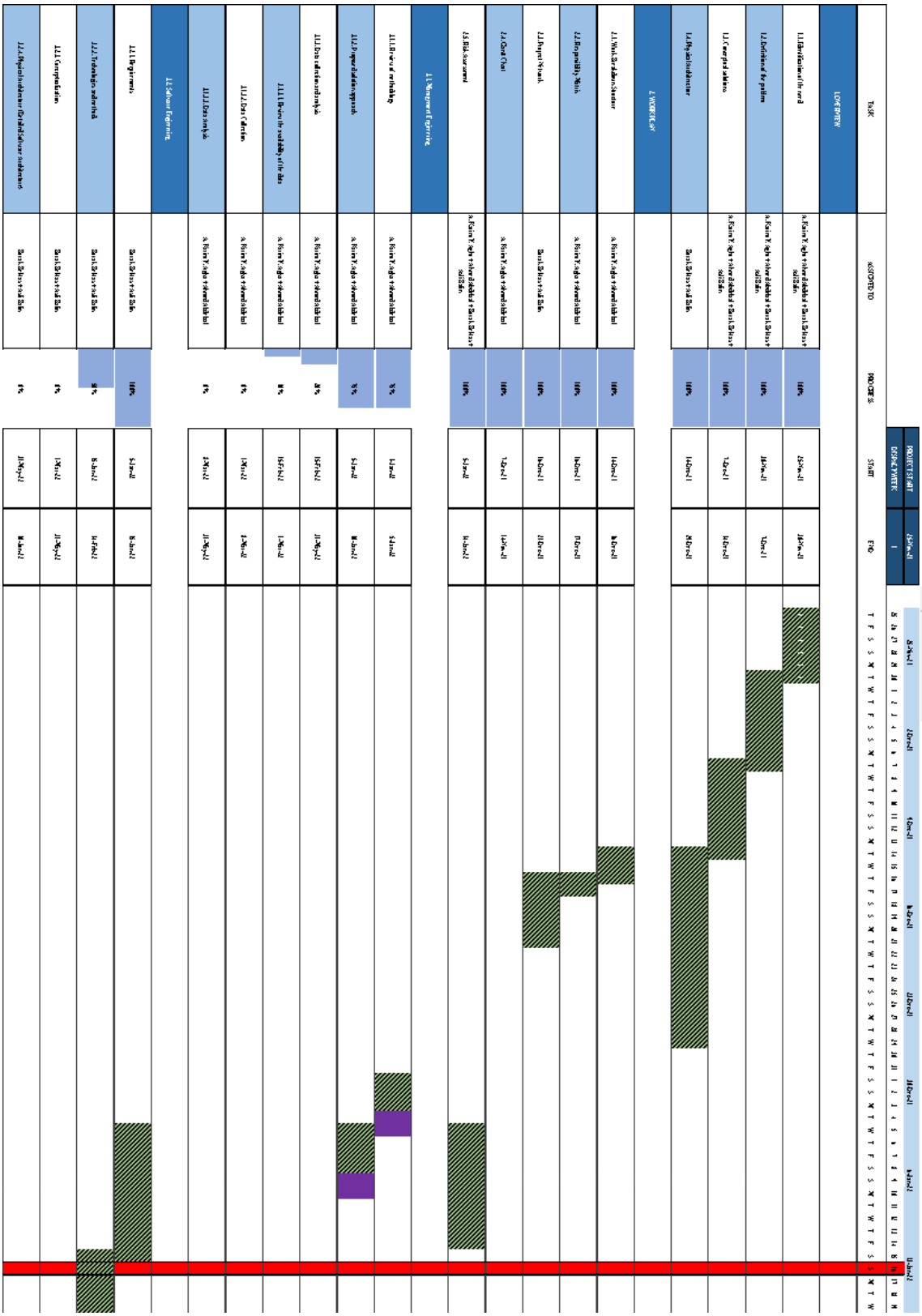


Figure 3. Gantt Chart W1-W8

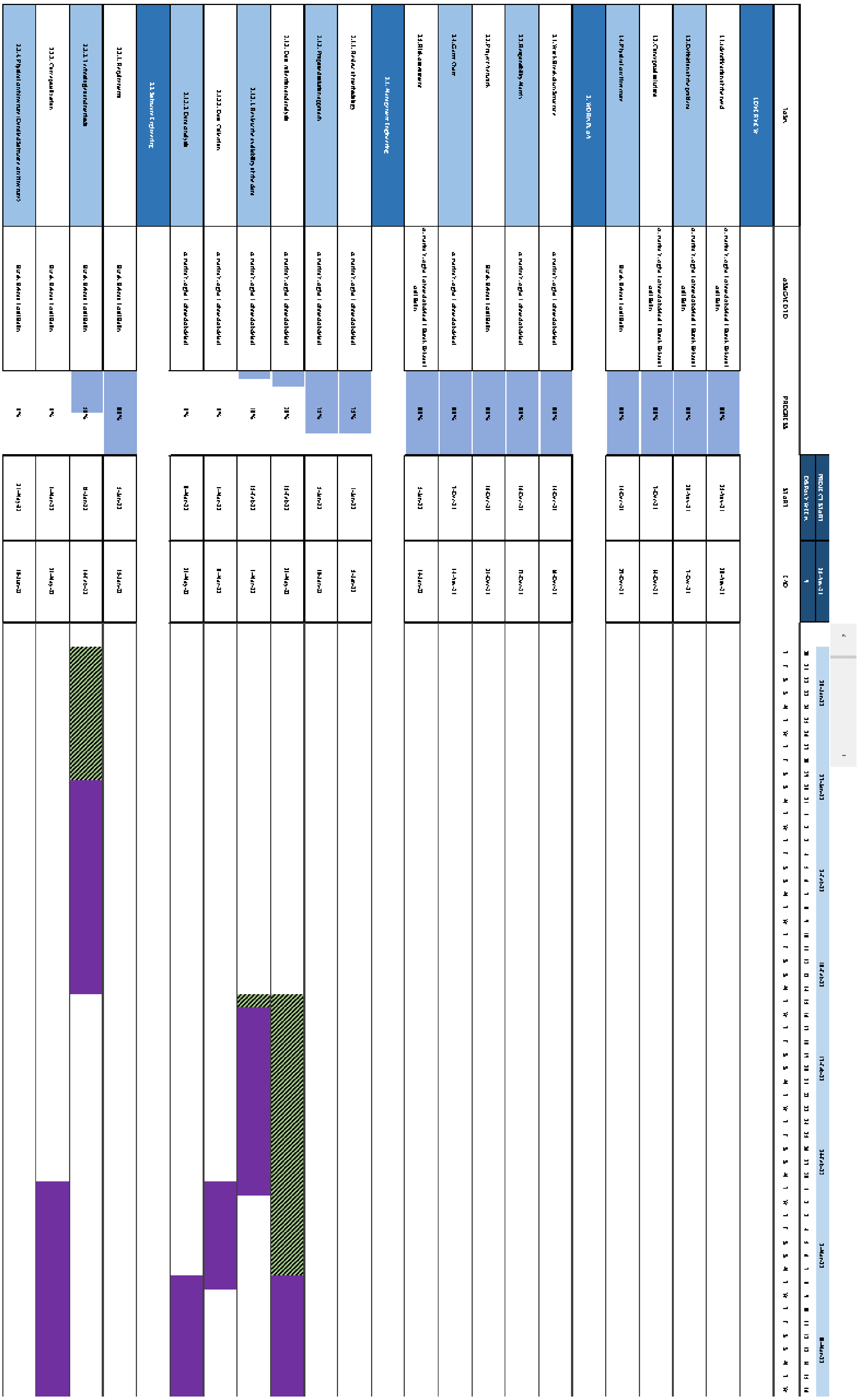


Figure 4. Gantt Chart W9-W16

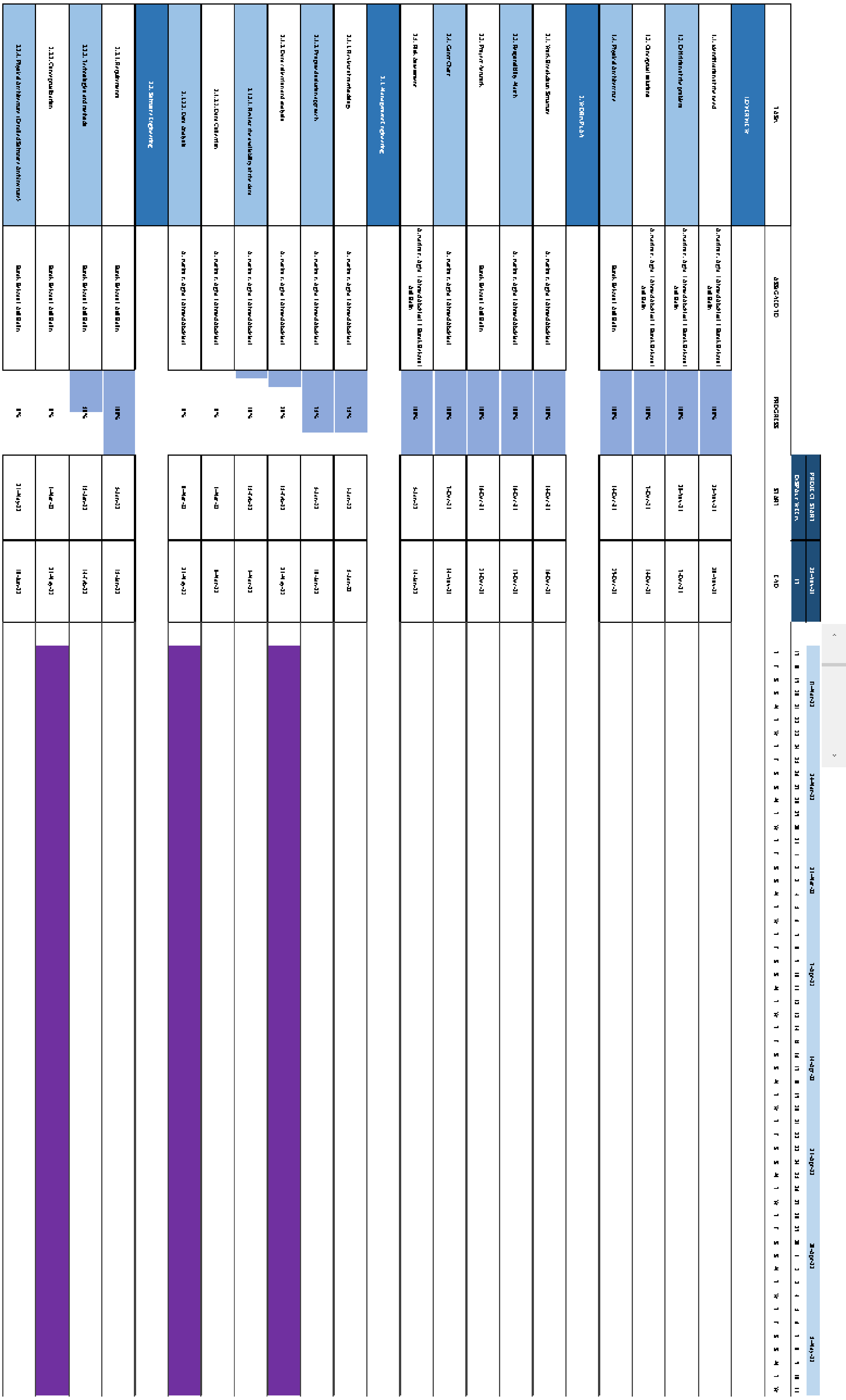


Figure 5. Gantt Chart W17-W24

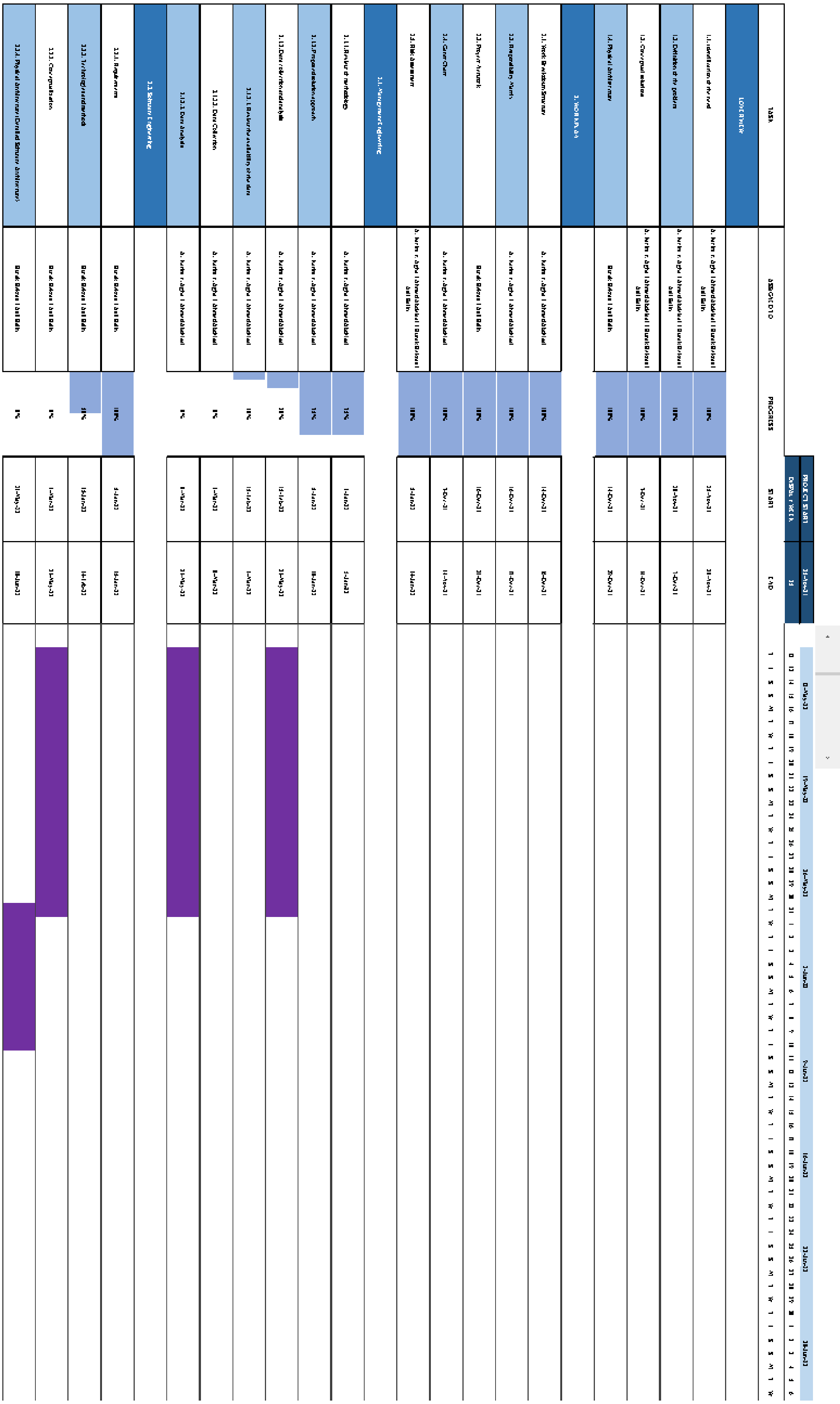


Figure 6. Gantt Chart W25-W29

2.5. Risk assessment

Failure Event	Probability	Severity	Risk Level	Plan of action
Domain time down	Unlikely The domain hosting is known to be sustainable	Major Would require a shift to a new domain	MEDIUM	Preparing a backup domain in case the main domain goes down
Cyberattack	Unlikely Would cause data loss and privacy breach	Major This will make our clients lose their trust in our protection levels	HIGH	Using the best protection software against cyberattacks
Insufficient data to get desired results	Likely If the company is private, or public with a few financial data available, the program might give back faulty outputs	Moderate The software will be designed to give a trust value, depending on the data input	LOW	Will ask the user to provide a bigger pool of data to the software

Table 3. Risk Assessment Table

3. SUB-SYSTEMS

In our project, both our teams work closely to ensure the best outcome for the project, both the teams are working in integration and harmony to make the best application possible for future investors and future users of our program.

The Management Engineering team will be working on collecting the financial data needed for the application and conducting the financial analysis required, and later on, passing the methods to the Software Engineering group.

The Software Engineering team will be taking the input from the Management Engineering team, and creating an application that will be hosted on the web, and available for use to the investors that are willing to use the application.

3.1. Engineering Management

3.1.1. Review of methodology

While there are many ways to evaluate a company's theoretical value, we will be using three different approaches of valuation models: Discounted Cash Flow Model using Free Cash Flow to Equity (FCFE), Residual Income, and Enterprise Valuation.

The FCFE method is a method that calculates the sum of cash a company could make that might be potentially given to shareholders [15]. It is constituted of net income, working capital, capital expenditures, and debt [16]. The formula for FCFE is as follows:

FCFE = Cash from operations - CAPEX + Net Debt Issued [15, 16]

FCFE is generally used to determine the value of the company, it has become more popular as a substitute to the dividend discount model, specifically for companies that do not pay dividend [16].

The Residual Income method uses the book value of the company as of the valuation day, as well as future earnings, while it is also a mixture of both the income approach and the cost approach [9]. This method states that the value of a given company is the sum of the book value and the present value of the future earnings [17]. The Residual Income can be calculated as follows:

Residual Income = Net Income - (Equity Capital x Cost of Equity) [18]

Lastly, the final method we will be covering is the Enterprise Valuation Model. This model gives us a picture of the company's value, where it is the sum of the company's market capitalization and its net debts [11]. In other words, it includes the market capitalization of the company as well as the short-term and long-term debts, adding also the cash available [19]. It can be calculated as follows:

Enterprise Value = Market Capitalization + Total Debt - Cash and cash equivalents [19]

3.1.2. Proposed solution approach

We will use the above-mentioned analysis methods to analyze the financials of the companies which will be collected from Investing.com, and further will be analyzed using the methods mentioned above. After that, they will be compiled and provided to the software team. so basically these different four methods have different measures and accounting concepts to achieve the needed result. So in the FCFE there will be collecting of some accounting concepts like net income, depreciation, changes in working capital and capital expenditure which all of these majors will be under the cash flow discounted method to conduct the fair price of the stock, also it is valid only with some constraint which is allow to apply this method only to the companies which its leverage is not volatile[and not to the companies which has changing debt leverage [20].

Another method will be the residual income which will rely on the budgeting techniques and net present value rule, also in this method the concepts such as net income and capital charge for each year with discounting the residual income with the cost of equality, this could be applied only if the company has a book value of the investment and the present value of the excess return [9].

The last solution will be the Enterprise method which includes in the measure marketing capitalization inaction to the long-short term debt and the cash of the company and that will happen to give an accurate takeover price in an accurate way since this method includes the debt on its calculations it can be used in the company which has a debt utilized on it [19].

In a comparison of each of the three solutions, it's obvious that the discounted cash flow relies on the accounting concepts but on the Residual Income relies more on the financial concepts. Furthermore, the Enterprise solution combines both the accounting and financial concepts.

Lastly, we will take a weighted average of each output from each method and will calculate the fair stock value in that way. The weights for the emerging markets will be totally different to the developed markets since we found out that one of the methods does not work entirely correctly for the emerging markets, so the weight of that method for the stock price calculation of the developing markets will be less.

3.1.3. Data collection and analysis

3.1.3.1. Review the availability of the data

We will be collecting data from 18 different companies to conduct our financial valuation. Those companies will be from four different sectors, namely, the energy sector, retail sector, electronics or technology sector, and the beverages sector. The companies are based in the Republic of Turkey and the United States of America.

- The companies in the **Turkish market** are as follows:
  - Energy Sector:

        - Aksa Elektrik,
        - Akenerji,
        - and Odaş Enerji
    - Retail Sector:
        - BIM,
        - Migros,
        - and CarrefourSA
    - Electronics Sector:
        - Bosch,
        - Arçelik,
        - Vestel,
- The companies of the **US market** are as follows:
    - Beverages Sector:
        - Coca-Cola,
        - PepsiCo,
        - and Monster
    - Retail Sector:
        - Walmart,
        - Dollar General Corporation,
        - and Target,
    - Technology Sector:
        - Apple,
        - Google,
        - and Microsoft,

We will be getting the data related to the above-mentioned companies from Investing.com and that's to have the same templates of the financial data and also because this website provides last 10 years of data, which will be used to forecast the next 4 years.

3.1.3.2. Data collection

The balance sheet, income statement, and cash flow statements for the last 10 years will be taken for each company and consolidated in an excel workbook, which will be used to analyze the financials of the company. Furthermore, we will find the market price of each company, which will be taken from the stock market. Adding on, depending on the calculation of each method, certain data related to the method of valuation will be taken from the respective companies/sources. Other data or concepts are going to be conducted such as the present value and the book value of the companies

also depending on the chosen method. Not only that but also the shares outstanding and the required Beta of the companies will be collected from the resource mentioned before.

3.1.3.3. Data analysis

We will use 3 different methods to analyze our data, and at the end of the analysis, we will be taking a weighted average of these three models, and that's to have logical and acceptable results.

- The first model will be the Discounted Cash Flow (**DCF**):

  The method will start by forecasting the free cash flow that will be through stages, beginning with finding the Free Cash Flow to Equity from the year 2012 till 2021, the formula of this will be as follows:

Free Cash Flow to Equity = Net income + Depreciation & Amortization - Increase in Net working Capital (NWC) - Capital Expenditures + Net borrowing

Afterwards, we will be forecasting the free cash flow to equity till the year 2025 and through our forecasting method which is calculating the Forecasted Net Income as follows:

***Forecasted Net Income** = (Net Income of Previous Year * Net Income Margin%) + Net Income of Previous Year*

and to calculate the forecasted net income, we need to find the *Revenue growth rate* and the *Net Income Margin %* using the revenue which will be also forecasted for 5 years and the formula for this is as follows:

***Revenue Growth Rate** = (current year - last year)/current year (then taking **the Average** of the 10 years' percentages)*

***Net Income Margins%** = Net Income/Revenue (and also taking The Average of 10 years' percentages)*

After that, we forecasted the revenue through the following formula:

***Forecasted Revenue** = (Revenue of Previous Year * Revenue Growth Rate) + Revenue of Previous Year*

Moving forward, we will be forecasting the Net income for the next 5 years by using the Forecasted Net Income formula mentioned above.

Furthermore, we used the ratio of FCF/Net Income and we used an IF statement to make the percentage logical and acceptable, where we used it as follows:

IF(|Average of the Net Income| > the max of the average of the net income, then take the maximum percentage, otherwise, take the |average of Net Income|)

After conducting the ratio of FCF/Net Income, the next thing is the main point which is forecasting the Free Cash Flow for the next 4 years through this formula:

***Estimated Free Cash Flow** = (Net Income * FCF/Net Income) + Net Income)*

The last step in the forecasting stage is finding the terminal value and this was calculated through the following formula:

Terminal Value *= (Free Cash Flow of Last Year *(1+Perpetual Growth))/Required Return - Perpetual Growth)*

The next stage will be finding the Discount factor of the future years, through the following formula:

Discount factor *= (1+Required Return)^Year Count*

Moving on, we calculated the present value of future years' cash flows by using the following formula:

PV *= Free Cash Flow / Discount Factor*

after that comes the calculations of the required return, by using WACC calculations (weighted average cost of capital), **the WACC** calculations are done by using the following:

- Finding Bonds Required Rate of Return either from Turkish or US Market.
- Finding the required Beta of each company.
- Calculating Re (cost of equity) from:

  *Cost of Equity = Bonds Required Rate of Return either from Turkish or US Market +(beta * market risk premium - Bonds Required Rate of Return either from Turkish or US Market).*
- Calculating Rd (cost of debt) from:

  Cost of Debt = Interest Expense / Total Debt.
- Calculating Wd (weighted average debt %)

  Weighted Average Debt = Total Debt / (Total of both debt and equity).
- Calculating We (weighted average equity %)

  Weighted Average Equity = Total equity / (Total of both debt and equity).
- Then last step which calculating the WACC through the following formula:

  *WACC = (wd*rd*(1-tax rate)) + (we*re)*

After these steps, the same thing will be calculated for the 10 years of data and then take the average of it those WACC values will be used as the required return in the stock calculations.

<u>We assumed the perpetual growth rate to be set as 2.5%.</u>

Then we calculated the value of the company as of today by summing all the present values of the future cash flow, and dividing over the shares outstanding of the specific company to give the wanted fair value of the stock price.

- The second model will be Enterprise Valuation through Earnings Before Interest, Taxes, Depreciation, and Amortization (**EV/EBTIDA**):

this model will start by finding the times of each company in specific sector and comparing the result to the sector average times, and evaluate the company after that, the related calculations are as follow:

- Finding **the market price** of today stock of the wanted companies.
- Finding the number of **common stocks** .
- Calculating the **Total Debt** through the following formula:

Total Debt *= Current Port. Of LT Debt/Capital Leases + Total Long Term Debt + Other Liabilities, Total*

- Finding the **Cash and Cash Equivalent**.
- Calculating the **Market Capitalization** through the formula:

Market Capitalization *= Market Price of Stock today * Number of Common Stock,*

- Then calculating the **Enterprise Value** through this formula:

EV *= Market Capitalization + Total Debt - Cash and Cash Equivalent*

- Calculating **EBTIDA:**

EBTIDA *= Net Income + Provision for Income Taxes + Interest Income (Expense) + Depreciation and Amortization*

Then the last step is to find the value of the company by dividing **EV/EBTIDA** to find number in type of times.
Moving on, the stock price of the company will be found by:

$$\frac{Stock\ Price\ of\ the\ company}{EV/EBTIDA} = \frac{Average\ stock\ price\ of\ the\ sector}{Average\ EV/EBTIDA\ of\ the\ sector}$$

- The third model will be Residual Income (**RI**):

This model will start with forecasting the free cash flow exactly as we mentioned in the first model **(DCF)** after the steps of forecasting the free cash flow then we also forecasted the total Equity by finding the **Equity growth rate** through this formula:

Equity Growth Rate = (current year - last year)/current year

Then taking the average of the growth rate to forecast the next 5 years of the Equity, and then took the average.
After that we calculated the **Residual Income** as:

*Residual Income = Net Income of current Year - (Total Equity of last year * Re)*

with calculating Re as mentioned before in the first method **(DCF)**, after that we calculated the **discount factor** to find the **present value of the Residual Income** of the future years, after that we calculated the closing value of 2025 to find the **Terminal value** from the formula:

Terminal Value = closing Value / (Re - Growth in Terminal Value)

which the growth estimated as 2.5%.
Moving on, we calculated the present value of the Terminal value:

PV of Terminal Value *= Terminal value/ discount factor*

after that comes the last and main step of this model, we calculated the **Total Equity value**:

Total Equity value *= Total Equity of last year +sum of the PV of residual income + PV of terminal value*

and after that to find the **fair value of the stock price** by the formula

Fair value of stock price *= Total Equity /Number of shares outstanding*

and that to deliver the idea of finding the fair value of these model through the equity of the company. To summarize the all three model is using deferent inputs and formulas with some specific parameters to obtain the main idea behind this which is the fair value of a company stock price so this number could be elevated and gave a decision based on this.

3.1.4. Application and results

While applying the three model there was some obstacles and limitations that was unsolvable from the accounting and calculation part which needed lots illogical modifications. As result the only solution to this was taking a combined average percentages of all three models so that could deliver some logical and acceptable result that could be evaluated.

We used the following weighted average to calculate the stock price of each company:

For US Market:

- Discounted Free Cash Flow – 40%
- Enterprise Valuation – 10%
- Residual Income – 50%

For Turkish Market:

- Discounted Free Cash Flow – 40%
- Enterprise Valuation – 50%
- Residual Income – 10%

3.1.5. Discussion of results

3.1.5.1. Theoretical

The result was as follow:

DCF and Enterprise value is working perfectly on both markets emerging markets as the Turkish market and also working fine on the developed markets as United States market.

However, the Residual Income model couldn’t work for the emerging companies due to the lack of stability in the accounting numbers in the financial documents of these companies while it's working perfectly in the developed markets with logical results that can be taken into the consideration.

3.1.5.2. Practical

Most of the emerging companies use the residual income models the 10 years or even 20 years won’t be enough to have a stable trend in the growth rate so it could give logical and acceptable results.

But the other two methods DCF and EV/EBTIDA can be as a working model to express the

emerging markets. On the other hand, for the developed markets and companies all the method works practically well and give real-life stability that can be taken into consideration and could be used as working models to evaluate the stock price of a company.

3.1.6. Discussion of limitations

The only limitations was that one of the models won't work on some companies and that's due to the lack of stability of the accounting numbers or the needed inputs which will be taken from the financial data of these companies.

3.2. Software Engineering Sub-Team

3.2.1. Requirements

3.2.1.1. Functional Requirements

- Behaviors of the Software Application

Actor Name	Name of Behavior	Description of Behavior
User	login()	Returns the result of login process
User	register()	User enters his/her information in correct format to register system
User	selectCompany()	User choose
User	uploadFile()	Makes calculations using necessary parameters
User	calculate()	Generates financial analysis report

Table 4. Software Behavior

- Attributes of the Software Application

Actor Name	Name of Attribute	Description of Attribute
User	user_fullname	Name and surname of the user

User	user_id	Equals id of the user
User	user_email	Equals email of the user
User	user_password	Password of the user

Table 5. Software attributes

3.2.1.2. Nonfunctional Requirements

- **Performance Requirements**

Making calculations and generating recommendations should be very quick like 3-5 seconds. Also, another performance requirement is designing interface and product very clear and understandable.

- **Safety Requirements**

Since the application is not a physical product, it can not damage or harm users. Also, in terms of economic part recommendations and the last decision is up to the user that means responsibility belongs to the user.

- **Security Requirements**

This software keeps the personal login information secret. Also the application does not keep company's information and datas after generating recommendations, it clears the cache.

3.2.2. Technologies and methods

Describe the connections between this software application and other specific software components (name and version), including databases, operating systems, tools, libraries, and integrated commercial components. Identify the data items or messages coming into the system and going out and describe the purpose of each. Describe the services needed and the nature of communications.

3.2.2.1. Pros and Cons for HTML5

+ Its cross platform which means you can use it on virtually any device

+ It provides audio and video support.(That means HTML5 allows you to generate dynamic graphics, incorporate online games, and use interactive video.)

+ The coding with HTML5 is clear and consistent.(It is simple, straight-forward, and very easy to read.)

+ There are more page layout elements available for your content. (With HTML5, you've got a lot of elements to play around with when designing your page layouts. Headers, footers, areas,

and sections are all available to you.)

+ It offers search engine optimization benefits. (That means real content, not repetitive content, pushes you higher in the rankings, creating the potential for higher conversions.)

+ HTML5 requires less maintenance than other options. It means that you'll be going through fewer maintenance issues over time because updates to the coding can be updated in real-time.

+ The storage options with HTML5 are more reliable. (With HTML5, you have the ability to store user-side data temporarily within a SQL database. That moves you away from the need to incorporate cookies, which is a definite advantage thanks to changes in privacy laws in Europe.)

+ It eliminates the need for multiple developments.

- It requires modern browsers to access it. (No one could really agree on what the standard video support should be within HTML5.)

- There are media licensing issues which must be considered. (If you have users trying to access your website through an older browser, then you're not going to be able to reach them.)

- Multiple device responsiveness can be a headache. (it does cause many websites to look the same. If you're developing a website, you must view your content on all device types and browsers to ensure it looks the same because there is always a chance that it won't render as it should.)

- The language of HTML5 is always a work in progress. (you may find yourself with unexpected changes in your coding that render your website useless until you get them fixed.)

- Gaming struggles with JavaScript under HTML5. (JavaScript is the only scripting language of HTMl5. It is a very capable language but there is a lack of features which are necessary for a strong gaming experience.)

3.2.2.2. Pros and Cons of Python for Web Development

+ Easy to use Programming Language (extremely easy to use for web projects, and here below, we explain the key factors responsible for this ease of use.)

+ Lowest Learning Curve (The simple syntax ensures a really low learning curve for this

language.)

+ Great for Visualizing Data (When it comes to data representation through a website or app, Python comes as a super-efficient programming language option for the web developers.)

+ Easy to Read Language (It can easily allow creating easy to understand reports and visual presentation of data.)

+ Powerful Programming (Python is a powerful programming language that ensures most of the qualitative parameters common to websites and modern apps.)

+ Asynchronous Coding (The good news is that Python supports and maintains asynchronous code. Allowing each code to run separately helps to solve and address problems more quickly.)

+ Unmatched Flexibility Python is a highly flexible programming language that doesn't remain constrained within its world and can integrate a number of languages and implementations in the programming process.

- Speed Limitations (Python being an interpreted programming language is slower than other programming languages.)

- Threading Issues (The Global Interpreter Lock (GIL) of Python doesn't allow executing more than one thread at a given time.)

- Simplicity (The programmers habituated with simple syntax often find it difficult to switch to languages with complex syntax such as Java.)

3.2.2.3. Pros and Cons of Javascript for Web Development

+ Speed (Execution speed of program)

+ Simplicity (JavaScript is easy to understand and learn)

+ Popularity (Almost all modern browsers support JavaScript)

+ Interoperability (JavaScript works perfect with other programming languages)

+ Rich Interfaces(JavaScript provides various interfaces to developers for creating catchy

webpages.)

+ Extended Functionality (Third-party add-ons allow the developers to add snippets of predefined code in their code to save time and money.)

+ Versatility(JavaScript is now capable of front-end as well as back-end development.)

- Client-side Security(Since the JavaScript code is viewable to the user, others may use it for malicious purposes.)

- Browser Support(The browser interprets JavaScript differently in different browsers.)

- Lack of Debugging Facility(Also, as the browser doesn't show any error, it is difficult for the developer to detect the problem.

- Single Inheritance (JavaScript only supports single inheritance and not multiple inheritance.)

- Rendering Stopped (A single code error can stop the rendering of the entire JavaScript code on the website).

3.2.2.4. Database Management System

We are planning to use MySQL, which is a query language and the last version of it is 8.0.27 and this database system belongs to Oracle Corporation. Also, we are going to connect it to the chosen programming language with importing or installing required libraries and packages.

3.2.2.5. Database Schema

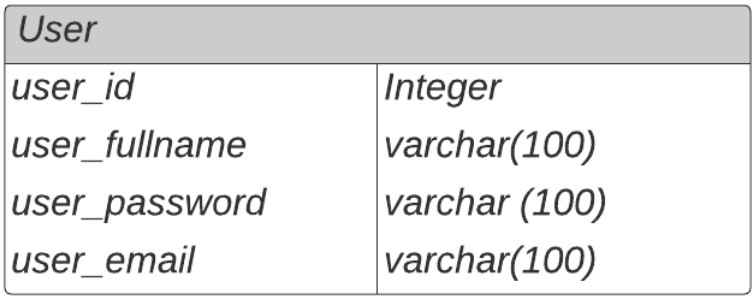


Figure 7. Database Schema

3.2.2.6. Database Physical Model

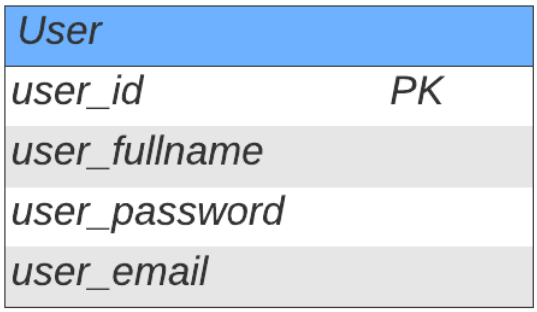


Figure 8. Database Physical Model

3.2.3. Conceptualization

3.2.3.1. Actor Glossary

There is one actor in our application: user.

3.2.3.2. Use-case Glossary

Use-case Name	Description	Participating Actors
Register	Users register to the system with required information.	User
Login	User logins to the system	User
Select company	User chooses the company from the select box.	User
Upload documents	User upload their company infos to system	User
Request for financial calculations	User sends a request for financial calculations to system	User

Table 6. Use-Case glossary

3.2.3.3. Use-case Scenarios

Prepare a scenario for each use-case. Describe your use cases for each functionality. There might be several use case scenarios.

Use-case Name	*Register*
Use-case Description	*User signs up to the website entering the necessary information which is needed for the database and creates an account.*
Actors	*User*
Pre-Condition	*User and the system must be connected to the internet then the user must reach the website register page.*
Post-Condition	*System should direct the user to the application's home page.*
Normal Flow	*step 1: User enters his / her full name,email and password information.* *step 2: System saves the user's information to the database with an ID.* *step 3: System displays a pop-up message like "Registration is successful".* *step 4: System directs user to the homepage automatically.*
Alternate Flow	*Alt-step 1: If any of the inputs are empty or in incorrect format the system shows warning messages.* *Alt-step 2: If users information is already used, the system gives a warning message.*

Table 7. Use-case scenario 1

Use-case Name	*Login*
Use-case Description	*User tries to enter the system with his/her username and password datas and also it is checked by the system through the database.*
Actors	*User*

Pre-Condition	*User and the system must be connected to the internet then the user must reach the application via devices.*
Post-Condition	*System directs the user who logged in successfully to the homepage with a "Login successful ! " message.*
Normal Flow	*step 1: User enters email and password informations* *step 2: System validates it through database* *step 3: System displays "Successful" message* *step 4: User reaches home page.*
Alternate Flow	*Alt-step 1: If login information is empty or incorrect, the system shows a pop-up message.* *Alt-step 2: If incorrect information is written or inputs are empty, the system shows an error message like "please enter information or please check the format".*

Table 7. Use-case scenario 2

Use-case Name	*Select Company*
Use-case Description	*A user who logged into system successfully chooses the company from the list that holds both Turkish and US Companies to make a calculation*
Actors	*User*
Pre-Condition	*Users must be registered and logged in the system successfully.*
Post-Condition	*Selected company's valuation should be displayed to the user.*

Normal Flow	*step 1: User selects the company he / she wants to see its value.* *step 2: User will click the calculate button for the selected company.* *step 3: System displays all method's output to user on the screen.* *step 4: User sees the value of the company calculated with all 3 methods.*
Alternate Flow	*Alt-step 2: If no company is selected, the system does not take any action.*

Table 8. Use-case scenario 3

Use-case Name	*Upload documents*
Use-case Description	*Users upload their company information to the system as an excel file.*
Actors	*User*
Pre-Condition	*Users must be registered and logged in the system successfully.* *The excel file must be in a certain format that is the same with the system.*
Post-Condition	*Files are uploaded to the system from the user and ready to make calculations.*
Normal Flow	*step 1: User clicks the button to upload information or drag-drop the file to the system.* *step 2:System reads the uploaded file and ready to be used for financial calculations.*

Alternate Flow	*Alt-step 1: If a user uploads an incorrect type of file or unmatched file format, the system shows a warning message.*

Table 9. Use-case scenario 4

Use-case Name	*Request for financial calculations according to methods*
Use-case Description	*User sends a request for financial calculations to system*
Actors	*User*
Pre-Condition	*Users must be registered and logged and system successfully.* *Users must upload a file or select an existing company from the select box.*
Post-Condition	*System does calculations and demonstrates the result of financial analysis to the user .*
Normal Flow	*step 1: User clicks the button to start the calculation process.* *step 2: System sends request to database to get information in order to start calculations.* *step 3: System makes financial calculations to find the value of the company.* *Step 4: Shows the decision and values based on formulas.*
Alternate Flow	*Alt-step 2: Loss of connection or error from the server side.* *Alt-step 2: If any financial value is missing or wrong calculation gives incorrect result.*

Table 10. Use-case scenario 5

3.2.3.4. Use-case Diagram

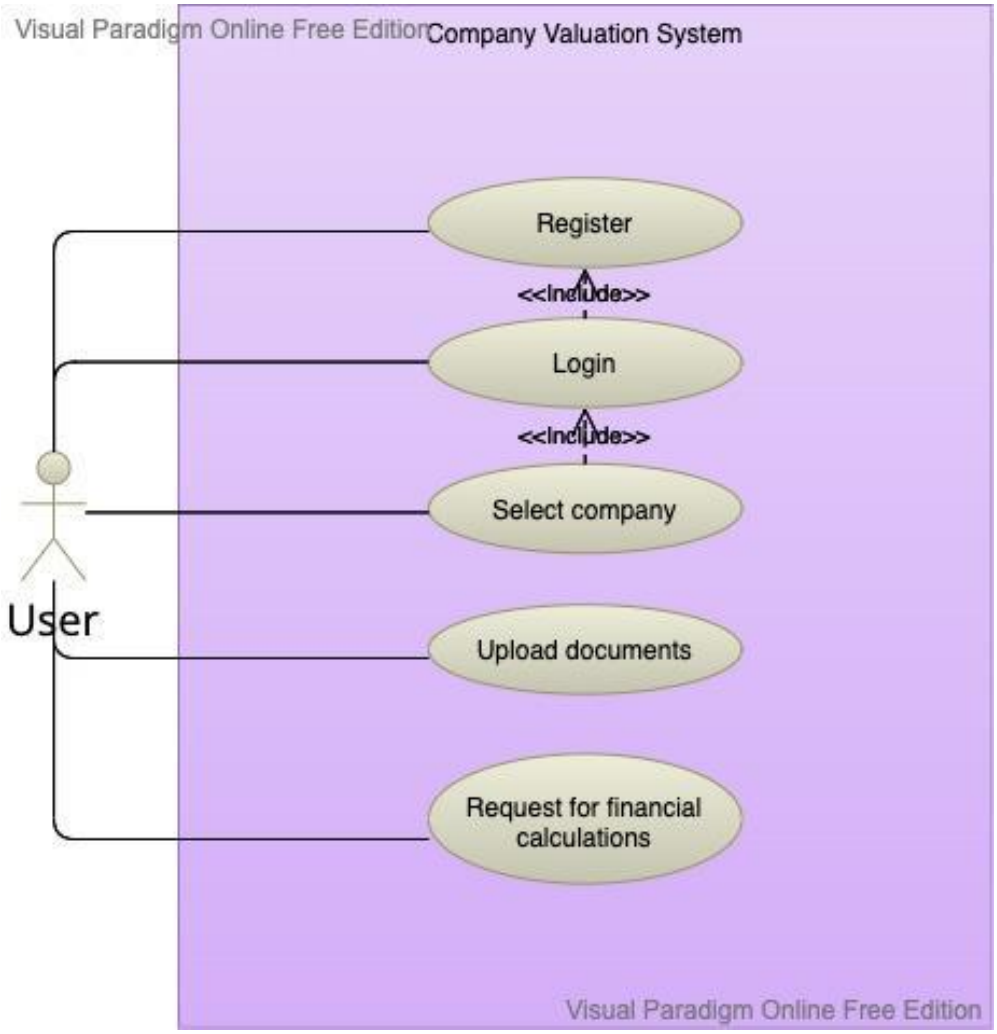


Figure 9. Use-case diagram

3.2.3.5. Activity Diagram

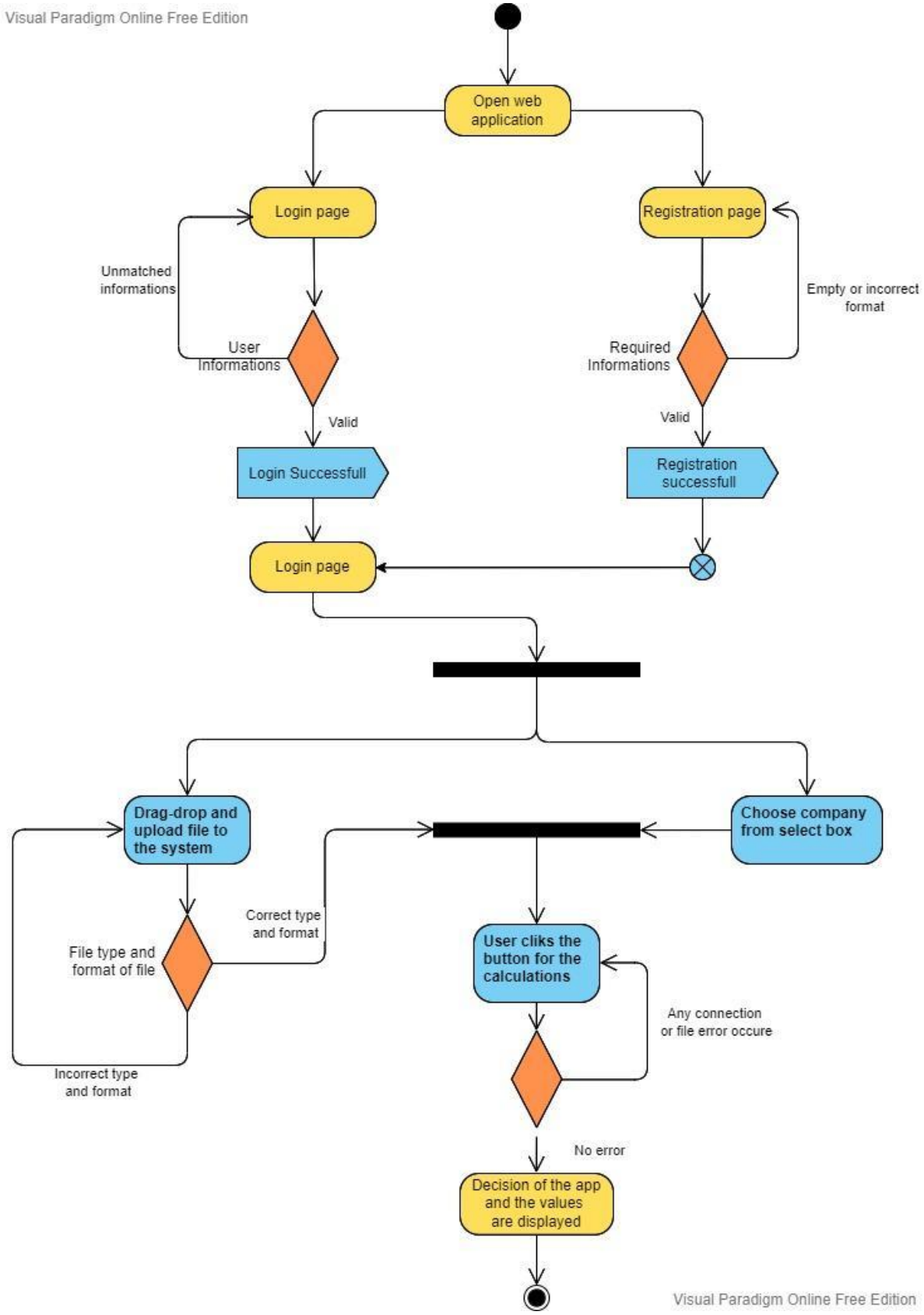


Figure 10. Activity Diagram

3.2.3.6. Sequence Diagram

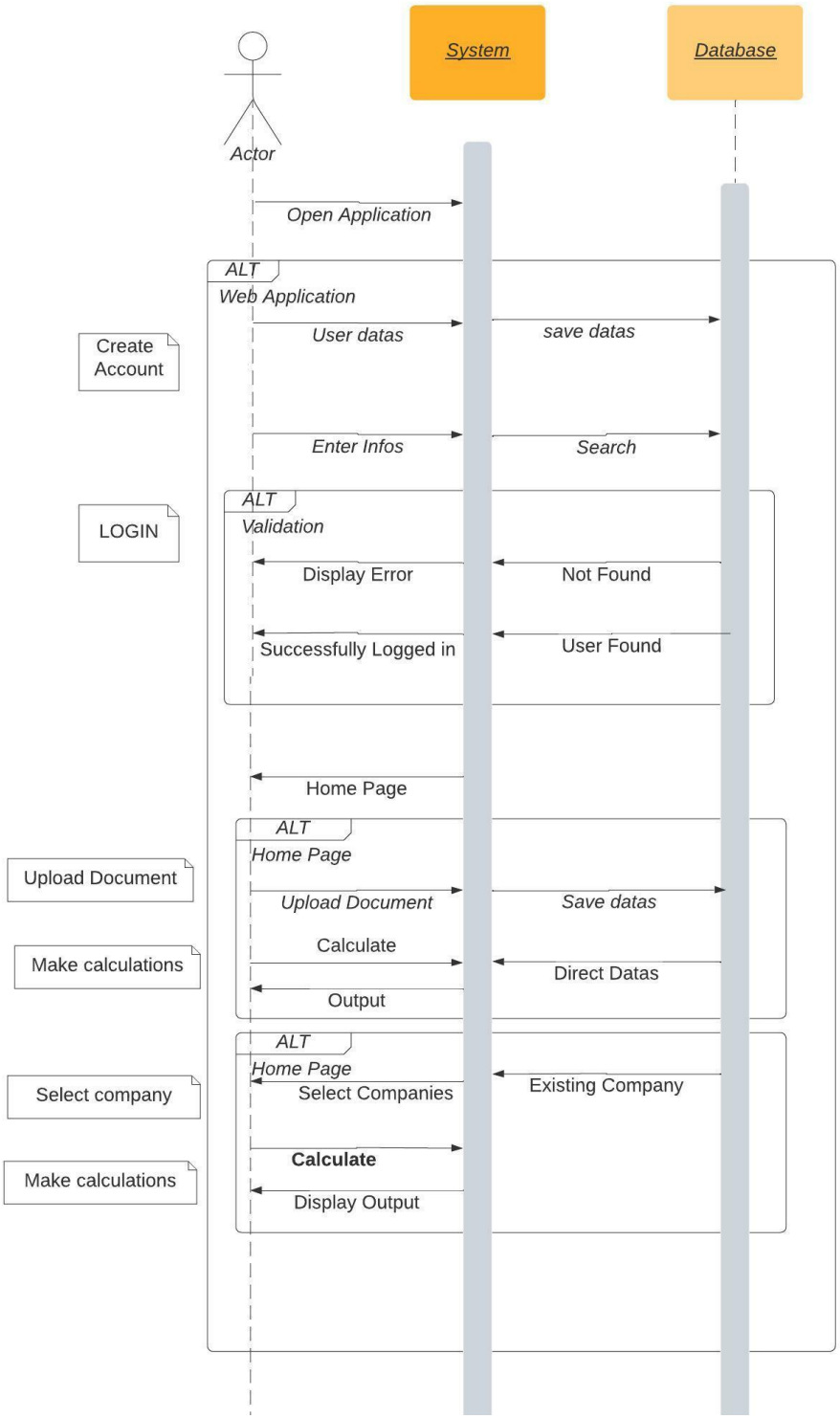


Figure 11. Sequence Diagram

3.2.4. Physical Architecture (Detailed Software Architecture)

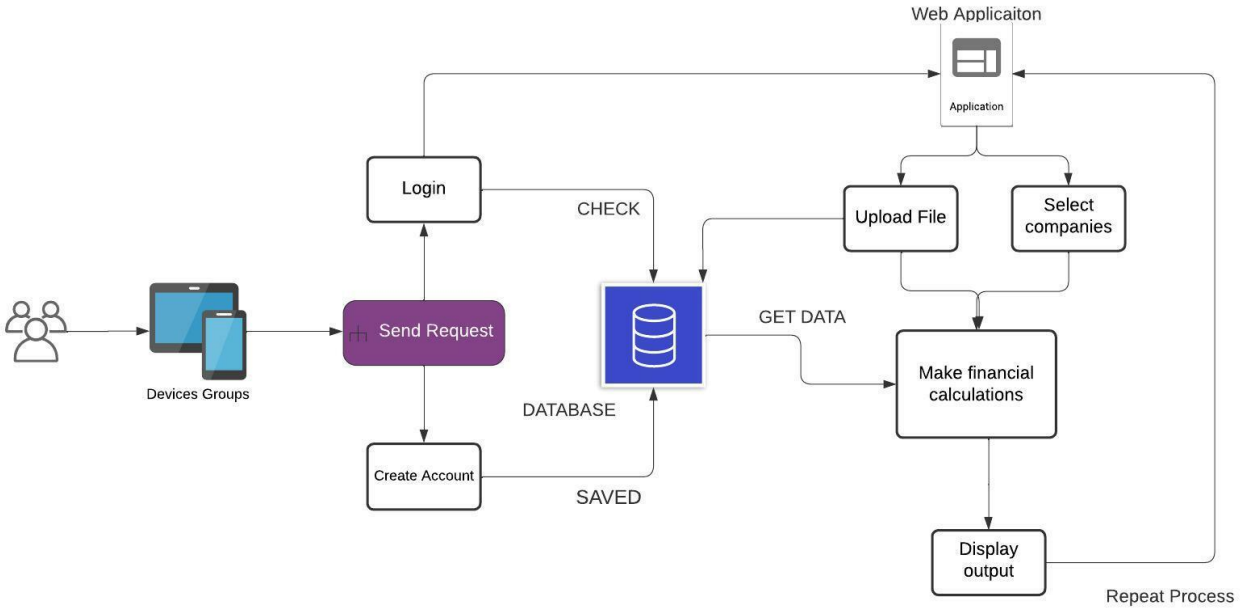
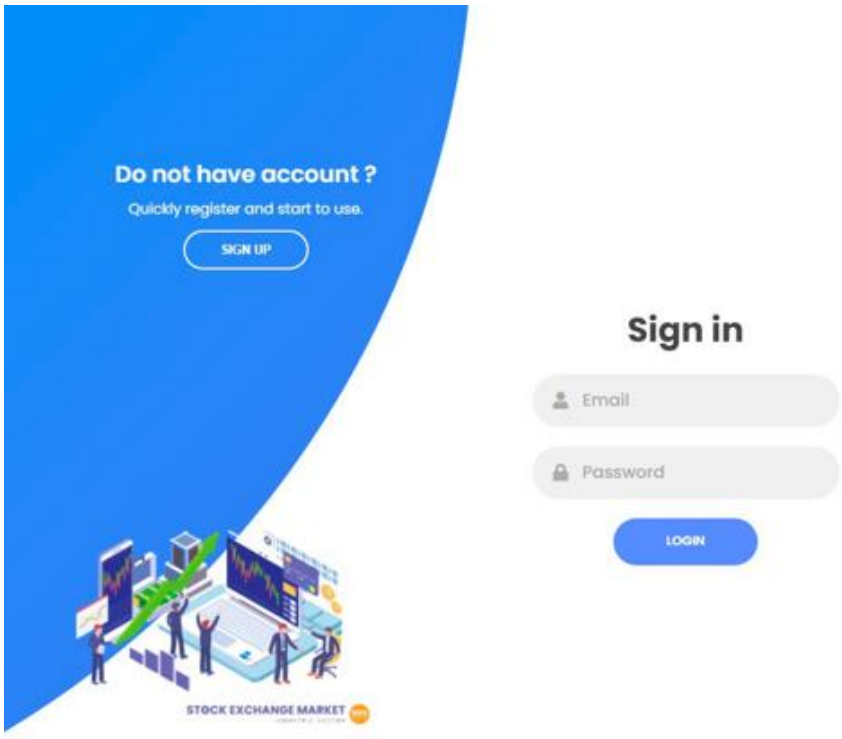


Figure 12. Physical Architecture

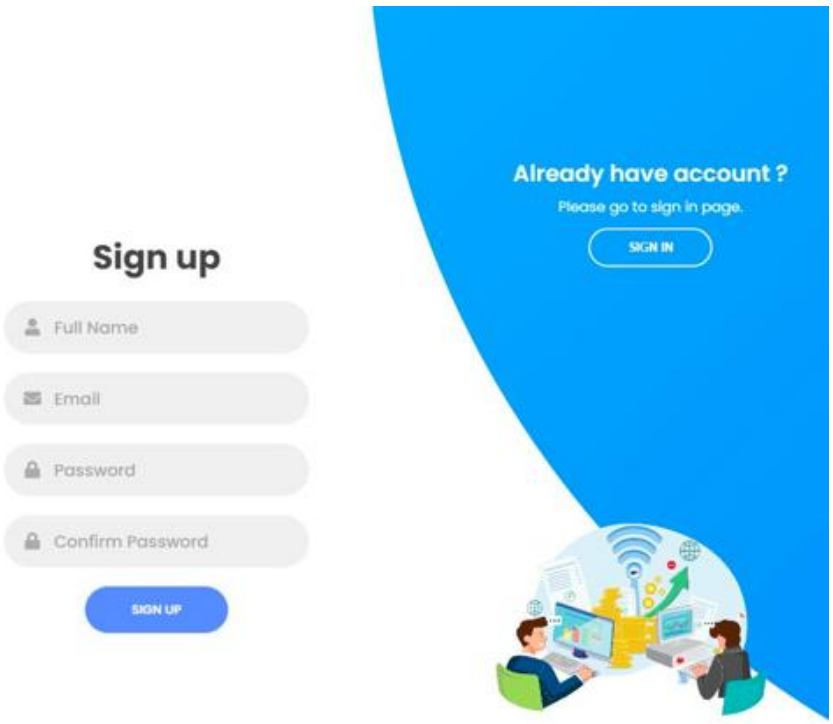
3.2.5. Implementation(Materialization)

First of all, to materialize our web application we started with a sign-in and sign-up page that is the first page users will see when they open the website. To create the front-end of those pages we use HTML, CSS and Javascript, for the back-end we use PHP and for the database we use Xampp control panel and MySQL. As a result we had an animated sign-in / sign-up page that also makes validation for the inputs. Secondly, we were planning to use machine learning in our project in the first semester, so we chose Python as another language. However, since we realize there is not enough data to train machine learning, we change our plan to not use it. As python has large libraries we thought we could use it and search about libraries. We found “Streamlit” that helps develop financial applications. Another modification is about providing a financial calculation method. It was planned to let users choose the calculation method but later on, it has been decided to use all financial methods and merge them to calculate the value of the company.

Implementing Sign in Page

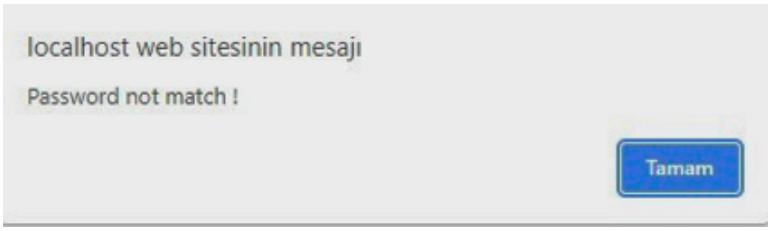


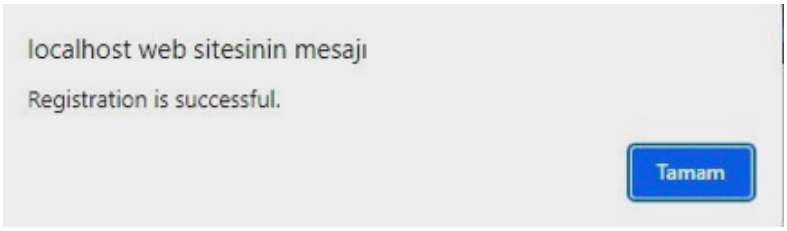
Implementing Register Page



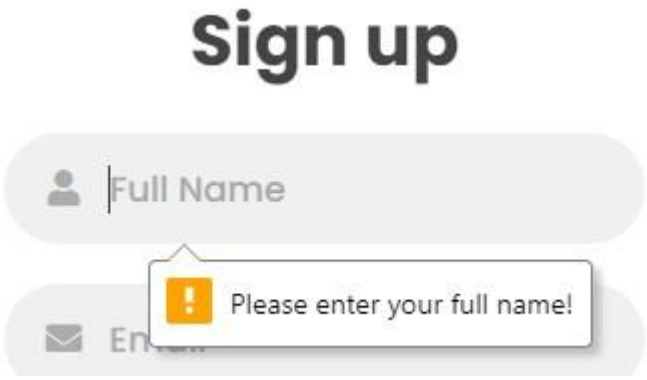
Implementing Error/Warning Messages

Unmatched password case

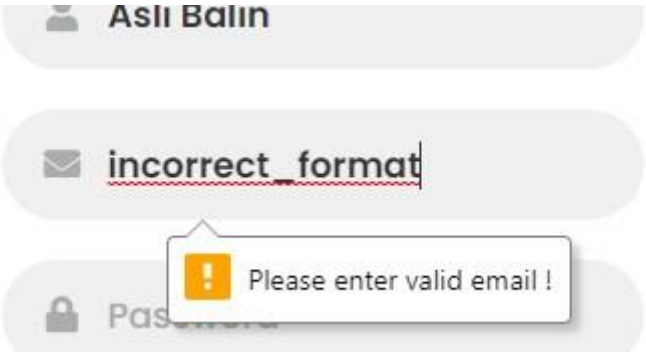




Successfull registration

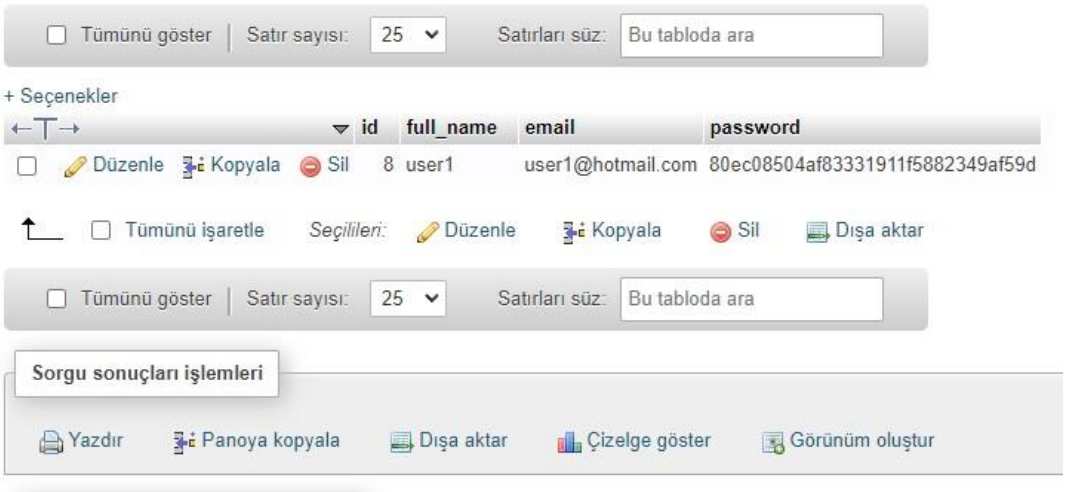


Empty inputs



Incorrect type of input

MySql database in Xampp Control Panel



3.2.6. Evaluation

In order to evaluate our sub-system and measure its success, we tried to obtain the values of the example companies we received from Management Engineering. After they gave us formulas of 3 different methods and the financial sheets of companies, we tried to convert those formulas to python code by reading the excel files which are in a certain format.After obtaining the values of the example companies correctly with our code, we obtained our general code that will work for the rest of the companies.In order for the company value to be accurate , we used Yahoo Finance API for daily changing financial numbers. As a result of that process we finished the financial calculations functions of our web application. As a next step we started to design the front-end with a python library called Streamlit. We added some widgets and a drag-drop area that helps to upload certain format financial sheets to the home page.Then we connect those widgets to the back-end functions. So every select box option points to unique financial sheets of companies and the application reads it.Final value called “Fair Value of Company” is compared with current price which shows the user company is “Overpriced” or “Underpriced”.

4. INTEGRATION AND EVALUATION

As mentioned previously, the establishment of this project will be through collecting the required data and conducting some financial calculations and measurements after choosing the method and that will depend on the analysis that will be done on the three methods to select which one will fit the application.

Through the stage of revising the data and applying the method, the whole required financial documents will be collected. Then the result which will be obtained from the stages above will be given to the software engineering team to code it and make the required process to create the application.

4.1. Integration

This screenshot shows some needs of software sub-system to make calculations for unique companies;

```
#CONSTANTS AND COUNTRY VALUES
ticker = "MGROS.IS"
perpetual_growth = 0.025
beta = 1.08
risk_free_rate = 0.17
market_rate_of_return = 0.583
si.get_live_price(ticker)
shares_out = financial_sheets['L43'].value * 1000
print(shares_out)
```

1 of 9 WACC calculation [2013-2021]

```
# WACC calculation / wd / rd / we / re  2013
total_debt_2013 = financial_sheets['D57'].value * 1000
total_equity_2013= financial_sheets['D52'].value * 1000
interest_expense_2013 = abs(financial_sheets['P27'].value * 1000)

total_2013 = total_debt_2013 + total_equity_2013
wd_2013 = total_debt_2013 /total_2013
rd_2013 = interest_expense_2013 / total_debt_2013
we_2013 = total_equity_2013 / (total_equity_2013 + total_debt_2013)
re = risk_free_rate + (beta * (market_rate_of_return - risk_free_rate))
wacc_2013 = (wd_2013 * rd_2013 * (1 - 0.23)) + (we_2013 * re)

print("wd: ",wd_2013)
print("rd: ",rd_2013)
print("we: ",we_2013)
print("re: ",re)
print("WACC for 2013 (also Required Return): ", wacc_2013)
```

```
wd:  0.7794089435901578
rd:  0.05209636566317017
we:  0.2205910564098422
re:  0.6160399999999999
WACC for 2013 (also Required Return):  0.16715828185206105
```

Last but not least, calculation of “Fair Value of Company” and “Current Value”

```
# PV of future cash flow
pv_of_future_cash_flow_2022 = free_cash_flow_2022 / discount_factor_2022
print("PV of future cash flow 2022: ",pv_of_future_cash_flow_2022)

pv_of_future_cash_flow_2023 = free_cash_flow_2023 / discount_factor_2023
print("PV of future cash flow 2023: ",pv_of_future_cash_flow_2023)

pv_of_future_cash_flow_2024 = free_cash_flow_2024 / discount_factor_2024
print("PV of future cash flow 2024: ",pv_of_future_cash_flow_2024)

pv_of_future_cash_flow_2025 = free_cash_flow_2025 / discount_factor_2025
print("PV of future cash flow 2025: ",pv_of_future_cash_flow_2025)

pv_of_future_cash_flow_terminal_value = free_cash_flow_terminal_value /discount_factor_terminal_value
print("PV of future cash flow terminal Value: ",pv_of_future_cash_flow_terminal_value)
```

```
PV of future cash flow 2022:  664600.6881681484
PV of future cash flow 2023:  551951.9929103316
PV of future cash flow 2024:  458397.061425564
PV of future cash flow 2025:  380699.532971392
PV of future cash flow terminal Value:  2128894.8323592157
```

```
todays_company_value = pv_of_future_cash_flow_2022 +  pv_of_future_cash_flow_2023
                     + pv_of_future_cash_flow_2024 + pv_of_future_cash_flow_2025
                     + pv_of_future_cash_flow_terminal_value

print("Today's Company Value: ",todays_company_value)
```

```
Today's Company Value:  4184544.1078346516
```

```
#Fair Value of Company
fair_value_of_company = todays_company_value / shares_out
print(fair_value_of_company)
```

```
23.11213288761724
```

```
def decision():
    if(fair_value_of_company < si.get_live_price(ticker)):
        print("OVER PRICED!!")
        print("Fair value of company: ",fair_value_of_company)
        print("Current value of company: ",si.get_live_price(ticker))
    else:
        print("UNDER PRICED")
        print("Fair value of company: ",fair_value_of_company)
        print("Current value of company: ",si.get_live_price(ticker))
```

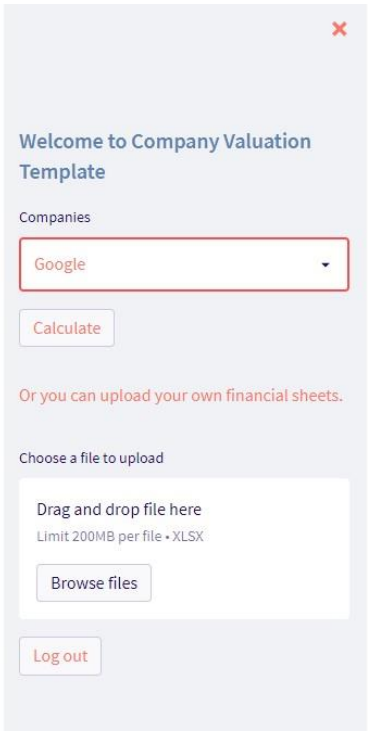
```
decision()
```

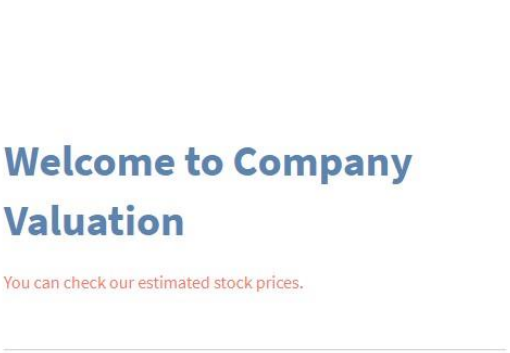
```
OVER PRICED!!
Fair value of company:  23.11213288761724
Current value of company:  46.65999984741211
```

Discount Factor		
PV of Future Cash Flow		
Required Return	18,3%	28,4%
Perpetual Growth	2,5%	
Today's Company Value	4.197.784,37	
Shares Out	181.054,00	
Fair Value of Company	**23,19**	Final Stock Value to appear on the results page
Stock Price Today	44,00	Today's Stock Price to be shown on the results page
Decision	OVER PRICED!	Final Decision to appear on the results page

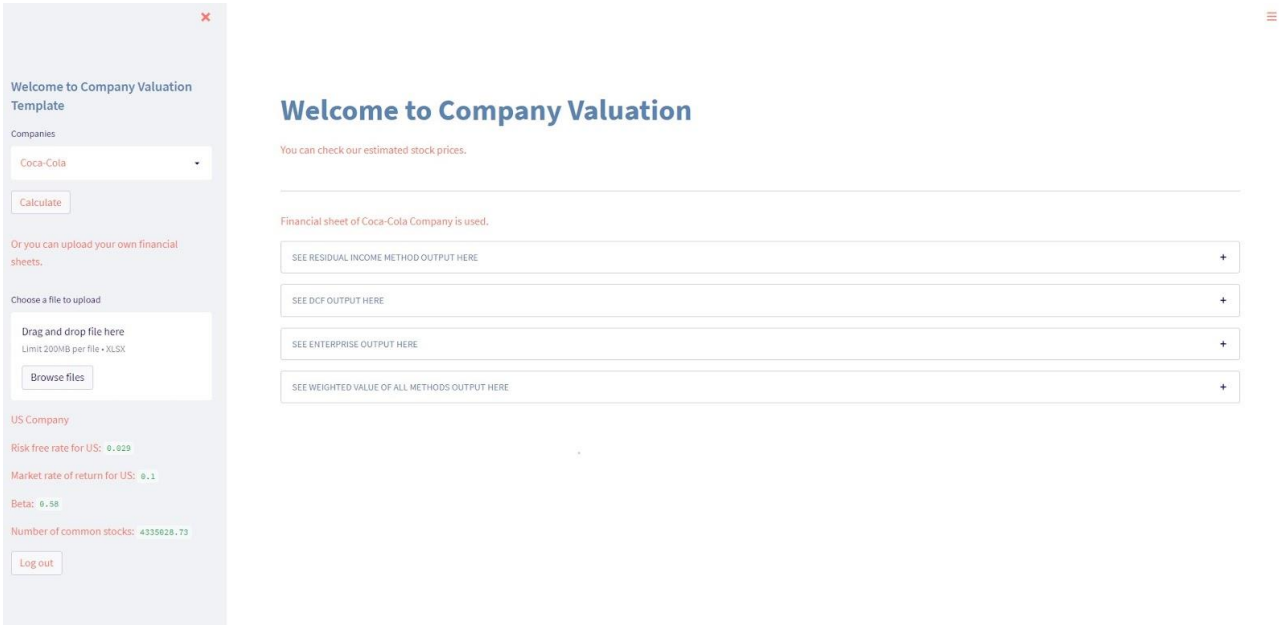
4.1.2 FINAL SOFTWARE PRODUCT

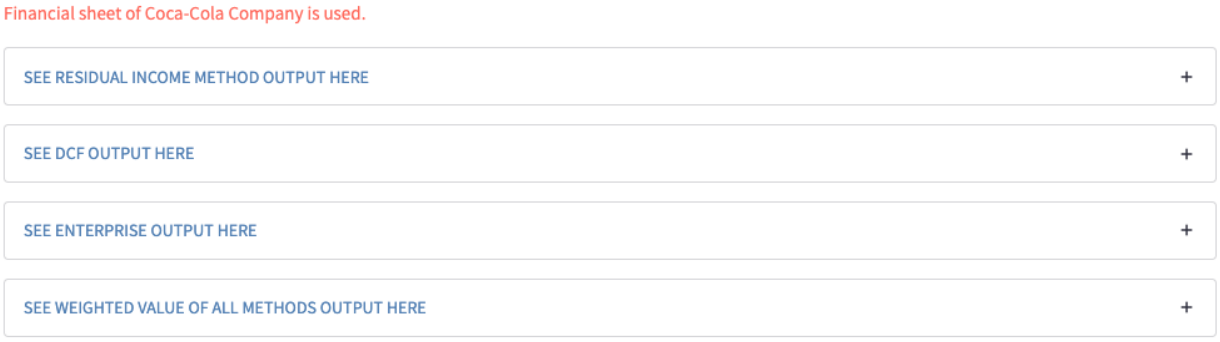
a. The page that users encounter after signing up/logging in is "dashboard". A very simple UI is preferred in order to present an easy and understandable interface to the user. Using the sidebar on the left, the user can select the company with the select box and see the calculation results by reading the excel file to the website using the "browse file" button.





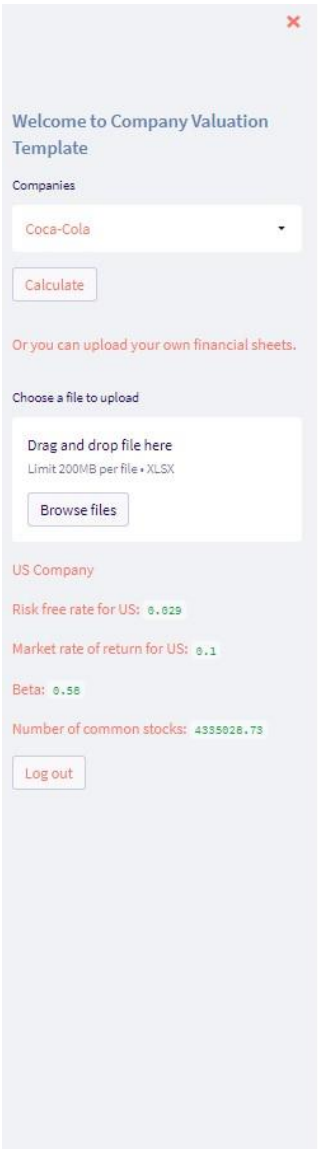
b. When the user selects a company from the select box and clicks the "calculate" button, the results are displayed on the screen in an average of 5-10 seconds depending on the data of the selected company.

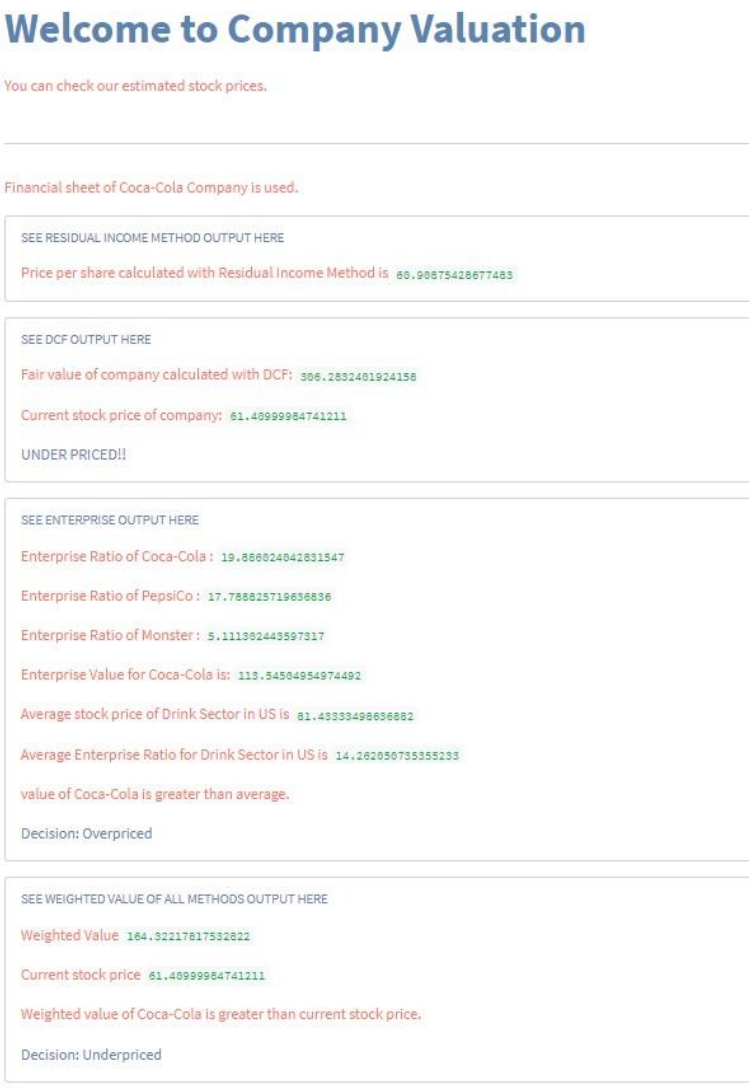




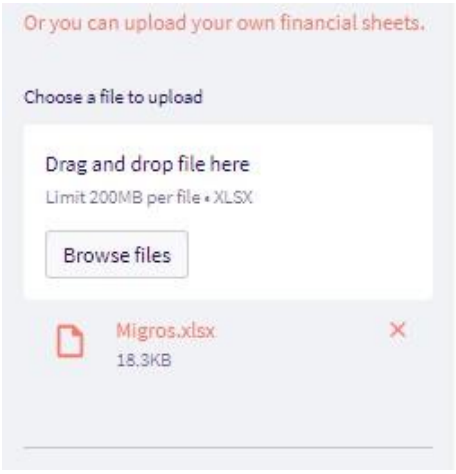
c. We have shown the values that change depending on whether the selected company is of Turkish or US origin, in the lower left part of the sidebar.

d. We displayed the calculated values on the screen by grouping them using the text expander st.expander() so that the calculated values are not confused and easier for the user to understand.

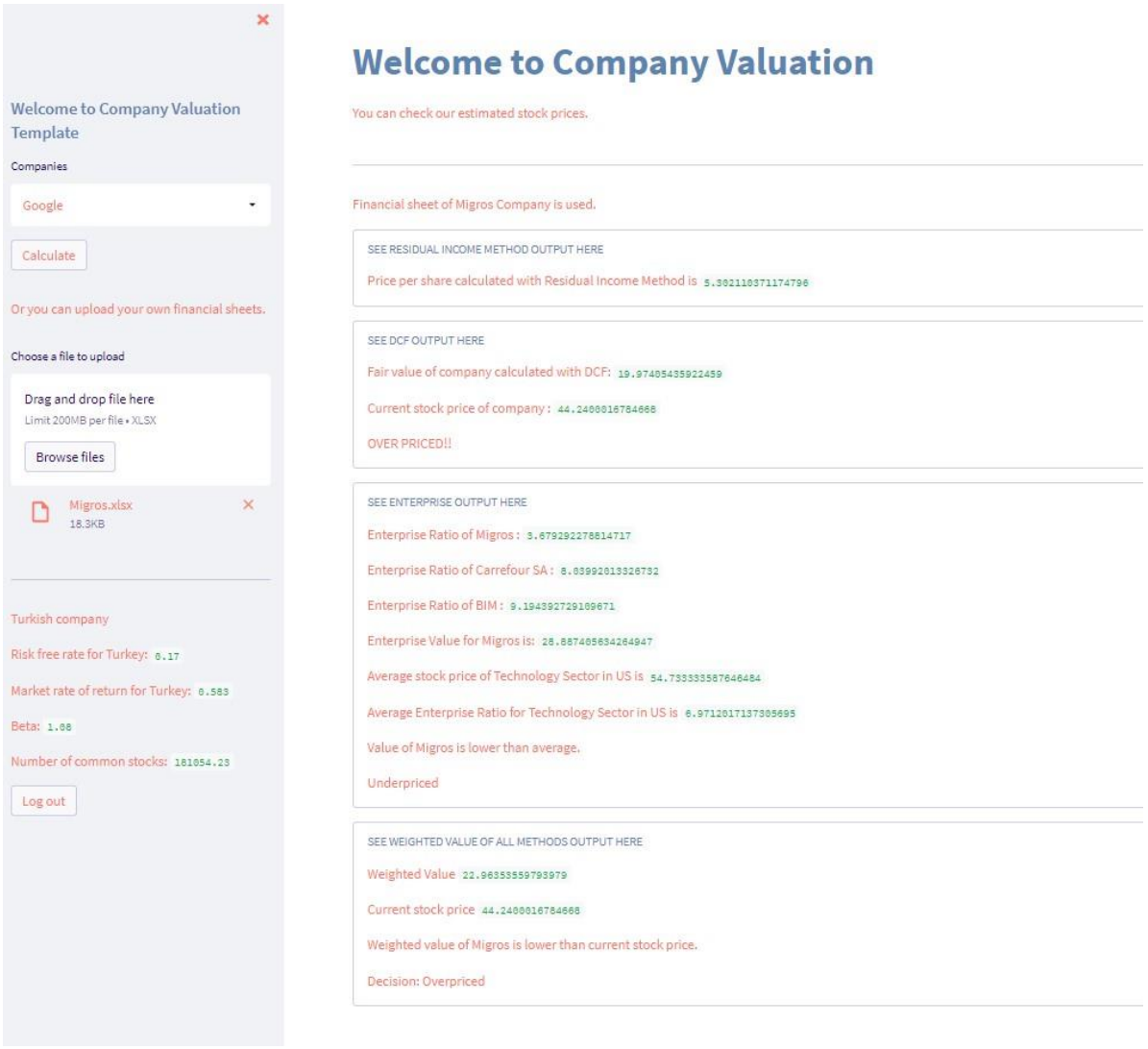




e. We created the feature using st.file_uploader() for the user to upload the excel file. When the user selects the file from her/his computer, the calculation is done automatically and displayed on the screen.



f. The uploaded file is also processed in the same way and the calculation results are presented to the user.



4.2 Evaluation

The functionality of this program will be providing financial data which will aid in the decision making of the investors who need to buy or sell stocks in some companies or firms and that will happen through some financial method such as FCFE, Residual Income, and Enterprise Valuation which will provide the required performance.

The stages of collecting the data and analyzing them with the specific calculation and measurements will be through taking the required financial documents through the websites of the chosen companies and by using Bloomberg. All of these evaluation stages will be collected in excel sheets and given to the software team to process it to create the program as the functionality and performance required have been met.

5. SUMMARY AND CONCLUSION

In summary, we conducted a deep financial analysis of the companies that we have chosen to implement our study on, where we will be using three different financial evaluation methods, DCF, Residual Income, and Enterprise Valuation, and we came to the conclusion that Residual Income method does not work for emerging markets.

Furthermore, we took the results of the financial analysis part and constructed an application that will be able to automatically calculate key financial ratios that will help the user of the application to make their financial decisions.

In conclusion, both sub-teams did the required responsibilities and made the best out of the information available at their hands.

The software will be used in various sectors for a lot of reasons, one of which is to invest in stocks.

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APPENDIX

app.js

```
const sign_in_btn = document.querySelector("#sign-in-btn");
const sign_up_btn = document.querySelector("#sign-up-btn");
  const container = document.querySelector(".container");

sign_up_btn.addEventListener("click", () => {
   container.classList.add("sign-up-mode");
                        });

sign_in_btn.addEventListener("click", () => {
  container.classList.remove("sign-up-mode");
                        });
```

db_connection.php

```
<?php
$hostname="localhost";
  $username= "root";
    $password= "";
  $db_name= "test_db";
$conn= mysqli_connect($hostname,$username,$password,$db_name) or die("Could
not connect to database")
?>
```

home.py

```
import streamlit as st
from datetime import date
import pandas as pd
from PIL import Image
import yfinance as yf
from fbprophet import Prophet
from fbprophet.plot import plot_plotly
from plotly import graph_objs as go




# Sidebar
st.sidebar.header('User Input')

#func to get input

st.sidebar.selectbox('Companies', ('Google','Apple','Microsoft',
                     'Coca-Cola','Pepsico','Monster',
                     'Walmart',' Dollar General Corporation',
                     'Target','Aksa Enerji',' Odaş Elektrik',
                     'Ak Enerji','Migros','Carrefour SA','BIM',
                     'Arçelik','Vestel','Bosch'))

st.sidebar.button('Calculate fair value',key=1,on_click=None)
st.sidebar.write('Or you can upload your own financial sheets.')
st.sidebar.button('Upload',key=1,on_click=None)
```

index.php (login - register)

```php
<?php
include 'db_connection.php';

session_start();

error_reporting(0);

if(isset($_SESSION["user_id"])){
  header("Location:home.php");
}

if(isset($_POST["signup"])){
  $fullname = mysqli_real_escape_string($conn,$_POST["full_name_signup"]);
  $email = mysqli_real_escape_string($conn,$_POST["email_signup"]);
  $password =
mysqli_real_escape_string($conn,md5($_POST["password_signup"]));
  $cpassword =
mysqli_real_escape_string($conn,md5($_POST["cpassword_signup"]));
  $check_email= mysqli_num_rows(mysqli_query($conn,"SELECT email FROM users
Where email='$email'"));

  if($password !== $cpassword){
    echo "<script>alert('Password not match !'); </script>";
  }elseif ($check_email > 0) {
    echo "<script>alert('Email already in use !'); </script>";
  }else{
    $sql="INSERT INTO users (full_name,email,password) VALUES
('$fullname','$email','$password')";
    $result= mysqli_query($conn,$sql);
    if($result){
      $_POST["full_name_signup"] = "";
      $_POST["email_signup"] = "";
      $_POST["password_signup"] = "";
      $_POST["cpassword_signup"] = "";

      echo "<script>alert('Registration is successful.'); </script>";
    }else{
      echo "<script>alert('Registration is not successful.');</script>')";
    }

  }
}
if(isset($_POST["signin"])){

  $email = mysqli_real_escape_string($conn,$_POST["email"]);
  $password = mysqli_real_escape_string($conn,md5($_POST["password"]));

  $check_email= mysqli_query($conn,"SELECT id FROM users Where
email='$email' AND password='$password'");

  if(mysqli_num_rows($check_email) > 0){
    $row = mysqli_fetch_assoc($check_email);
    $_SESSION["user_id"] = $row['id'];
    header("Location:home.php");

  }else{
```

```
    echo "<script>alert('Login failed. Please try again!!'); </script>";
  }



}
?>
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="UTF-8" />
    <meta name="viewport" content="width=device-width, initial-scale=1.0" />
    <script
      src="https://kit.fontawesome.com/64d58efce2.js"
      crossorigin="anonymous"
    ></script>
    <link rel="stylesheet" href="style.css" />
    <title>Sign in & Sign up Form</title>
  </head>
  <body>
    <div class="container">
      <div class="forms-container">
        <div class="signin-signup">
          <form action="" class="sign-in-form" method="POST">    <!-- SIGN
IN FORM-->
            <h2 class="title">Sign in</h2>
            <div class="input-field">
              <i class="fas fa-user"></i>
              <input type="text" placeholder="Email" name="email"
value="<?php echo $_POST["email"]; ?>" required />
            </div>
            <div class="input-field">
              <i class="fas fa-lock"></i>
              <input type="password" placeholder="Password" name="password"
value="<?php echo $_POST["password"]; ?>" required />
            </div>
            <input type="submit" value="Login" name="signin" class="btn
solid" />
          </form>
          <form action="" class="sign-up-form" method="post" >  <!-- SIGN UP
FORM-->
            <h2 class="title">Sign up</h2>
            <div class="input-field">
              <i class="fas fa-user"></i>
              <input type="text" placeholder="Full Name"
name="full_name_signup" value="<?php echo $_POST["full_name_signup"]; ?>"
required/>
            </div>
            <div class="input-field">
              <i class="fas fa-envelope"></i>
              <input type="email" placeholder="Email" name="email_signup"
value="<?php echo $_POST["email_signup"]; ?>" required/>
            </div>
            <div class="input-field">
              <i class="fas fa-lock"></i>
              <input type="password" placeholder="Password" name =
"password_signup" value="<?php echo $_POST["password_signup"]; ?>"
required/>
            </div>
```

```
            <div class="input-field">
              <i class="fas fa-lock"></i>
              <input type="password" placeholder="Confirm Password" name =
"cpassword_signup" value="<?php echo $_POST["cpassword_signup"]; ?>"
required/>
            </div>
            <input type="submit" class="btn" name="signup" value="Sign up"
/>
          </form>
        </div>
      </div>

      <div class="panels-container">
        <div class="panel left-panel">
          <div class="content">
            <h3>Do not have account ?</h3>
            <p>
                Quickly register and start to use.
            </p>
            <button class="btn transparent" id="sign-up-btn">
              Sign up
            </button>
          </div>
          <img src="img/signin-icon.png" class="image" alt="" />
        </div>
        <div class="panel right-panel">
          <div class="content">
            <h3>Already have account ?</h3>
            <p>
                Login and start to use.
            </p>
            <button class="btn transparent" id="sign-in-btn">
              Sign in
            </button>
          </div>
          <img src="img/signup-icon.svg" class="image" alt="" />
        </div>
      </div>
    </div>

    <script src="app.js"></script>
  </body>
</html>
```

logout.php

```
<?php
session_start();
session_unset();
session_destroy();
header("Location: index.php");
?>
```

style.css

```
@import
url("https://fonts.googleapis.com/css2?family=Poppins:wght@200;300;400;500;6
00;700;800&display=swap");

* {
  margin: 0;
```

```
  padding: 0;
  box-sizing: border-box;
}

body,
input {
  font-family: "Poppins", sans-serif;
}

.container {
  position: relative;
  width: 100%;
  background-color: #fff;
  min-height: 100vh;
  overflow: hidden;
}

.forms-container {
  position: absolute;
  width: 100%;
  height: 100%;
  top: 0;
  left: 0;
}

.signin-signup {
  position: absolute;
  top: 50%;
  transform: translate(-50%, -50%);
  left: 75%;
  width: 50%;
  transition: 1s 0.7s ease-in-out;
  display: grid;
  grid-template-columns: 1fr;
  z-index: 5;
}

form {
  display: flex;
  align-items: center;
  justify-content: center;
  flex-direction: column;
  padding: 0rem 5rem;
  transition: all 0.2s 0.7s;
  overflow: hidden;
  grid-column: 1 / 2;
  grid-row: 1 / 2;
}

form.sign-up-form {
  opacity: 0;
  z-index: 1;
}

form.sign-in-form {
  z-index: 2;
}
```

```css
.title {
  font-size: 2.2rem;
  color: #444;
  margin-bottom: 10px;
}

.input-field {
  max-width: 380px;
  width: 100%;
  background-color: #f0f0f0;
  margin: 10px 0;
  height: 55px;
  border-radius: 55px;
  display: grid;
  grid-template-columns: 15% 85%;
  padding: 0 0.4rem;
  position: relative;
}

.input-field i {
  text-align: center;
  line-height: 55px;
  color: #acacac;
  transition: 0.5s;
  font-size: 1.1rem;
}

.input-field input {
  background: none;
  outline: none;
  border: none;
  line-height: 1;
  font-weight: 600;
  font-size: 1.1rem;
  color: #333;
}

.input-field input::placeholder {
  color: #aaa;
  font-weight: 500;
}

.social-text {
  padding: 0.7rem 0;
  font-size: 1rem;
}

.social-media {
  display: flex;
  justify-content: center;
}

.social-icon {
  height: 46px;
  width: 46px;
  display: flex;
  justify-content: center;
  align-items: center;
  margin: 0 0.45rem;
```

```
  color: #333;
  border-radius: 50%;
  border: 1px solid #333;
  text-decoration: none;
  font-size: 1.1rem;
  transition: 0.3s;
}

.social-icon:hover {
  color: #4481eb;
  border-color: #4481eb;
}

.btn {
  width: 150px;
  background-color: #5995fd;
  border: none;
  outline: none;
  height: 49px;
  border-radius: 49px;
  color: #fff;
  text-transform: uppercase;
  font-weight: 600;
  margin: 10px 0;
  cursor: pointer;
  transition: 0.5s;
}

.btn:hover {
  background-color: #4d84e2;
}
.panels-container {
  position: absolute;
  height: 100%;
  width: 100%;
  top: 0;
  left: 0;
  display: grid;
  grid-template-columns: repeat(2, 1fr);
}

.container:before {
  content: "";
  position: absolute;
  height: 2000px;
  width: 2000px;
  top: -10%;
  right: 48%;
  transform: translateY(-50%);
  background-image: linear-gradient(-45deg, #4481eb 0%, #04befe 100%);
  transition: 1.8s ease-in-out;
  border-radius: 50%;
  z-index: 6;
}

.image {
  width: 100%;
  transition: transform 1.1s ease-in-out;
  transition-delay: 0.4s;
```

```
}

.panel {
  display: flex;
  flex-direction: column;
  align-items: flex-end;
  justify-content: space-around;
  text-align: center;
  z-index: 6;
}

.left-panel {
  pointer-events: all;
  padding: 3rem 17% 2rem 12%;
}

.right-panel {
  pointer-events: none;
  padding: 3rem 12% 2rem 17%;
}

.panel .content {
  color: #fff;
  transition: transform 0.9s ease-in-out;
  transition-delay: 0.6s;
}

.panel h3 {
  font-weight: 600;
  line-height: 1;
  font-size: 1.5rem;
}

.panel p {
  font-size: 0.95rem;
  padding: 0.7rem 0;
}

.btn.transparent {
  margin: 0;
  background: none;
  border: 2px solid #fff;
  width: 130px;
  height: 41px;
  font-weight: 600;
  font-size: 0.8rem;
}

.right-panel .image,
.right-panel .content {
  transform: translateX(800px);
}

/* ANIMATION */

.container.sign-up-mode:before {
  transform: translate(100%, -50%);
  right: 52%;
```

```
}

.container.sign-up-mode .left-panel .image,
.container.sign-up-mode .left-panel .content {
  transform: translateX(-800px);
}

.container.sign-up-mode .signin-signup {
  left: 25%;
}

.container.sign-up-mode form.sign-up-form {
  opacity: 1;
  z-index: 2;
}

.container.sign-up-mode form.sign-in-form {
  opacity: 0;
  z-index: 1;
}

.container.sign-up-mode .right-panel .image,
.container.sign-up-mode .right-panel .content {
  transform: translateX(0%);
}

.container.sign-up-mode .left-panel {
  pointer-events: none;
}

.container.sign-up-mode .right-panel {
  pointer-events: all;
}

@media (max-width: 870px) {
  .container {
    min-height: 800px;
    height: 100vh;
  }
  .signin-signup {
    width: 100%;
    top: 95%;
    transform: translate(-50%, -100%);
    transition: 1s 0.8s ease-in-out;
  }

  .signin-signup,
  .container.sign-up-mode .signin-signup {
    left: 50%;
  }

  .panels-container {
    grid-template-columns: 1fr;
    grid-template-rows: 1fr 2fr 1fr;
  }

  .panel {
    flex-direction: row;
```

```
  justify-content: space-around;
  align-items: center;
  padding: 2.5rem 8%;
  grid-column: 1 / 2;
}

.right-panel {
  grid-row: 3 / 4;
}

.left-panel {
  grid-row: 1 / 2;
}

.image {
  width: 200px;
  transition: transform 0.9s ease-in-out;
  transition-delay: 0.6s;
}

.panel .content {
  padding-right: 15%;
  transition: transform 0.9s ease-in-out;
  transition-delay: 0.8s;
}

.panel h3 {
  font-size: 1.2rem;
}

.panel p {
  font-size: 0.7rem;
  padding: 0.5rem 0;
}

.btn.transparent {
  width: 110px;
  height: 35px;
  font-size: 0.7rem;
}

.container:before {
  width: 1500px;
  height: 1500px;
  transform: translateX(-50%);
  left: 30%;
  bottom: 68%;
  right: initial;
  top: initial;
  transition: 2s ease-in-out;
}

.container.sign-up-mode:before {
  transform: translate(-50%, 100%);
  bottom: 32%;
  right: initial;
}
```

```
  .container.sign-up-mode .left-panel .image,
  .container.sign-up-mode .left-panel .content {
    transform: translateY(-300px);
  }

  .container.sign-up-mode .right-panel .image,
  .container.sign-up-mode .right-panel .content {
    transform: translateY(0px);
  }

  .right-panel .image,
  .right-panel .content {
    transform: translateY(300px);
  }

  .container.sign-up-mode .signin-signup {
    top: 5%;
    transform: translate(-50%, 0);
  }
}

@media (max-width: 570px) {
  form {
    padding: 0 1.5rem;
  }

  .image {
    display: none;
  }
  .panel .content {
    padding: 0.5rem 1rem;
  }
  .container {
    padding: 1.5rem;
  }

  .container:before {
    bottom: 72%;
    left: 50%;
  }

  .container.sign-up-mode:before {
    bottom: 28%;
    left: 50%;
  }
}
```

calculate.py

```
from openpyxl import load_workbook
import pandas as pd
import yahoo_fin.stock_info as si
from yahoo_fin import options
book = load_workbook('Migros Template New FCFE.xlsx')
print(book.sheetnames)
dcf_sheet = book['DCF Method']
residual_income_sheet = book['Residual Income']
```

```
financial_sheets = book['BS-IS']
enterprise_sheet = book['Enterprise']
residual_income_rows = residual_income_sheet.rows
dcf_rows = dcf_sheet.rows
fs_rows = financial_sheets.rows
enterprise_rows = enterprise_sheet.rows
# WACC calculation / wd / rd / we / re  2013
total_debt_2013 = financial_sheets['D57'].value * 1000
total_equity_2013= financial_sheets['D52'].value * 1000
interest_expense_2013 = abs(financial_sheets['P27'].value * 1000)

total_2013 = total_debt_2013 + total_equity_2013
wd_2013 = total_debt_2013 /total_2013
rd_2013 = interest_expense_2013 / total_debt_2013
we_2013 = total_equity_2013 / (total_equity_2013 + total_debt_2013)
re = risk_free_rate + (beta * (market_rate_of_return - risk_free_rate))
wacc_2013 = (wd_2013 * rd_2013 * (1 - 0.23)) + (we_2013 * re)

print("wd: ",wd_2013)
print("rd: ",rd_2013)
print("we: ",we_2013)
print("re: ",re)
print("WACC for 2013 (also Required Return): ", wacc_2013)

# WACC calculation / wd / rd / we / re  2014
total_debt_2014 = financial_sheets['E57'].value * 1000
total_equity_2014= financial_sheets['E52'].value * 1000
interest_expense_2014 = abs(financial_sheets['Q27'].value * 1000)

total_2014 = total_debt_2014 + total_equity_2014
wd_2014 = total_debt_2014 /total_2014
rd_2014 = interest_expense_2014 / total_debt_2014
we_2014 = total_equity_2014 / (total_equity_2014 + total_debt_2014)
re = risk_free_rate + (beta * (market_rate_of_return - risk_free_rate))
wacc_2014 = (wd_2014 * rd_2014 * (1 - 0.23)) + (we_2014 * re)

print("wd: ",wd_2014)
print("rd: ",rd_2014)
print("we: ",we_2014)
print("re: ",re)
print("WACC for 2014 (also Required Return): ", wacc_2014)
# WACC calculation / wd / rd / we / re  2015
total_debt_2015 = financial_sheets['F57'].value * 1000
total_equity_2015= financial_sheets['F52'].value * 1000
interest_expense_2015 = abs(financial_sheets['R27'].value * 1000)

total_2015 = total_debt_2015 + total_equity_2015
wd_2015 = total_debt_2015 /total_2015
rd_2015 = interest_expense_2015 / total_debt_2015
we_2015 = total_equity_2015 / (total_equity_2015 + total_debt_2015)
re = risk_free_rate + (beta * (market_rate_of_return - risk_free_rate))
```

```
wacc_2015 = (wd_2015 * rd_2015 * (1 - 0.23)) + (we_2015 * re)

print("wd: ",wd_2015)
print("rd: ",rd_2015)
print("we: ",we_2015)
print("re: ",re)
print("WACC for 2015 (also Required Return): ", wacc_2015)

# WACC calculation / wd / rd / we / re  2016
total_debt_2016 = financial_sheets['G57'].value * 1000
total_equity_2016= financial_sheets['G52'].value * 1000
interest_expense_2016 = abs(financial_sheets['S27'].value * 1000)

total_2016 = total_debt_2016 + total_equity_2016
wd_2016 = total_debt_2016 /total_2016
rd_2016 = interest_expense_2016 / total_debt_2016
we_2016 = total_equity_2016 / (total_equity_2016 + total_debt_2016)
re = risk_free_rate + (beta * (market_rate_of_return - risk_free_rate))
wacc_2016 = (wd_2016 * rd_2016 * (1 - 0.23)) + (we_2016 * re)

print("wd: ",wd_2016)
print("rd: ",rd_2016)
print("we: ",we_2016)
print("re: ",re)
print("WACC for 2016 (also Required Return): ", wacc_2016)
# WACC calculation / wd / rd / we / re  2017
total_debt_2017 = financial_sheets['H57'].value * 1000
total_equity_2017 = financial_sheets['H52'].value * 1000
interest_expense_2017 = abs(financial_sheets['T27'].value * 1000)

total_2017 = total_debt_2017 + total_equity_2017
wd_2017 = total_debt_2017 /total_2017
rd_2017 = interest_expense_2017 / total_debt_2017
we_2017 = total_equity_2017/ (total_equity_2017 + total_debt_2017)
re = risk_free_rate + (beta * (market_rate_of_return - risk_free_rate))
wacc_2017= (wd_2017* rd_2017* (1 - 0.23)) + (we_2017 * re)

print("wd: ",wd_2017)
print("rd: ",rd_2017)
print("we: ",we_2017)
print("re: ",re)
print("WACC for 2017(also Required Return): ", wacc_2017)

# WACC calculation / wd / rd / we / re  2018
total_debt_2018 = financial_sheets['I57'].value * 1000
total_equity_2018 = financial_sheets['I52'].value * 1000
interest_expense_2018 = abs(financial_sheets['U27'].value * 1000)

total_2018 = total_debt_2018 + total_equity_2018
wd_2018 = total_debt_2018 /total_2018
rd_2018 = interest_expense_2018 / total_debt_2018
```

```
we_2018 = total_equity_2018/ (total_equity_2018 + total_debt_2018)
re = risk_free_rate + (beta * (market_rate_of_return - risk_free_rate))
wacc_2018= (wd_2018* rd_2018* (1 - 0.23)) + (we_2018 * re)

print("wd: ",wd_2018)
print("rd: ",rd_2018)
print("we: ",we_2018)
print("re: ",re)
print("WACC for 2018(also Required Return): ", wacc_2018)

# WACC calculation / wd / rd / we / re  2019
total_debt_2019 = financial_sheets['J57'].value * 1000
total_equity_2019 = financial_sheets['J52'].value * 1000
interest_expense_2019 = abs(financial_sheets['V27'].value * 1000)

total_2019 = total_debt_2019 + total_equity_2019
wd_2019 = total_debt_2019 /total_2019
rd_2019 = interest_expense_2019 / total_debt_2019
we_2019 = total_equity_2019/ (total_equity_2019 + total_debt_2019)
re = risk_free_rate + (beta * (market_rate_of_return - risk_free_rate))
wacc_2019= (wd_2019* rd_2019* (1 - 0.23)) + (we_2019 * re)

print("wd: ",wd_2019)
print("rd: ",rd_2019)
print("we: ",we_2019)
print("re: ",re)
print("WACC for 2019(also Required Return): ", wacc_2019)
# WACC calculation / wd / rd / we / re  2020
total_debt_2020 = financial_sheets['K57'].value * 1000
total_equity_2020 = financial_sheets['K52'].value * 1000
interest_expense_2020 = abs(financial_sheets['W27'].value * 1000)

total_2020 = total_debt_2020 + total_equity_2020
wd_2020 = total_debt_2020 /total_2020
rd_2020 = interest_expense_2020 / total_debt_2020
we_2020 = total_equity_2020/ (total_equity_2020 + total_debt_2020)
re = risk_free_rate + (beta * (market_rate_of_return - risk_free_rate))
wacc_2020= (wd_2020* rd_2020* (1 - 0.23)) + (we_2020 * re)


print("wd: ",wd_2020)
print("rd: ",rd_2020)
print("we: ",we_2020)
print("re: ",re)
print("WACC for 2020(also Required Return): ", wacc_2020)
# WACC calculation / wd / rd / we / re  2021
total_debt_2021 = financial_sheets['L57'].value * 1000
total_equity_2021 = financial_sheets['L52'].value * 1000
interest_expense_2021 = abs(financial_sheets['X27'].value * 1000)

total_2021 = total_debt_2021 + total_equity_2021
```

```
wd_2021 = total_debt_2021 /total_2021
rd_2021 = interest_expense_2021 / total_debt_2021
we_2021 = total_equity_2021/ (total_equity_2021 + total_debt_2021)
re = risk_free_rate + (beta * (market_rate_of_return - risk_free_rate))
wacc_2021= (wd_2021* rd_2021* (1 - 0.23)) + (we_2021 * re)


print("wd: ",wd_2021)
print("rd: ",rd_2021)
print("we: ",we_2021)
print("re: ",re)
print("WACC for 2021(also Required Return): ", wacc_2021)

#Required Return
required_return = (wacc_2013 + wacc_2014 + wacc_2015 + wacc_2016 + wacc_2017 +
wacc_2018 + wacc_2019 + wacc_2020 + wacc_2021) / 9
print(required_return)
#Revenues
revenue_2013 = financial_sheets['P13'].value * 1000
revenue_2014 = financial_sheets['Q13'].value * 1000
revenue_2015 = financial_sheets['R13'].value * 1000
revenue_2016 = financial_sheets['S13'].value * 1000
revenue_2017 = financial_sheets['T13'].value * 1000
revenue_2018 = financial_sheets['U13'].value * 1000
revenue_2019 = financial_sheets['V13'].value * 1000
revenue_2020 = financial_sheets['W13'].value * 1000
revenue_2021 = financial_sheets['X13'].value * 1000

# Net Incomes
net_income_2013 = financial_sheets['P31'].value * 1000
net_income_2014 = financial_sheets['Q31'].value * 1000
net_income_2015 = financial_sheets['R31'].value * 1000
net_income_2016 = financial_sheets['S31'].value * 1000
net_income_2017 = financial_sheets['T31'].value * 1000
net_income_2018 = financial_sheets['U31'].value * 1000
net_income_2019 = financial_sheets['V31'].value * 1000
net_income_2020 = financial_sheets['W31'].value * 1000
net_income_2021 = financial_sheets['X31'].value * 1000
print(net_income_2013)

#Revenue Growth Rates
revenue_growth_rate_2014 = (revenue_2014 - revenue_2013) / revenue_2014
revenue_growth_rate_2015 = (revenue_2015 - revenue_2014) / revenue_2015
revenue_growth_rate_2016 = (revenue_2016 - revenue_2015) / revenue_2016
revenue_growth_rate_2017 = (revenue_2017 - revenue_2016) / revenue_2017
revenue_growth_rate_2018 = (revenue_2018 - revenue_2017) / revenue_2018
revenue_growth_rate_2019 = (revenue_2019 - revenue_2018) / revenue_2019
revenue_growth_rate_2020 = (revenue_2020 - revenue_2019) / revenue_2020
revenue_growth_rate_2021 = (revenue_2021 - revenue_2020) / revenue_2021
```

```
revenue_growth_rate_2022 = (revenue_growth_rate_2014 + revenue_growth_rate_2015 +
revenue_growth_rate_2016 + revenue_growth_rate_2017 + revenue_growth_rate_2018 +
revenue_growth_rate_2019 + revenue_growth_rate_2020 + revenue_growth_rate_2021  ) / 8
print(revenue_growth_rate_2022)

#Net Income Margins
net_income_margin_ratio_2013 = net_income_2013 / revenue_2013
net_income_margin_ratio_2014 = net_income_2014 / revenue_2014
net_income_margin_ratio_2015 = net_income_2015 / revenue_2015
net_income_margin_ratio_2016 = net_income_2016 / revenue_2016
net_income_margin_ratio_2017 = net_income_2017 / revenue_2017
net_income_margin_ratio_2018 = net_income_2018 / revenue_2018
net_income_margin_ratio_2019 = net_income_2019 / revenue_2019
net_income_margin_ratio_2020 = net_income_2020 / revenue_2020
net_income_margin_ratio_2021 = net_income_2021 / revenue_2021
net_income_margin_ratios_previous = (net_income_margin_ratio_2013 +
net_income_margin_ratio_2014 + net_income_margin_ratio_2015 +
net_income_margin_ratio_2016 + net_income_margin_ratio_2017 +
net_income_margin_ratio_2018 + net_income_margin_ratio_2019 +
net_income_margin_ratio_2020 + net_income_margin_ratio_2021)
net_income_margin_ratio_2022 = net_income_margin_ratios_previous / 9
net_income_margin_ratio_2023 = (net_income_margin_ratios_previous +
net_income_margin_ratio_2022) / 10
net_income_margin_ratio_2024 = (net_income_margin_ratios_previous +
net_income_margin_ratio_2022 + net_income_margin_ratio_2023) / 11
net_income_margin_ratio_2025 = (net_income_margin_ratios_previous +
net_income_margin_ratio_2022 + net_income_margin_ratio_2023 +
net_income_margin_ratio_2024 ) / 12

# Net Income Estimation
net_income_2022 = net_income_2021 + (net_income_2021 * net_income_margin_ratio_2022 )
print("Net income 2022: ",net_income_2022)

net_income_2023 = net_income_2022 + (net_income_2022 * net_income_margin_ratio_2023)
print("Net income 2023: ",net_income_2023)

net_income_2024 = net_income_2023 + (net_income_2023 * net_income_margin_ratio_2024)
print("Net income 2024: ",net_income_2024)

net_income_2025 = net_income_2024 + (net_income_2024 * net_income_margin_ratio_2025)
print("Net income 2025: ",net_income_2025)

# Discount Factors
required_return = (wacc_2013 + wacc_2014 + wacc_2015 + wacc_2016 + wacc_2017 +
wacc_2018 + wacc_2019 + wacc_2020 + wacc_2021) /9
discount_factor_2022 = (1 + required_return)**1
discount_factor_2023 = (1 + required_return)**2
discount_factor_2024 = (1 + required_return)**3
discount_factor_2025 = (1 + required_return)**4
discount_factor_terminal_value = (1 + required_return)**4
```

```
# EAT For Free Cash Flow
eat_2013 = ((financial_sheets['P13'].value + financial_sheets['P16'].value +
financial_sheets['P21'].value + financial_sheets['P22'].value) * 1000) * 0.79
eat_2014 = ((financial_sheets['Q13'].value + financial_sheets['Q16'].value +
financial_sheets['Q21'].value + financial_sheets['Q22'].value) * 1000) * 0.79
eat_2015 = ((financial_sheets['R13'].value + financial_sheets['R16'].value +
financial_sheets['R21'].value + financial_sheets['R22'].value) * 1000) * 0.79
eat_2016 = ((financial_sheets['S13'].value + financial_sheets['S16'].value +
financial_sheets['S21'].value + financial_sheets['S22'].value) * 1000) * 0.79
eat_2017 = ((financial_sheets['T13'].value + financial_sheets['T16'].value +
financial_sheets['T21'].value + financial_sheets['T22'].value) * 1000) * 0.79
eat_2018 = ((financial_sheets['U13'].value + financial_sheets['U16'].value +
financial_sheets['U21'].value + financial_sheets['U22'].value) * 1000) * 0.79
eat_2019 = ((financial_sheets['V13'].value + financial_sheets['V16'].value +
financial_sheets['V21'].value + financial_sheets['V22'].value) * 1000) * 0.79
eat_2020 = ((financial_sheets['W13'].value + financial_sheets['W16'].value +
financial_sheets['W21'].value + financial_sheets['W22'].value) * 1000) * 0.79
eat_2021 = ((financial_sheets['X13'].value + financial_sheets['X16'].value +
financial_sheets['X21'].value + financial_sheets['X22'].value) * 1000) * 0.79

# Depreciation
depreciation_2013 = financial_sheets['P55'].value * 1000
depreciation_2014 = financial_sheets['Q55'].value * 1000
depreciation_2015 = financial_sheets['R55'].value * 1000
depreciation_2016 = financial_sheets['S55'].value * 1000
depreciation_2017 = financial_sheets['T55'].value * 1000
depreciation_2018 = financial_sheets['U55'].value * 1000
depreciation_2019 = financial_sheets['V55'].value * 1000
depreciation_2020 = financial_sheets['W55'].value * 1000
depreciation_2021 = financial_sheets['X55'].value * 1000

# Increase in fixed assets
increased_in_fixed_assets_2013 = (financial_sheets['D21'].value -
financial_sheets['C21'].value) * 1000
increased_in_fixed_assets_2014 = (financial_sheets['E21'].value -
financial_sheets['E21'].value) * 1000
increased_in_fixed_assets_2015 = (financial_sheets['F21'].value -
financial_sheets['F21'].value) * 1000
increased_in_fixed_assets_2016 = (financial_sheets['G21'].value -
financial_sheets['G21'].value) * 1000
increased_in_fixed_assets_2017 = (financial_sheets['H21'].value -
financial_sheets['H21'].value) * 1000
increased_in_fixed_assets_2018 = (financial_sheets['I21'].value - financial_sheets['I21'].value)
* 1000
increased_in_fixed_assets_2019 = (financial_sheets['J21'].value - financial_sheets['J21'].value)
* 1000
increased_in_fixed_assets_2020 = (financial_sheets['K21'].value -
financial_sheets['K21'].value) * 1000
increased_in_fixed_assets_2021 = (financial_sheets['L21'].value -
financial_sheets['L21'].value) * 1000
```

```
# Increase in working capital
increase_in_working_capital_2013 = (financial_sheets['D19'].value -
financial_sheets['D36'].value) * 1000 - (financial_sheets['C19'].value -
financial_sheets['C36'].value)  * 1000
increase_in_working_capital_2014 = (financial_sheets['E19'].value -
financial_sheets['E36'].value) * 1000 - (financial_sheets['D19'].value -
financial_sheets['D36'].value)  * 1000
increase_in_working_capital_2015 = (financial_sheets['F19'].value -
financial_sheets['F36'].value) * 1000 - (financial_sheets['E19'].value -
financial_sheets['E36'].value)  * 1000
increase_in_working_capital_2016 = (financial_sheets['G19'].value -
financial_sheets['G36'].value) * 1000 - (financial_sheets['F19'].value -
financial_sheets['F36'].value)  * 1000
increase_in_working_capital_2017 = (financial_sheets['H19'].value -
financial_sheets['H36'].value) * 1000 - (financial_sheets['G19'].value -
financial_sheets['G36'].value)  * 1000
increase_in_working_capital_2018 = (financial_sheets['I19'].value -
financial_sheets['I36'].value) * 1000 - (financial_sheets['H19'].value -
financial_sheets['H36'].value)  * 1000
increase_in_working_capital_2019 = (financial_sheets['J19'].value -
financial_sheets['J36'].value) * 1000 - (financial_sheets['I19'].value -
financial_sheets['I36'].value)  * 1000
increase_in_working_capital_2020 = (financial_sheets['K19'].value -
financial_sheets['K36'].value) * 1000 - (financial_sheets['J19'].value -
financial_sheets['J36'].value)  * 1000
increase_in_working_capital_2021 = (financial_sheets['L19'].value -
financial_sheets['L36'].value) * 1000 - (financial_sheets['K19'].value -
financial_sheets['K36'].value)  * 1000
print("Increase in Working Capital 2013: ",increase_in_working_capital_2013)
print("Increase in Working Capital 2014: ",increase_in_working_capital_2014)
print("Increase in Working Capital 2015: ",increase_in_working_capital_2015)
print("Increase in Working Capital 2016: ",increase_in_working_capital_2016)
print("Increase in Working Capital 2017: ",increase_in_working_capital_2017)
print("Increase in Working Capital 2018: ",increase_in_working_capital_2018)
print("Increase in Working Capital 2019: ",increase_in_working_capital_2019)
print("Increase in Working Capital 2020: ",increase_in_working_capital_2020)
print("Increase in Working Capital 2021: ",increase_in_working_capital_2021)

# Free cash Flow of previous years
free_cash_flow_2013 = eat_2013 + depreciation_2013 - increased_in_fixed_assets_2013 -
increase_in_working_capital_2013
free_cash_flow_2014 = eat_2014 + depreciation_2014 - increased_in_fixed_assets_2014 -
increase_in_working_capital_2014
free_cash_flow_2015 = eat_2015 + depreciation_2015 - increased_in_fixed_assets_2015 -
increase_in_working_capital_2015
free_cash_flow_2016 = eat_2016 + depreciation_2016 - increased_in_fixed_assets_2016 -
increase_in_working_capital_2016
free_cash_flow_2017 = eat_2017 + depreciation_2017 - increased_in_fixed_assets_2017 -
increase_in_working_capital_2017
free_cash_flow_2018 = eat_2018 + depreciation_2018 - increased_in_fixed_assets_2018 -
increase_in_working_capital_2018
```

```
free_cash_flow_2019 = eat_2019 + depreciation_2019 - increased_in_fixed_assets_2019 - increase_in_working_capital_2019
free_cash_flow_2020 = eat_2020 + depreciation_2020 - increased_in_fixed_assets_2020 - increase_in_working_capital_2020
free_cash_flow_2021 = eat_2021 + depreciation_2021 - increased_in_fixed_assets_2021 - increase_in_working_capital_2021

# CapEx and Net Borrowing
capex_2013 = (financial_sheets['D21'].value - financial_sheets['C21'].value + financial_sheets['P55'].value )*1000
capex_2014 = (financial_sheets['E21'].value - financial_sheets['D21'].value + financial_sheets['Q55'].value )*1000
capex_2015 = (financial_sheets['F21'].value - financial_sheets['E21'].value + financial_sheets['R55'].value )*1000
capex_2016 = (financial_sheets['G21'].value - financial_sheets['F21'].value + financial_sheets['S55'].value )*1000
capex_2017 = (financial_sheets['H21'].value - financial_sheets['G21'].value + financial_sheets['T55'].value )*1000
capex_2018 = (financial_sheets['I21'].value - financial_sheets['H21'].value + financial_sheets['U55'].value )*1000
capex_2019 = (financial_sheets['J21'].value - financial_sheets['I21'].value + financial_sheets['V55'].value )*1000
capex_2020 = (financial_sheets['K21'].value - financial_sheets['J21'].value + financial_sheets['W55'].value )*1000
capex_2021 = (financial_sheets['L21'].value - financial_sheets['K21'].value + financial_sheets['X55'].value )*1000
print("CapEx 2013: ",capex_2013)

net_borrowing_2013 = (financial_sheets['D39'].value - financial_sheets['D34'].value)*1000
net_borrowing_2014 = (financial_sheets['E39'].value - financial_sheets['E34'].value)*1000
net_borrowing_2015 = (financial_sheets['F39'].value - financial_sheets['F34'].value)*1000
net_borrowing_2016 = (financial_sheets['G39'].value - financial_sheets['G34'].value)*1000
net_borrowing_2017 = (financial_sheets['H39'].value - financial_sheets['H34'].value)*1000
net_borrowing_2018 = (financial_sheets['I39'].value - financial_sheets['I34'].value)*1000
net_borrowing_2019 = (financial_sheets['J39'].value - financial_sheets['J34'].value)*1000
net_borrowing_2020 = (financial_sheets['K39'].value - financial_sheets['K34'].value)*1000
net_borrowing_2021 = (financial_sheets['L39'].value - financial_sheets['L34'].value)*1000

#Free Cash Flow to Equity
fcfe_2013 = net_income_2013 + depreciation_2013 - increase_in_working_capital_2013 - capex_2013 + net_borrowing_2013
fcfe_2014 = net_income_2014 + depreciation_2014 - increase_in_working_capital_2014 - capex_2014 + net_borrowing_2014
fcfe_2015 = net_income_2015 + depreciation_2015 - increase_in_working_capital_2015 - capex_2015 + net_borrowing_2015
fcfe_2016 = net_income_2016 + depreciation_2016 - increase_in_working_capital_2016 - capex_2016 + net_borrowing_2016
fcfe_2017 = net_income_2017 + depreciation_2017 - increase_in_working_capital_2017 - capex_2017 + net_borrowing_2017
fcfe_2018 = net_income_2018 + depreciation_2018 - increase_in_working_capital_2018 - capex_2018 + net_borrowing_2018
```

```
fcfe_2019 = net_income_2019 + depreciation_2019 - increase_in_working_capital_2019 -
capex_2019 + net_borrowing_2019
fcfe_2020 = net_income_2020 + depreciation_2020 - increase_in_working_capital_2020 -
capex_2020 + net_borrowing_2020
fcfe_2021 = net_income_2021 + depreciation_2021 - increase_in_working_capital_2021 -
capex_2021 + net_borrowing_2021

# FCF / Net Income
fcf_over_nı_2013 = fcfe_2013 / net_income_2013
fcf_over_nı_2014 = fcfe_2014 / net_income_2014
fcf_over_nı_2015 = fcfe_2015 / net_income_2015
fcf_over_nı_2016 = fcfe_2016 / net_income_2016
fcf_over_nı_2017 = fcfe_2017 / net_income_2017
fcf_over_nı_2018 = fcfe_2018 / net_income_2018
fcf_over_nı_2019 = fcfe_2019 / net_income_2019
fcf_over_nı_2020 = fcfe_2020 / net_income_2020
fcf_over_nı_2021 = fcfe_2021 / net_income_2021
fcf_over_nı_array = [fcf_over_nı_2013,fcf_over_nı_2014,fcf_over_nı_2015,
                fcf_over_nı_2016,fcf_over_nı_2017,fcf_over_nı_2018,
                fcf_over_nı_2019,fcf_over_nı_2020,fcf_over_nı_2021]
fcf_over_nı_average = (fcf_over_nı_2013 + fcf_over_nı_2014 + fcf_over_nı_2015 +
                  fcf_over_nı_2016 + fcf_over_nı_2017 + fcf_over_nı_2018 +
                  fcf_over_nı_2019 + fcf_over_nı_2020 + fcf_over_nı_2021) / 9

if(abs(fcf_over_nı_average) > max(fcf_over_nı_array)):
   fcf_over_nı_2022 = max(fcf_over_nı_array)
else:
   fcf_over_nı_2022 = abs(fcf_over_nı_average)

fcf_over_nı_2023 = fcf_over_nı_2022
fcf_over_nı_2024 = fcf_over_nı_2022
fcf_over_nı_2025 = fcf_over_nı_2022

# Free cash Flow estimation 2022, 2023, 2024, 2025
free_cash_flow_2022 = net_income_2022 + (fcf_over_nı_2022 * net_income_2022)
print("Free cash flow 2022: ",free_cash_flow_2022)

free_cash_flow_2023 = net_income_2023 + (fcf_over_nı_2023 * net_income_2023)
print("Free cash flow 2023: ",free_cash_flow_2023)

free_cash_flow_2024 = net_income_2024 + (fcf_over_nı_2024 * net_income_2024)
print("Free cash flow 2024: ",free_cash_flow_2024)

free_cash_flow_2025 = net_income_2025 + (fcf_over_nı_2025 * net_income_2025)
print("Free cash flow 2025: ",free_cash_flow_2025)

free_cash_flow_terminal_value = (free_cash_flow_2025 * (1 + perpetual_growth)) /
required_return - perpetual_growth
print("Free cash flow terminal value: ", free_cash_flow_terminal_value)

# PV of future cash flow
```

```
pv_of_future_cash_flow_2022 = free_cash_flow_2022 / discount_factor_2022
print("PV of future cash flow 2022: ",pv_of_future_cash_flow_2022)

pv_of_future_cash_flow_2023 = free_cash_flow_2023 / discount_factor_2023
print("PV of future cash flow 2023: ",pv_of_future_cash_flow_2023)

pv_of_future_cash_flow_2024 = free_cash_flow_2024 / discount_factor_2024
print("PV of future cash flow 2024: ",pv_of_future_cash_flow_2024)

pv_of_future_cash_flow_2025 = free_cash_flow_2025 / discount_factor_2025
print("PV of future cash flow 2025: ",pv_of_future_cash_flow_2025)

pv_of_future_cash_flow_terminal_value = free_cash_flow_terminal_value
/discount_factor_terminal_value
print("PV of future cash flow terminal Value: ",pv_of_future_cash_flow_terminal_value)

todays_company_value = pv_of_future_cash_flow_2022 +  pv_of_future_cash_flow_2023
                + pv_of_future_cash_flow_2024 + pv_of_future_cash_flow_2025
                + pv_of_future_cash_flow_terminal_value

print("Today's Company Value: ",todays_company_value)

#Fair Value of Company
fair_value_of_company = todays_company_value / shares_out
print(fair_value_of_company)

def decision():
   if(fair_value_of_company < si.get_live_price(ticker)):
      print("OVER PRICED!!")
      print("Fair value of company: ",fair_value_of_company)
      print("Current value of company: ",si.get_live_price(ticker))
   else:
      print("UNDER PRICED")
      print("Fair value of company: ",fair_value_of_company)
      print("Current value of company: ",si.get_live_price(ticker))

decision()
```