Independent University **Bangladesh (IUB)**

IUB Academic Repository

Internship Reports Summer 2022

2022-09-13

Sales Trend Monitoring System (STMS) of Beximco Pharma

Gomes, Daniel

Independent University, Bangladesh

https://ar.iub.edu.bd/handle/11348/790

Downloaded from IUB Academic Repository



An Undergraduate Internship on Sales Trend Monitoring System (STMS) of Beximco Pharma

By

Daniel Gomes

Student ID: 1822007

Semester of Summer, 2022

Supervisor:
Ajmiri Sabrina Khan
Lecutrer
Department of Computer Science & Engineering
Independent University, Bangladesh

September 13, 2022

Dissertation submitted in partial fulfillment for the degree of Bachelor of Science in Computer Science

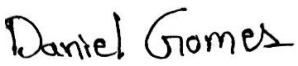
Department of Computer Science & Engineering

Independent University, Bangladesh.

Attestation

In Sincerity, this is to certify that "Sales Trend Monitoring System" is constructed by Daniel Gomes (ID-1822007, Dept. CSE) as Undergraduate Internship in partial fulfillment of the requirement for the Degree of Computer Science & Engineering from Independent University, Bangladesh (IUB) under supervision and guidance of Ajmiri Sabrina Khan (Internal Supervisor) and Arup Kanti Deb (External Supervisor). All the work under progress is completely authentic and genuine as experience of internship is one of the most highly required part of my career growth and skills. I hereby declare that none of my work is plagiarized or any malpractice was adapted during the course of my Internship.

Sincerely,



Signature 13/09/2022

Daniel Gomes Date

Acknowledgement

I would like to thank God, Almighty, for providing me with this wonderful opportunity to work with one of the most renowned Multi-National Corporation as Beximco Pharmaceuticals ltd.

I would also like to express my gratitude towards my institution and my supportive internal supervisor and lecturer, Ms. Ajmiri Sabrina Khan, for her valuable time and guidance towards the completion of a challenging project based on my internship program.

I would also like to thank my external supervisor, Mr. Arup Kanti Deb, Senior Manager, at MIS department, and his team for enormous support, guidance and acceptance of my project idea and providing me with a wonderful opportunity to learn more about the company and bond well with my environment and wonderful MIS family.

Lastly, I would like to thank the authorities and regulatory bodies at Independent University, Bangladesh for providing me with an opportunity as the internship program which has contributed to addition of new skills and experiences in my career growth.

Daniel Gomes

1822007

13/09/2022

Dhaka, Bangladesh

Letter of Transmittal

Date

Ajmiri Sabrina Khan

Internship Supervisor & Lecturer

Department of Computer Science and Engineering

Independent University, Bangladesh

Subject: Internship report on 'Sales Trend Monitoring System', a product for Beximco Pharmaceuticals Ltd.

Dear Madam,

I am grateful to have this opportunity to submit an internship report to you on 'Sales Trend Monitoring System' which is a web application developed for Beximco Pharmaceuticals Ltd. This report highlights the experiences I have gathered during my three months internship at Beximco Pharmaceuticals Ltd. It was a wonderful experience with Beximco Pharma where I was granted this wonderful opportunity to discover my true skills and unlock new potentials. It would be my honor to provide you with all the knowledges I have gathered so far and product that I have been able to engineer as per requirement through this report so that it serves its intended purpose. I am also very grateful for your time, support, knowledge and direction which has played important role in completing my internship program. I really hope and pray that you will find my report acceptable.

Thanking you for your kind co-operation and guidance throughout my internship program.

Yours Sincerely,

Daniel Gomes

1822007

Evaluation Committee

Internal Supervisor



Signature

Ajmiri Sabrina Khan

Name

Internal Examiner



Signature

Sanzar Adnan Alam

Name

Organizational Supervisor



Signature

Arup Kanti Deb

Name

Head of Department



Signature

Dr. Mahady Hasan

Name

Abstract

Sales Trend Monitoring System (STMS) is a web application engineered for employees to monitor sales and analyze sales trend. Data is very important resource in the present time as it holds important value which enables organizations to manage business. STMS helps employees tack progress of sales in real time. It provides control of sales process which can be utilized to increase sales performance. The application allows users to upload sales files which is read by the system. In this process, data is extracted from the uploaded file and then sorted and stored at the backend of the SQLite server. The system allows user to enter dates preferred to search for data frames and graphs to analyze and monitor sales trend. Users can select preferred chart choices, namely, pie chart, bar chart and line chart. The search can be resulted by transaction id or sales date. After setting all the search preferences and selecting search, the data frames, namely, Sales Data Frame, Positions Data Frame, Merged Data Frame is displayed on the screen along with the preferred chart and result. Forecasted graph is displayed to provide sales forecast. Users can add new reports and save it which is available on the Reports page. The sales details are available for each transaction. The main objective of the application is to provide users with fast calculations, sales trends and forecasted analytics.

Contents

Attestation ……Page 2

Acknowledgement...……...Page 3

Letter of Transmittal...……..Page 4

Evaluation Committee…..……...Page 5

Abstract…….……Page 6

Table of Content……....Page 7

List of Figures…….……...Page 9

1. **Introduction…….……Page 10**
   1.1 Overview …..……..Page 10
   1.2 Objectives…..……...Page 11
   1.3 Scopes……..Page 11

2. **Literature Review……..……..Page 12**
   2.1 Relationship with Undergraduate Studies……..……Page 12
   2.3 Related Works……...……..Page 13

3. **Project Management & Financing……..Page 14**
   3.1 Work Breakdown Structure…….....Page14
   3.2 Process/Activity wise Time Distribution…….....Page 16
   3.3 Gantt Chart…….…..Page 16
   3.4 Process/Activity wise Resource Allocation…….Page 18
   3.5 Estimated Costing……Page 19

4. **Methodology…….Page 20**

5. **Body of the project……...Page 21**

   5.1 Six Element Analysis ……..Page 21

   5.2 System Analysis……Page 22
      5.2.1 Six Element Analysis ……..Page 22

5.2.2 Feasibility Analysis……Page 23
5.2.3 Problem Solution Analysis……Page 24
5.2.4 Effect and Constraints Analysis……Page 24
5.3 System Design……Page 25
5.3.1 Rich Picture……...Page 25
5.3.2 UML Diagrams……..Page 26
5.3.3 Functional and Non-Functional Requirements……..Page 27
5.4 Product Features……..Page 27
5.4.1 Input……Page 35
5.4.2 Output……...Page 38
5.4.3 Architecture ……..Page 44

6. Result & Analysis……..…..Page 45

7. Project as Engineering Problem Analysis…….....Page 46
7.1 Sustainability of the Project/Work……..Page 46
7.2 Social and Environmental Effects and Analysis…….Page 46
7.3 Addressing Ethics and Ethical Issues……..Page 47

8. Lesson Learned…….....Page48
8.1 Problems Faced During this Period……..Page 48
8.2 Solution of those Problems……...Page 49

9. Future Work & Conclusion……Page 50
9.2 Future Works……Page 50
9.2 Conclusion……Page 50

Bibliography……..Page 51

List of Figures

3.1: Work Breakdown Structure……..Page14

3.2: Critical Path Mapping…….Page 16

3.3 Gantt Chart STMS……..…….Page 18

3.4 Activity Wise Work Percentage Allocation……...……..Page 19

3.5 Estimated Cost…….Page 20

4.1 Agile Methodology…….Page 21

5.2.1 Six Elements……...Page 23

5.3.1 Rich Picture STMS……Page 26

5.3.2: Use Case Diagram……Page 27

5.3.3: Activity Diagram……..Page 28

5.3.4: ER Diagram……..…Page 29

5.3.5: Functional Requirements……..…Page 34

5.4.1: Login Page……Page 35

5.4.2: Home Page…….Page 35

5.4.3: User Profile Page……...Page 36

5.4.4: Add from file page…….Page 36

5.4.5: Reports Page…….....Page 37

5.4.6: Sales Page……...Page 37

5.4.7 Add from file Page Output…….Page 38

5.4.8 Home Page Output……..Page 38

5.4.9 Reports Page Output……...Page 40

5.4.10 Reports Detail Page……...Page 41

5.4.11 Reports PDF Page……..Page 41

5.4.12: Sales Page…….…Page 42

5.4.13: Sales Detail Page……...Page 42

5.4.14: Admin Page……Page 43

5.4.15: System Architecture……..Page 44

Chapter 1

Introduction

1.1 Overview

Sales Trend Monitoring System is a proposed solution which will provide sales trend and performance analytics that will be useful for Beximco Pharma in terms of budgeting and financial analysis to make progress in revenue growth rate of business. The goal is to collect and observe the existing sales data over a historical period and compare it with the time frames which will project the future trend and predict the sales in near future with the existing pharmaceutical products on the shelf. The system will include predictive modelling such as Time-Series Regression or to find out how much sales can possibly occur in the next periods, Growth rate analysis to find which products are having highest or lowest growth or decline, Time-Series similarity Analysis to show which products will have similar or opposite sales pattern and Correlation Analysis to show how consistent the growth or decline trend will be.

Sales and Performance Monitoring System will include sales trend analysis based on daily, weekly, monthly, quarterly, half-yearly, yearly and hourly period. It will be performed based on the products. By utilizing the Regression analysis technique such as ARIMA Model, a predictive model will be developed to summarize the trends of historical data which will be applied to sales time-series data. Based on the time-series projections, inventory levels will be maintained efficiently so that the company can plan manufacturing capacities. Forecasting will be short term, mid term and long term. Sales time-series data will contain seasonal patterns to find particular product sale that can fluctuate based on seasonal ARIMA. Underlying sales patterns makes It challenging to project sales figures accurately, thus time-series regression will be capable of capturing these hidden data which will be utilized to predict values on seasonal adjustments.

1.2 Objectives

- Allow users to import data files such as csv or excel files which will be cleaned and processed for projection of the graphical trend curve.
- Provide analytical report of the corresponding graphical depictions.
- Provide stakeholders with comparative sales analysis based on existing product by two or more competitors using ARIMA (Auto-Regressive Integrated Moving Average) Model.
- Provide sales details.
- Provide Data Frames.

1.3 Scopes

- **Login Page** – This page will be used to verify registered user into the web application with their designated credentials.
- **Admin Page** – This page will display options for the administrator privileges such as Creating user, removing user, updating user access, view site and other administrative advantages.
- **Home Page** – This page will display homepage to the user where list of the menu will be available for quick access. Users will be allowed to enter sales date into the fields and select choice of chart such as Bar chart, Pie chart or Line chart and result by which will display the charts according to the choice of selection such as transaction id or sales date. Data frames such as Sales Data Frame, Positions Data Frame, Merged Data Frame and Grouped by Data Frame will be displayed and below the choice of chart will also be displayed. Users can then add Report and save it.
- User Profile page – This page will allow users to view the bio and upload profile picture.
- **Add from File page**– This page will display a drag and drop box which will allow users to simply select the choice of csv file and drop it across the box and the data will be pushed into the designated database models for further operations.
- **Reports Page** -This page will display list of analytical reports ready to be viewed, download or print.
- **Sales Page –** This page will display sales list from which users can select any transaction id and view the sales detail for a particular product.

Chapter 2

Literature Review

2.1 Relationship with undergraduate studies.

The advanced courses designed by the Department of Computer Science and Engineering has been utilized in the course of internship which has contributed in the development and deployment of STMS (Sales Trend Monitoring System). The respective courses are:

- **CSE213**, **Object Oriented Programming**: This course is based on the concepts of object-oriented programming with background of procedural programming. The basic concepts include objects, classes, constructors, destructors, abstract data types, composition, inheritance, polymorphism, overloading, function chaining. Although languages used were C++ and Java, I have utilized and applied the concept of OOP using Python as it was convenient for me due to the application of Python in courses such as CSE317, Numerical Methods and CSE 417, Data Mining.
- **CSE303, Database Management**: This course is based on database design and the use of database management systems. It covers the concepts of the development process, database architectural principles, relational algebra and SQL using SQL server. Other topics such as data modelling (E-R modeling, relational data model, integrity constraints, data model operations, normalization, OOP data modelling), database security, administration and distributed systems were also utilized as the concepts to build the backend for the system.
- **CSE317**, **Numerical Methods**: This course is based on the numerical approximation techniques. Topics that were covered in the course were, floating point computation, accuracy and errors, solutions of single variable equations, interpolation, polynomial approximation, numerical differentiation and integration, methods for solving single variable equations, systems of linear equations, first order differential equations, systems of linear equations first order differential equations and initial value problem.
- **CSE307, System Analysis & Design**: This course is based on the utilization of tools and techniques used to design and analysis of information systems. It covers topics such as Systems and models, Project Management, Tools for determining system requirements, dataflow diagrams, decision table and decision tree, System analysis: systems development life cycle models, Object Oriented analysis: use-case modelling, Unified modelling language. Feasibility analysis, Structured Analysis. Systems prototyping, System design and implementation: application architecture, user interface design, Front

end and backend design, database design, software management and hardware selection and lastly Case studies of information systems.

- **CSE417**, **Datamining and Warehouse**: This course is based on the fundamental concepts of data mining and techniques associated with analysis of large data sets. The topics that were covered in the course were data mining, classification of data mining and data models, data pre-processing, data mining primitives, query languages and system architecture, characterization and comparison, association rules, cluster analysis, multidimensional analysis and descriptive mining of complex data objects, data mining in distributed heterogenous database systems, data mining applications and the future of research issues.
- **CSE451**, **Software Engineering**: This course is based on analysis, design and implement complex software engineering projects. Although this course focuses on the group development project from the beginning to the end. Other aspects of the course such as software as product and process, Project management and planning, tracking and scheduling, risk analysis and assurance techniques, configuration management, project and process metrics, size and function oriented metrics, software testing techniques, black box and white box techniques, testing strategy, unit, integration and system testing, concepts of OOP, event-driven and network programming m client-server architecture and web engineering are some of the fundamentals to the project

2.2 Related works

Beximco Pharma currently utilizes a Sales Monitoring System (SMS) web application to keep track of their sales in revenue growth both in national and international market. The system provides real time data and records of sales as well as past history. The system has features to forecast data based on previous sales. It aims to monitor business expedite to increase sales and most importantly to increase profit of the company. The main objective of SMS is to know and identify the business process and problems, gain economy in purchasing, determine commodity, maintain data consistency, reduce manual works through automated system, provide valuable information related to material purchase, keep track of supplier and items details purchased. Get right quality of supplies at right time and place, generate reports as on date for particular period. It provides user friendly interface and improves accuracy of calculation of data. It provides easy accessing and retrieval of information quickly. It also ensures data security by providing backups and provide user privileges.

Chapter 3

Project Management & Financing

3.1 Work Breakdown Structure

The WBS (Work Breakdown Structure) for STMS (Sales Trend Monitoring System) can be utilized to break down the entire project into small components highlighting the achievable objectives and create the required deliveries. The main objective is to take the entire project scheduling and cost estimations and break it down into hierarchical manner.

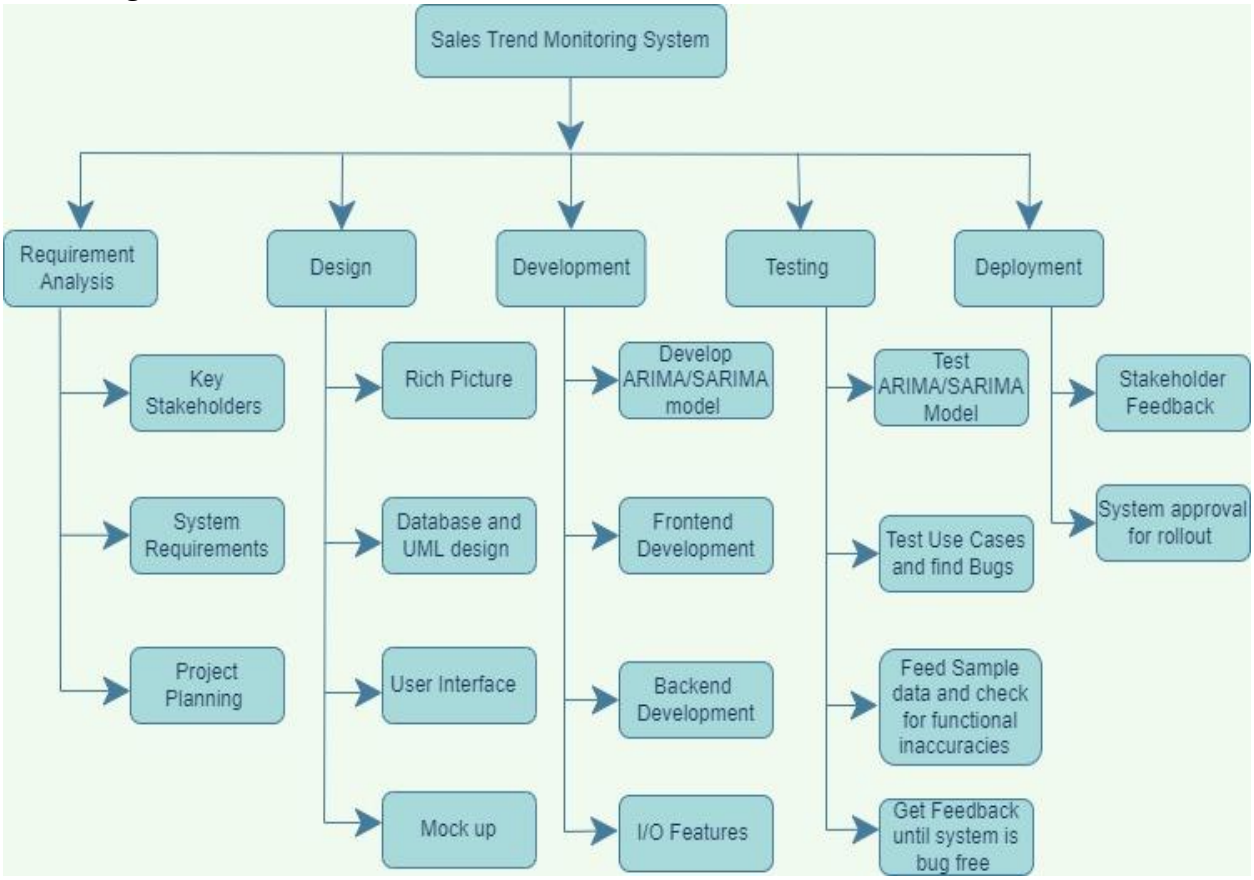


Figure 3.1: Work Breakdown Structure

- **Requirement Analysis:** In this phase, a descriptive initial documentation will be created highlighting the basic project needs or general guideline to reduce the initial needs and emphasize on the necessities based on the system analysis and requirements.
- **Design:** A rough mock-up of the user interface during the stage of the System Development Life Cycle will be built in order for evaluation of the software application. Rich picture, UML diagram, Activity Diagram will be completed in this phase.
- **Development:** During this phase, code will be produced and design documentation will be translated into actual software. However, this phase is time consuming since it forms the foundation of the entire process but there aren't too many iterations in this phase. As for the programming language, Python will be used since required packages such as numpy, pandas, y-finance. Pmdarima, statsmodel, csv and matplotlib.pyplot are available for creating a forecasting model using the functional KPI.
- **Testing:** The application will be tested for compatibility and ensure that the software is bug free. Testing will grow more comprehensive, and include not only functional testing but also system integration, interoperability, and acceptance testing.
- **Deployment:** The Sales Trend Monitoring System Software will be installed on the servers and made available to the company either as demonstration or actual use. Iterations will include updating of certain modules, adding new features and detecting and fixing issues.

Once all phases are completed, a discussion regarding the progress will be achieved toward meeting the requirements. Suggestions for improvements are highly encouraged during this phase for further development of the software in the future.

3.2 Process/Activity wise Time Distribution

Critical Path Analysis (CPM) is a technique for a project management that defines the steps and activities that helps a project to be completed in due time. The following CPM below defines tasks that are identified into Non-Critical and Critical paths. After evaluation, total 60 days were allocated for the project to be completed and delivered to Beximco Pharma.

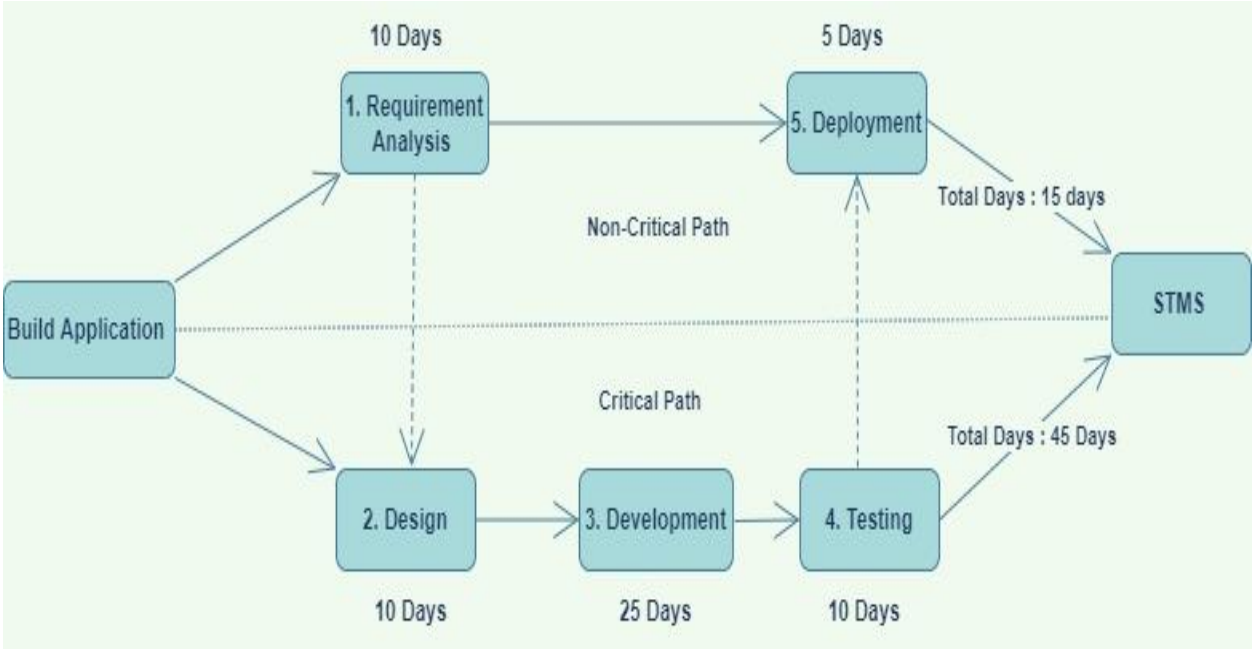


Figure 3.2: Critical Path Mapping

1. **Requirement Analysis:** In this task, requirements were gathered regarding the data design, functionality and utilization of the application. Ten working Days were allocated in order to understand and identify the purpose of the application and what organizational data could be provided and in order for the system to process the output graphical trends. Analysis such as Six Element Analysis, Feasibility Analysis, Problem Solution Analysis, Effect and Constraint Analysis were documented in gathering of requirements analysis phase.

2. **Design:** In this task, ten working days were allocated in processing the information gathered during the analysis phase in order to map the rich picture to give a general idea of the system. The UML diagram was also designed during this phase which includes the Use Case Diagram to demonstrate how the users could interact with the system. Based on the use case diagram the Activity Diagram was also designed to demonstrate the flow of events. Entity Relation Diagram was also designed to demonstrate the connection between entity sets and how the logical structure of the database system handles the data.

3. **Development:** In this phase, 25 days were allocated in order to program the backend to manage the database systems and the frontend to allow users to interact with the system and utilize the data to project forecast sales trend and growth rate analysis. The ARIMA/SARIMA model applying Machine learning algorithm was written in jupyter notebook and tested with sample data to observe the predictable outputs. The code was then integrated with the code base and connected with the backend of the sqlite3 server to feed the ARIMA/SARIMA model and the visual output projected at the frontend to the user.

4. **Testing:** For this phase 10 days were allocated for revision of the first three phases and walk through of the scopes of the project was delivered. Feedbacks were noted during this phase for further modification of the application. According to the feedbacks, the application was updated and Quality Assurance was conducted as part of the testing phase.

5. **Deployment:** After the completion of the project, 5 days were allocated for the deployment where the application is ready to be hosted on Beximco's server domain.

3.3 Gantt Chart

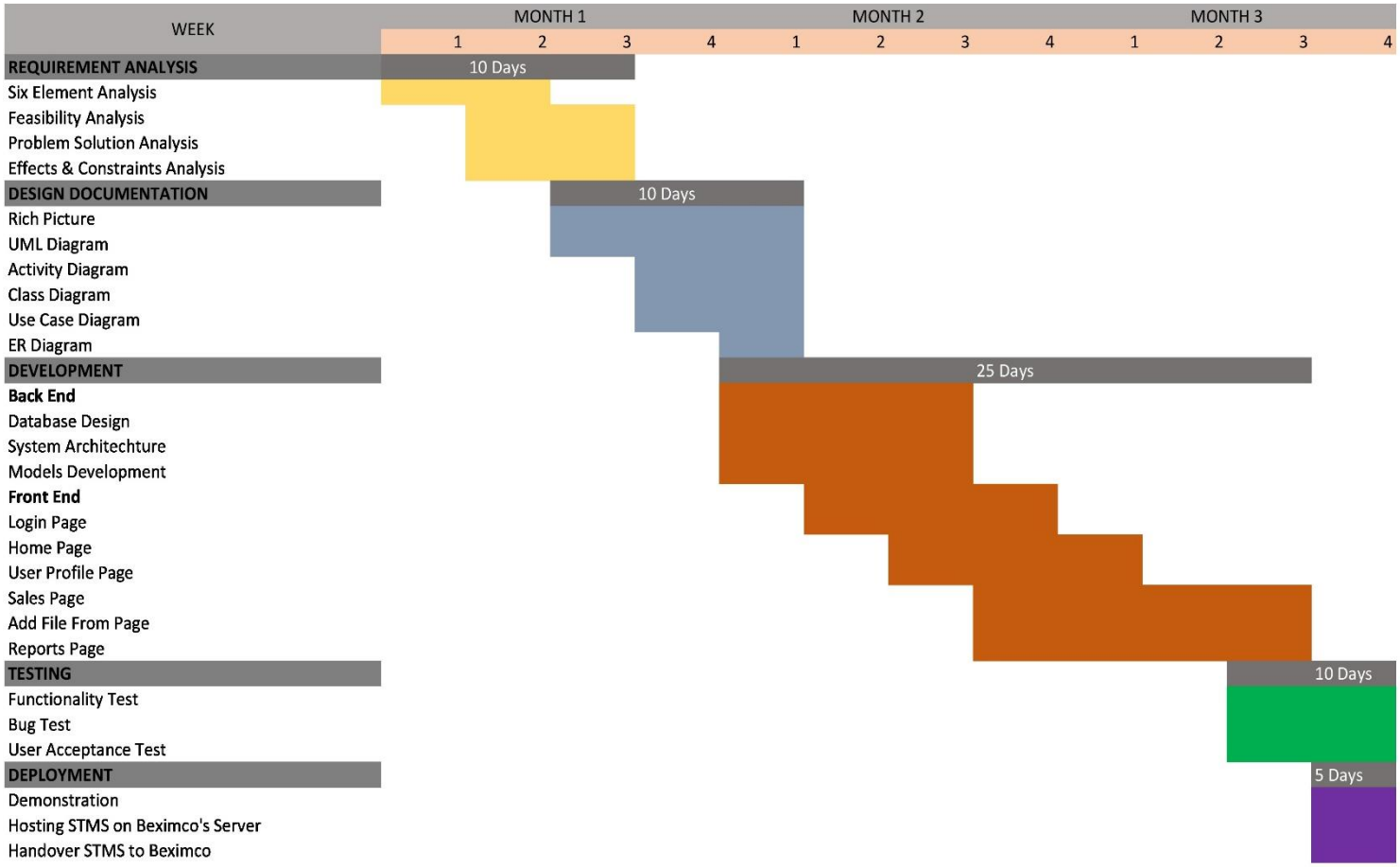


Figure 3.3 Gantt Chart STMS

Gantt Chart is one of the most useful tools for project management. It is typically a type of bar chart which illustrates schedules based on activities and time intervals emphasizing the start and finish dates for specific task. It helps to monitor the progress of the work and the degrees to its completion. Furthermore, it projects tasks on a vertical axis and timelines that represents task duration. During the work progress of engineering STMS, the Gantt aided to keep track of the start date of specific project schedule, what tasks to be dealt with on next steps, The percentage of work progress to complete each activity, milestones and project phases based on the schedule, the critical path for the project and the finish date for the project. As every other typical project, this project is estimated to take 60 working days to complete with activities mentioned above in the figure.

3.4 Process/Activity wise Resource Allocation

Task	Days	Work Progress(%)
Requirement Analysis	10	10%
Design	10	25%
Development	25	50%
Testing	10	10%
Deployment	5	5%
Total	60	100%

Figure 3.4 Activity Wise Work Percentage Allocation

Resource allocation, in other words known as resource scheduling helps to map and assign resources for specific period of time based on the activities. The scope of project can change during the project life cycle. Changes in project requirements can also trigger changes in resource allocation. For this project, spreadsheet is used to map the resource allocation which shows the 100 percent of the overall work divided into five tasks, namely:

- Requirement Analysis: 10 Days
- Design: 10 Days
- Development: 25 Days
- Testing: 10 Days
- Deployment: 5 Days

It is estimated that it will take around 60 working days to complete the project in three months. Since

3.5 Estimated Costing

Work Distribution	Cost(BDT)
Interface Design	0
Functionality	0
Maintenance	0
Total:	0

Figure 3.5 Estimated Cost

In a web application or software application development, the most common question that arises is that how much does it cost to develop a system and how much time does it take for the development team to complete the project. It is planned and supported by project manager and architecture team, development team, and test team for performing these tasks. It is based on well-defined cost model of the system on a credible basis. The use of cost estimation determines how many engineers are required to develop and establish the project during planning stage while keeping a track of the project's progress. The above Estimated Cost table provides cost estimation for Interface Design, Functionality and Maintenance.

Chapter 4

Methodology

In order to build a functional system web application within a short course of time, Agile methodology is be adapted for continuous development and testing through out the development cycle of the project to save a lot of time by optimizing the tasks and avoid errors that may occur during the planning stages. The Agile methodology is simple yet effective methodologies to set the goals into working reality. It proposes incremental and iterative approach to system design. The systems engineering involves breakdown of models individually where individuals work can work on at efficient pace. Furthermore, client has early frequent opportunity to look at the product and suggest any changes required. In case of building STMS, it is a really helpful method to implement the project rapidly since it is a small project. Although I did not have a team and had to work solo, I was still able to manage all the roles by myself.

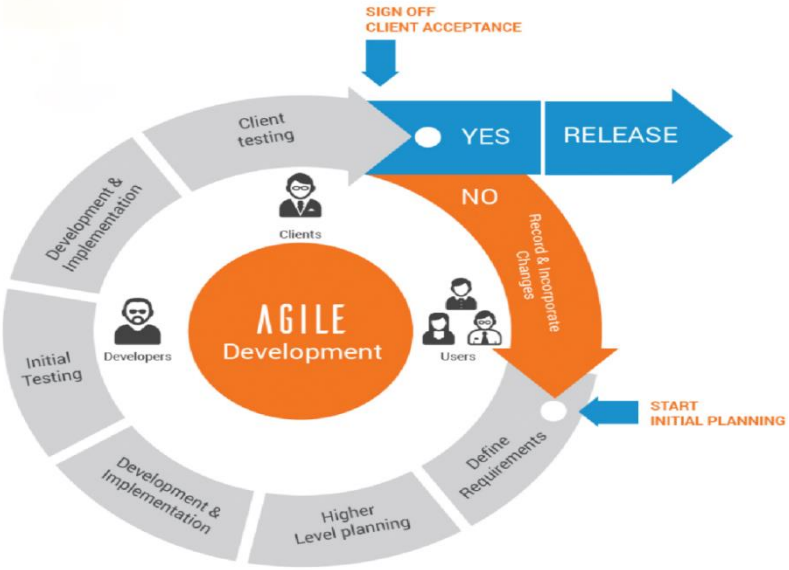


Figure 4.1 Agile Methodology

Chapter 5

Body of the Project

5.1 Work Description

Beximco Pharma was founded in 1976 and started operations in 1980, manufacturing products under licenses of Bayer AG of Germany and Upjohn Inc of the US. In present time, Beximco Pharma manufactures and markets its own branded generics of diseases such as AIDS, Cancer, Asthma, Hypertension and diabetes targeting both national and international markets. It is a privilege to have this wonderful opportunity to work for a reputed company and the MIS Department. The main objective of the STMS website application is to take existing sales data, process the data to depict visual sales trend and forecast sales applying ARIMA model. By inputting date range and selecting the choice of results, users can view and save the graphs. The Reports can be viewed or downloaded in pdf format from the reports page. To save time and make data input easier, Add From-File page is designed to allow users to convert the excel sheet to csv file and simply drag and drop it which is scanned by the file reader and the data is then stored to its designated fields. The calculations are all executed by code or functions which reduces complexities to manually calculate and set values. The Sales page allows user to view sales list from where users can select sales list by transaction id and view the detail of sales for individual products.

Since the project idea was primarily proposed by me, I had the privilege to utilize my full-stack python knowledge including the front-end, back-end and integrating the functionality as well as optimization of the ARIMA model using packages such as y-finance, pmdarima, statsmodel. The front-end of the web application is built utilizing HTML and for styling CSS with customized JavaScript and jQuery functions and plugins. For backend I have used Sqlite3 for database. Furthermore, I have used Bootstrap4 which is currently a popular CSS Framework for developing the responsiveness of the website. The entire project is built using the Django framework which is a free open source python-based framework which follows the MTV(Model Template View) architectural pattern quite similar to MVC(Model View Control) architecture of C# ASP.Net. It helped me to keep the codes as tidy and organized as possible and utilize short time to create complex database driven website while reusing components, coding less and rapid development of the STMS site.

5.2 System Analysis

The term "System Analysis" refers to the process of analysis of a business to identify the purposes as well as the goals in order to create procedures that can followed to achieve efficiency to a solve real world problems by breaking down larger components into sub components then into micro components for complex tasks that can be executed within a certain short amount of time. The fields are closely related to the requirements analysis which is a form of explicit formal inquiry carried out to help identify a better course of action alternative to existing inefficient system. Analysis can also be a series of components that perform functions together such as system engineering which focuses on how complex engineering projects can be designed and managed. In computer-based IT systems the development of system analysis phase helps produce a data model which is precursor to creating enhanced database. Once the computer- based IT system is developed, System Analysis constitutes the development of feasibility study which determines whether if the project is economically, socially, technologically and organizationally feasible. Scope Analysis or Definition is stated which defines the clear objectives and requirements necessary to meet project requirements. Problem Solution Analysis which helps understand problems and needs that are required to be met. Requirement Analysis which helps determine the conditions that are required to be met. Effects and Constraint Analysis provides insight on how analysis models respond to the variation of parameters.

5.2.1 Six Element Analysis

Process	Human	Non-Hardware	Computing Hardware	Software	Database	Communication Network
Login	User, Admin	N/A	Computer	Web Browser	Sqlite3	WAN/LAN
Upload files	User	N/A	Computer	Web Browser	Sqlite3	WAN/LAN
Search Sales	User	N/A	Computer	Web Browser	Sqlite3	WAN/LAN
Save Report	User	N/A	Computer	Web Browser	Sqlite3	WAN/LAN
View Report	User, Admin	N/A	Computer	Web Browser	Sqlite3	WAN/LAN
View Sales Details	User, Admin	N/A	Computer	Web Browser	Sqlite3	WAN/LAN

Fig 5.2.1 Six Elements

5.2.2 Feasibility Analysis

Feasibility analysis helps evaluate key factors applicable to a project which includes economic, technological and legal aspects and project time frame. The purpose of the Feasibility Analysis is to help predict the likelihood of project success. It intends to logically examine the pros and cons of existing or proposed system of a business and related venture and resources as per requirement to execute operations and equate the success rate. It also gives a vivid idea of the budget that is associated and the return that can be expected. Feasibility study is carried out based on analysis whether if the intended software product is right in terms of development, implantation and contribution to the organization.

1. **Technical Feasibility:** In Technical Feasibility, existing resources such as both hardware and software with additional technology is analyzed to develop the project. It provides feasibility of resources and technology that can be utilized in the project development along with the technical skills and capabilities of the engineering team. This project however is technically possible since the hardware, software is available for the development of STMS.
2. **Economic Feasibility:** In Economic Feasibility, we analyze the cost and benefit of the project. A detailed analysis is carried out regarding the cost of the project and development which includes the costs associated with the hardware and software, design, development and operational cost in terms of understanding whether if the project is beneficial for organization. For this project, there is no required for extra labor as I will be working on almost all of the roles to develop the system. There is no additional cost associated with the maintenance and functionality of the system.
3. **Legal Feasibility:** In Legal Feasibility, analysis is carried onwards the legal point of view which emphasizes the barriers on legality of the implementation of the project for the organization, data projection acts or social media laws, project certificate, license and copyright etc. Simply it's the legal feasibility of the proposed project that conforms legal and ethical requirements. For this project however, access to sensitive sales data is denied as it is strictly prohibited to share data outside of the organization externally.
4. **Operational Feasibility:** In operational Feasibility, the degree of providing service to requirements is analyzed on how much the product will be easy to operate and maintain after deployment. It is associated with the scopes that determines the usefulness of the product and whether if the solution is acceptable or not. For this project, most functionality and codes are optimized to make operation easier. Since the codes are organized into different files it is much more convenient to manage for its tidiness.
5. **Schedule Feasibility:** In Schedule Feasibility, it deals with timelines and deadlines for the proposed project scheduled to be completed and delivered within the time frame. Teams take great initiative to complete the final project which has impact on the organization's purpose otherwise a failure if it is not deliverable within time.

5.2.3 Problem Solution Analysis

The proposal of Sales Trend Monitoring System (STMS) was unclear at the beginning as the scopes and objectives of the system to serve its purpose to the esteemed organization seemed pretty unrealistic. During the requirement analysis phase, upon a discussion with my external supervisor, few factors were considered in the spotlight regarding the accuracy of the data collection that could provide inaccurate results. Since the retail pharmacy shops do not have systems to monitor the outgoing sales of supplied products by Beximco pharma, it is quite challenging to conduct basket analysis using the apriori algorithm to find the products that are reaching the consumer ends. Another factor that effects the system is the existing competitors in the market. For example, Napa, a generic pharma product known as paracetamol, is one of the popular products which is recognized in national and international market branded by Beximco Pharma. Similarly, Ace is also a generic paracetamol product which is manufactured and branded by Square pharmaceuticals Ltd. The issue is that both companies have been competing to optimize the product and quality to increase sales of the said product, however, it is not possible to extract information from Square pharma regarding the sales of the paracetamol products to conduct the product growth comparison analysis as its company policy to keep data confidential. Another factor is that, Beximco Pharma has its strict company policy to keep the private data confidential. In order to continue with the proposed project, I decided to generate sample data and test it into the system to test the functionality of the modules. Furthermore, it was a very challenging task to pull the entire project by myself as the deadline pressure and to improve skills to meet the industry standards were quite overwhelming. Fitting the ARIMA model was also very challenging task as intensive study and research had to be conducted in order to align the model with the STMS site to forecast sales trend with best fit and accuracy as the sample data were generated by me. Additionally, I had to learn and apply the Django framework to build the STMS site with little knowledge I had gathered from working with MVC architecture and previous projects with python language.

5.2.4 Effect and Constraints Analysis

There were exceptions and constraints that had to be considered while developing the STMS site such as time, functionality and design. In depth analysis had to conducted in order to extract key information, considering how the system responsiveness and effectiveness could impact the targeted user experience.

5.3 System Design

5.3.1 Rich Picture

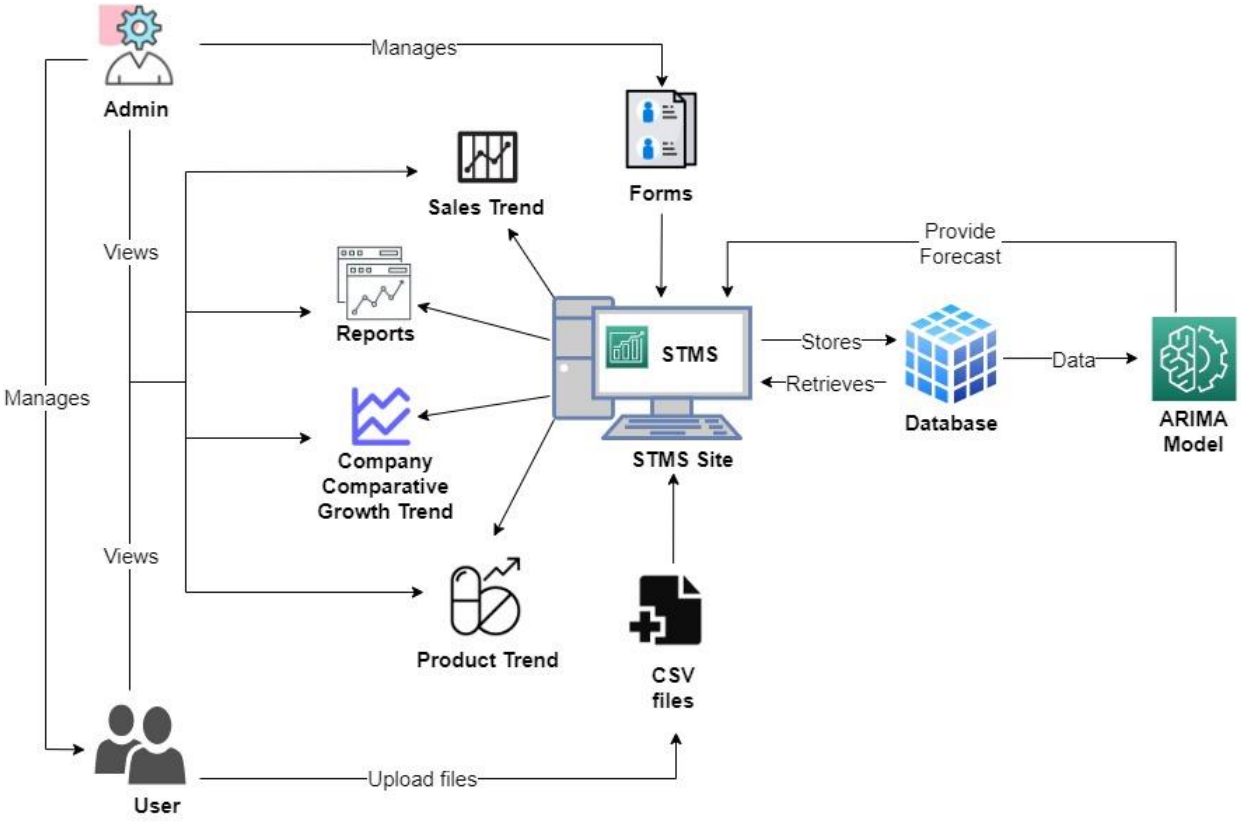


Figure 5.3.1 Rich Picture STMS

5.3.2 UML Diagrams

1. Use Case Diagram

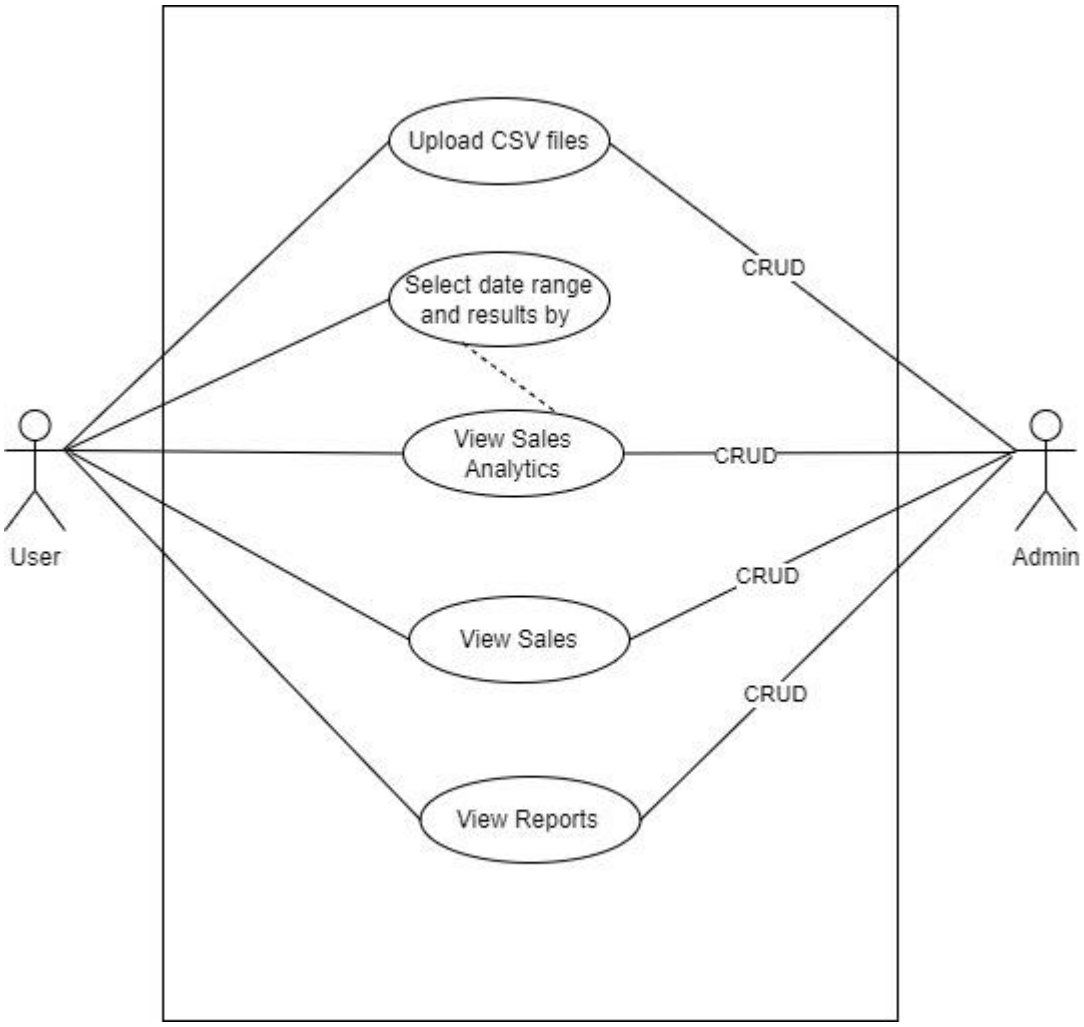


Fig 5.3.2: Use Case Diagram

2. Activity Diagram

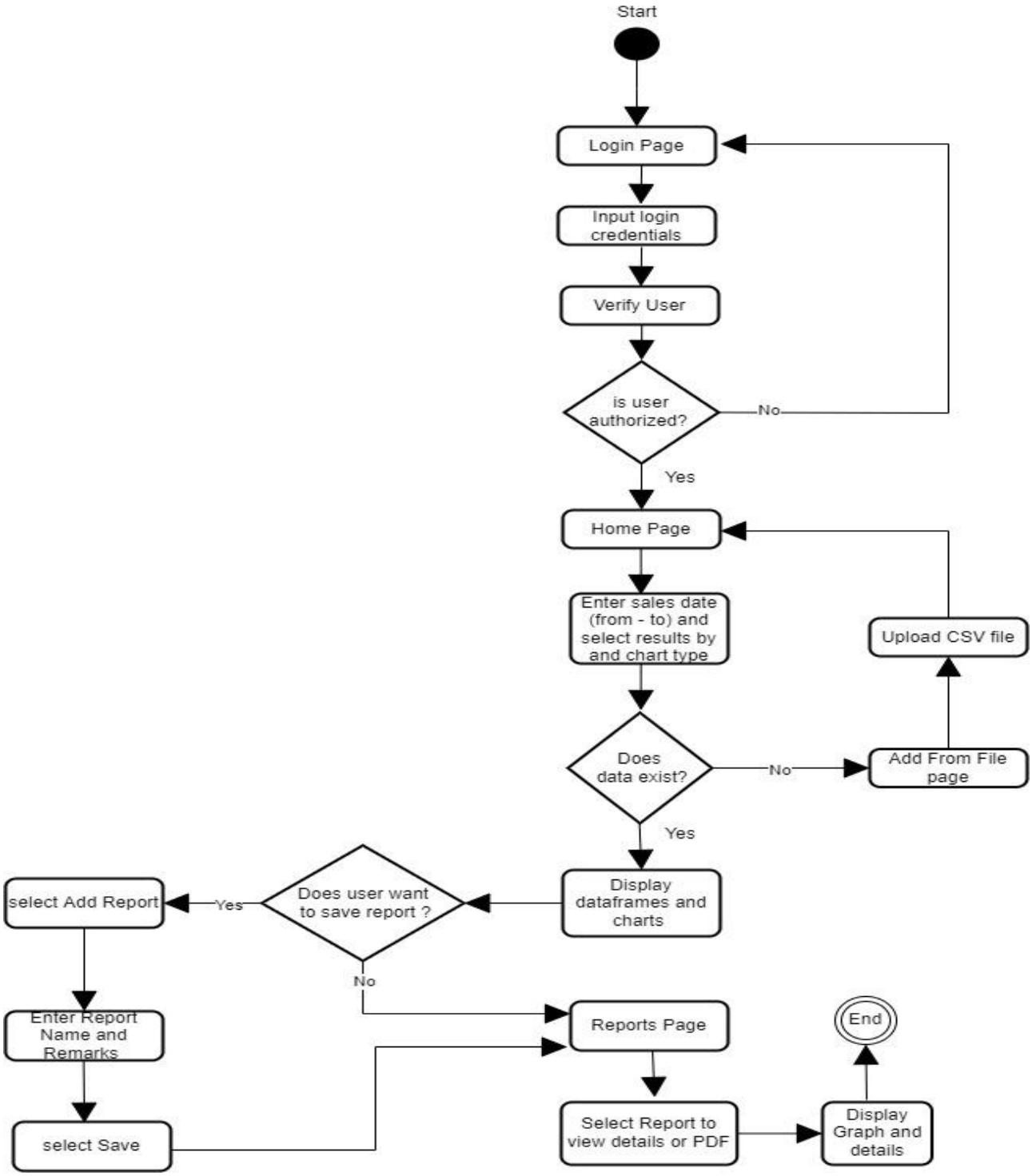


Fig 5.3.3: Activity Diagram

3. ER Diagram

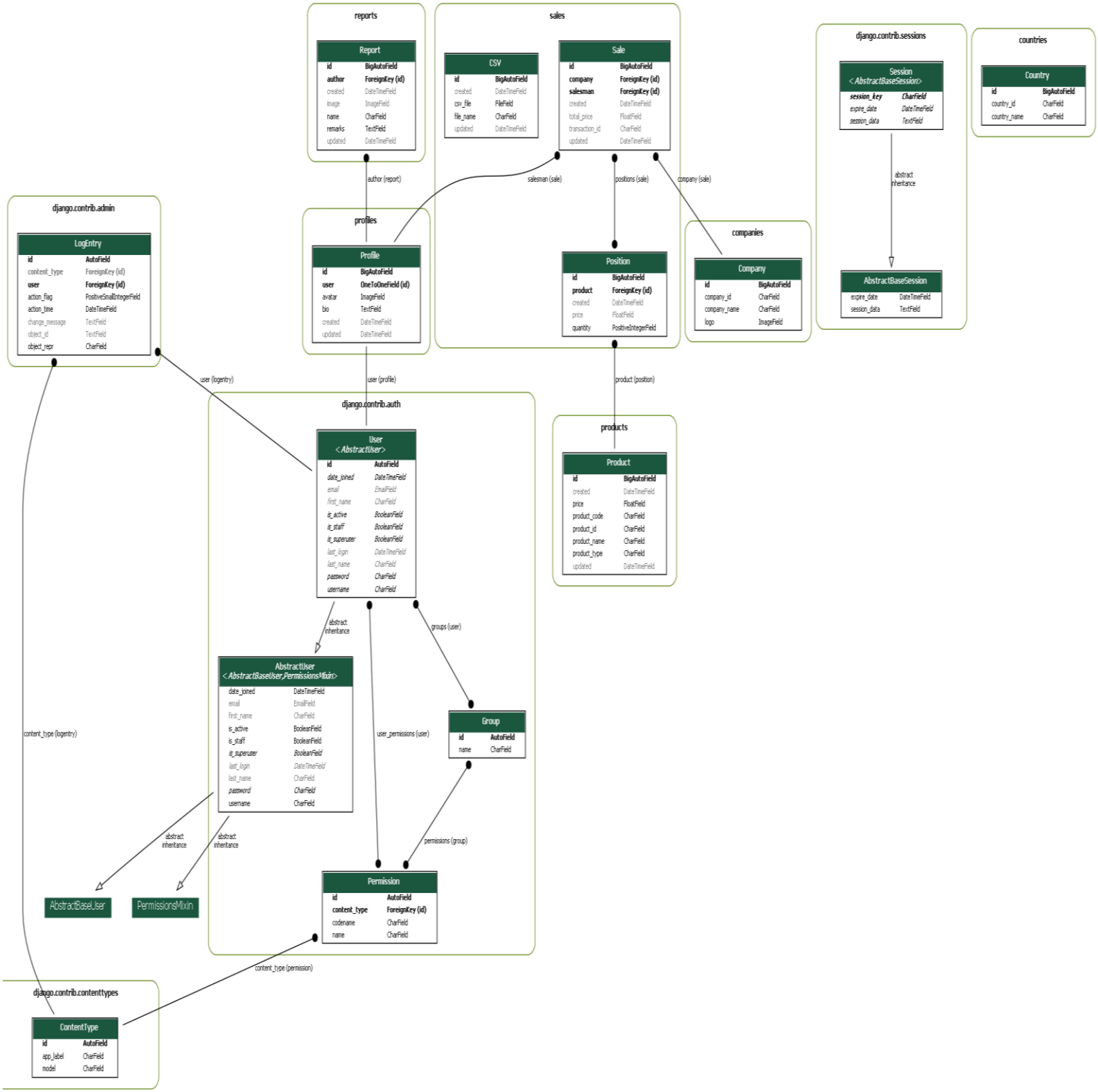


Fig 5.3.4: ER Diagram

5.3.3 Functional and Non-Functional Requirements

1. Functional Requirements

Name of Function: Login to STMS site		
Input: 1. Username 2. Password	**Process:** 1. Enter Username and Password. 2. select "Login" Button. 3. Verify login credentials. 4. Redirect user to Home Page.	**Output:** 1. User is successfully logged into the STMS site.
Pre-Condition:	1. User must be created and registered with the site by the Admin. 2. User must have username and password to log into the site.	
Post-Condition:	1. User is able to view the home page of the site. 2. User can view the menu on the top of the page.	
Alternative Options	1. If username and password is not valid, user will get invalid login error. 2. User will be prompted to enter correct username and password.	

Name of Function: Upload sales .csv files to Add File From page.		
Input: 1. file_name.csv file	**Process:** 1. Log in to STMS site with login credentials. 2. Select "Add from file" link from the menu. 3. Convert .xls file to .csv file. 4. Select file from drive and drag and drop it on the box provided for upload.	**Output:** 1. On success, message will be displayed "Uploaded Successfully".
Pre-Condition:	1. User must be Logged in to STMS site. 2. The file must column headers "Pos", "Transaction Id", "Product", "Quantity", "Company" and "Date" and the respective data. 3. The file must be converted to .csv format.	
Post-Condition:	1. On success, 'Uploaded Successfully" message will be displayed.	
Alternative Options:	1. If the .csv file was uploaded once, an error message will be displayed "File already exists!".	

<table>
<tr><td colspan="3">Name of Function: Search Sales data to view Data Frames and Graphs.</td></tr>
<tr><td>Input:
“Date From” in “mm/dd/yyyy” format.
“Date to” in “mm/dd/yyyy” format.
“Chart Type”
“Results by”</td><td>Process:
Log in to STMS site.
On home page, Enter Sales “Date From” in “mm/dd/yyyy” format.
Enter Sales “Date to” in “mm/dd/yyyy” format.
Select chart type from drop down choice.
Select Results by from drop down choice.
Select “Search” button.</td><td>Output:
“Sales Data Frame” will be displayed.
“Positions Data Frame” will be displayed.
“Merged Data Frame” will be displayed.
“Grouped By Data Frame” will be displayed.
Chart will be displayed as per selection.
Sales Forecast graph will be displayed.</td></tr>
<tr><td>Pre-Condition:</td><td colspan="2">User must be logged in to the STMS site.
.csv file should be uploaded to the “Add from file” page.
User must enter valid date range.</td></tr>
<tr><td>Post-Condition:</td><td colspan="2">User should be able to view all the Data frames displayed on the page.
User should be able to view the Chart.
User should be able to view the Forecasted Graph.</td></tr>
<tr><td>Alternative Options:</td><td colspan="2">If the .csv file is not uploaded to the system, an error message will be displayed “No data available in this date range!”
If the user does not enter the exact dates matching of the “Date” value in the .csv file, an error message will be displayed “No data available in this date range!”</td></tr>
</table>

<table>
<tr><td colspan="3">Name of Function: Add Sales Report</td></tr>
<tr><td>Input:
1. “Name”
2. “Remarks”</td><td>Process:
1. Log in to the STMS site.
2. On home page, Enter Sales “Date From” in “mm/dd/yyyy” format.
3. Enter Sales “Date to” in “mm/dd/yyyy” format.
4. Select chart type from drop down choice.
5. Select Results by from drop down choice.
6. Select “Search” button.
7. Select “Add Report” Button.
8. Enter report “Name” and “Remarks”.
9. Select “Save”</td><td>Output:
1. On success, a message will be displayed “Saved Successfully”</td></tr>
<tr><td>Pre-Condition:</td><td colspan="2">1. User must be logged in to the STMS site.
2. User must be logged in to the STMS site.
3. .csv file should be uploaded to the “Add from file” page.
4. User must enter valid date range.
5. “Add Report” button should be displayed.
6. User must enter report name and remarks.</td></tr>
<tr><td>Post-Condition:</td><td colspan="2">1. User should be able to save the report and on success “Saved Successfully!” message will be displayed.</td></tr>
<tr><td>Alternative Options:</td><td colspan="2">None</td></tr>
</table>

<table>
<tr><td colspan="3">Name of Function: View Reports</td></tr>
<tr><td>Input:
None</td><td>Process:
1. Log in to the STMS site.
2. Select “Reports” link from the menu.
3. From the list of reports, to view report details, select “Details”.
4. From the list of reports, to view report reports in PDF, select “PDF”.</td><td>Output:
1. User will be redirected to the “Reports” page where all the saved reports will be available.
2. If user selects “Details” user will be redirected to the “Details” page where all the details will be displayed.
3. If user selects “PDF” user will be redirected to the “PDF” formatted page where the report will be displayed and options to print and download will be available.</td></tr>
<tr><td>Pre-Condition:</td><td colspan="2">1. User must be logged in to the STMS site.
2. User must save the reports.</td></tr>
<tr><td>Post-Condition:</td><td colspan="2">1. User should be able to see list of reports.
2. User should be able to select “Details” and view the report details.
3. User should be able to select “PDF” and view the report in PDF format.</td></tr>
<tr><td>Alternative Options:</td><td colspan="2">None.</td></tr>
</table>

Name of Function: View Sales Details.		
Input: None.	**Process:** 1. Log in to the STMS site. 2. Select "Sales" link from the menu. 3. From the sales list select link provided with the "Transaction Id"	**Output:** 1. List of sales will be available in ascending order. 2. Sales information for specific Transaction Id will be displayed.
Pre-Condition:	1. User must be logged in to the STMS site. 2. User should be able to find the "Sales" link on the menu and select the link. 3. User should be able to select sales from the list provided by the Transaction id.	
Post-Condition:	1. User should be able to see the details of the sales including Company, Transaction Id, Salesman, Product, Quantity, Price.	
Alternative Options:	None.	

Fig 5.3.5: Functional Requirements

2. Non-Functional Requirements

- **Performance**
  1. **Response Time:** 55ms – 22.08ms
  2. **Processing Time:** 36ms
  3. **Query & Reporting Time:** 24ms
- **Capacity and Scalability**
  4. **Throughput:** As per input capacity.
  5. **Storage:** 7.1MB
  6. **Growth:** Adjustable
- **Availability:**
  7. **Hours of Operation:** Unlimited
  8. **Location of operation:** Internet
- **Maintainability:**
  9. **Architecture Standards:** Standard MTV architecture development
  10. **Coding Standards:** Python programming language, Django Framework, JavaScript, jQuery, HTML, CSS, Bootstrap4.
- **Recovery:**
  11. **Restore Time:** 2241ms
  12. **Backup Time:** 2500ms
- **Security:**
  13. **Standard:** XSS, HTTPS, CSRF

5.4 Products Features

Product features specifies a product's discrete areas of functionality which are deliverable to the clients which states the corresponding benefits and purposes. Along with features, it is important to have a consistent, repeatable method for defining how these features serve the business objective. Below I have illustrated some input, output and architectural features of the STMS site.

5.4.1 Input

- **Login:**

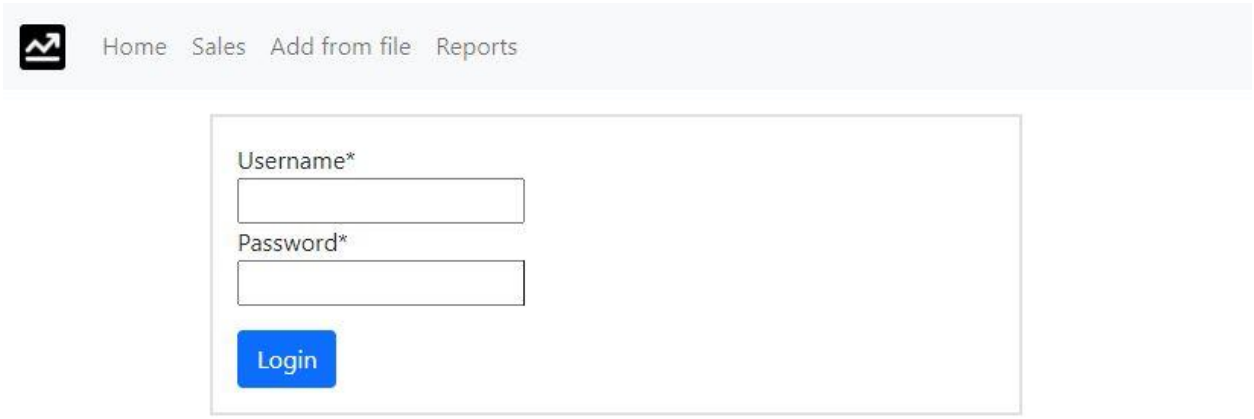


Fig 5.4.1: Login Page

- **Home page:**

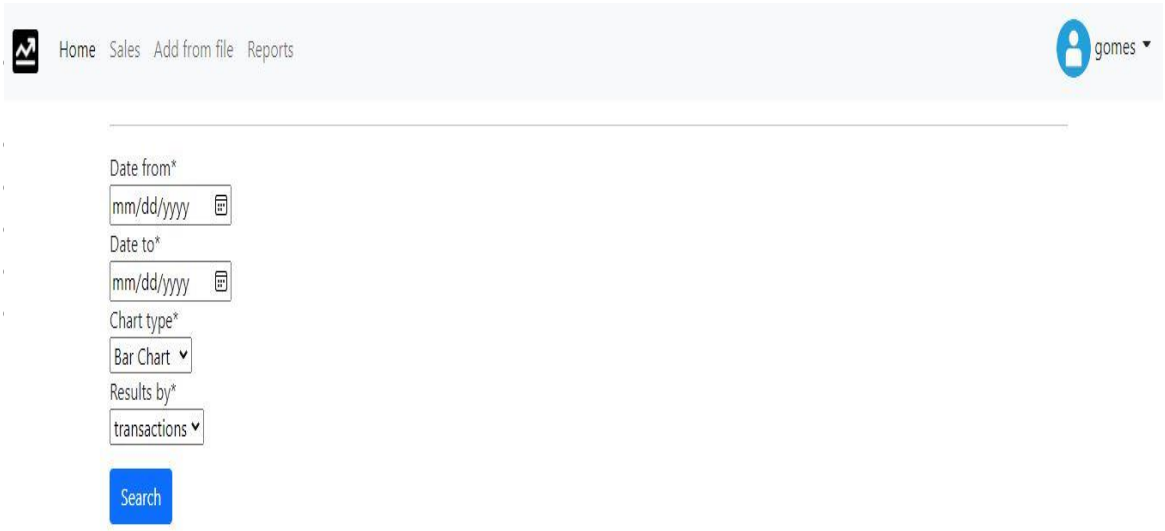


Fig 5.4.2: Home Page

- **User profile page:**

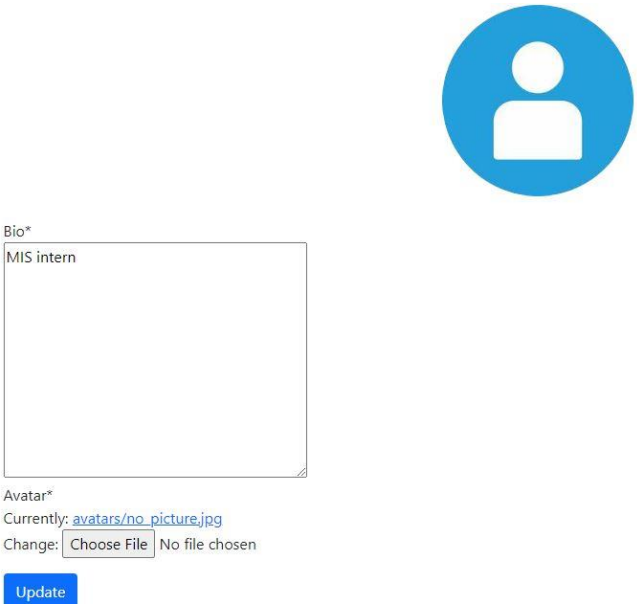


Fig 5.4.3: User Profile Page

- **Add from file page:**

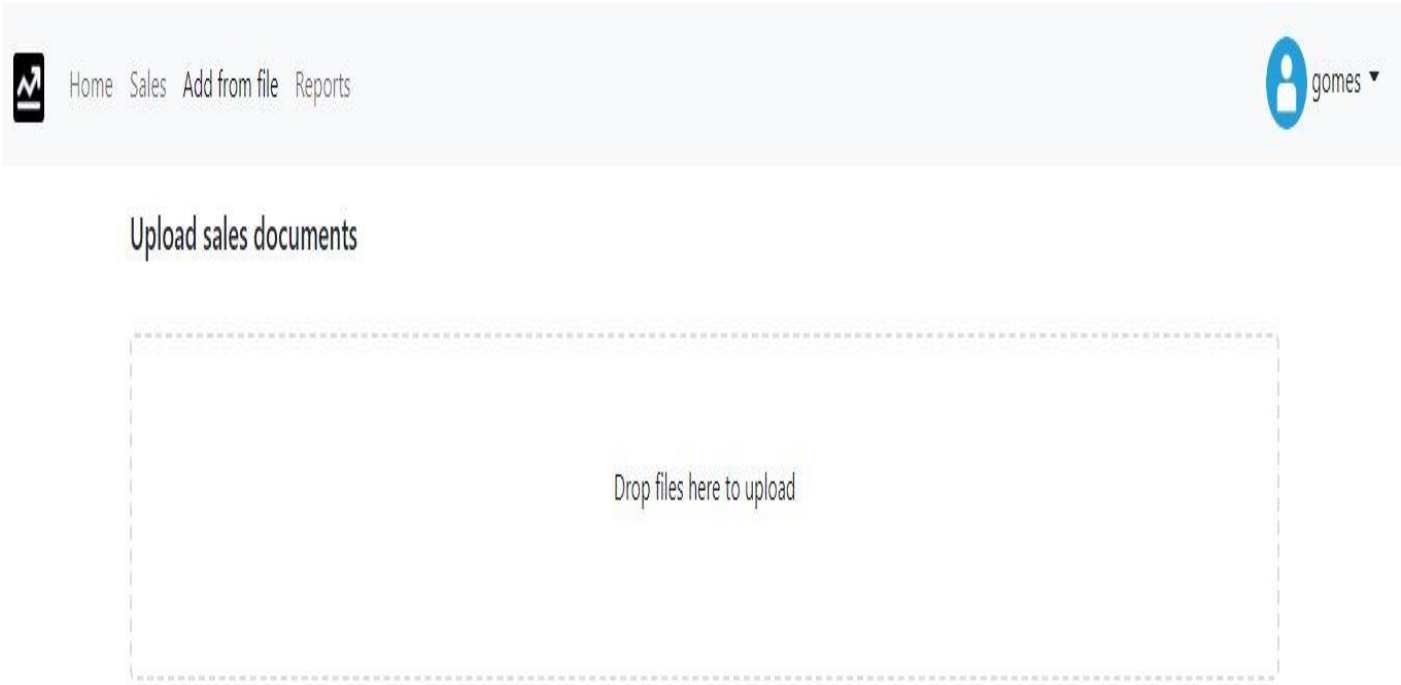


Fig 5.4.4: Add from file page

- **Reports page:**

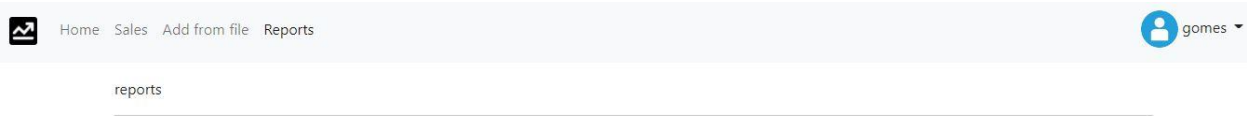


Fig 5.4.5: Reports Page

- **Sales page:**

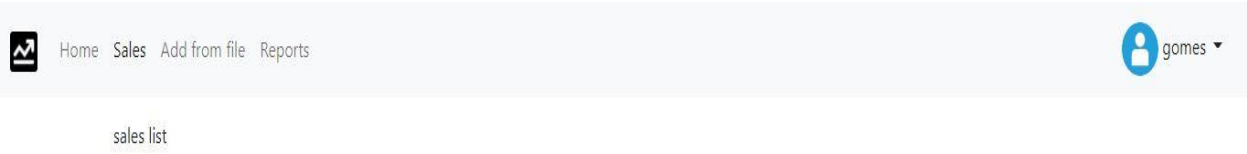


Fig 5.4.6: Sales Page

5.4.2 Output

- **Add from file page:**

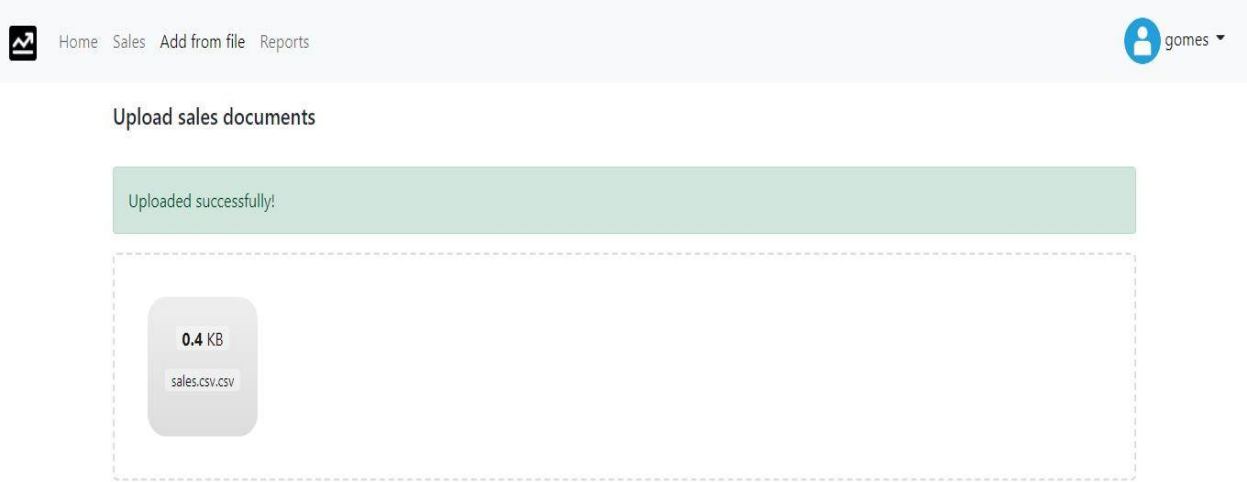
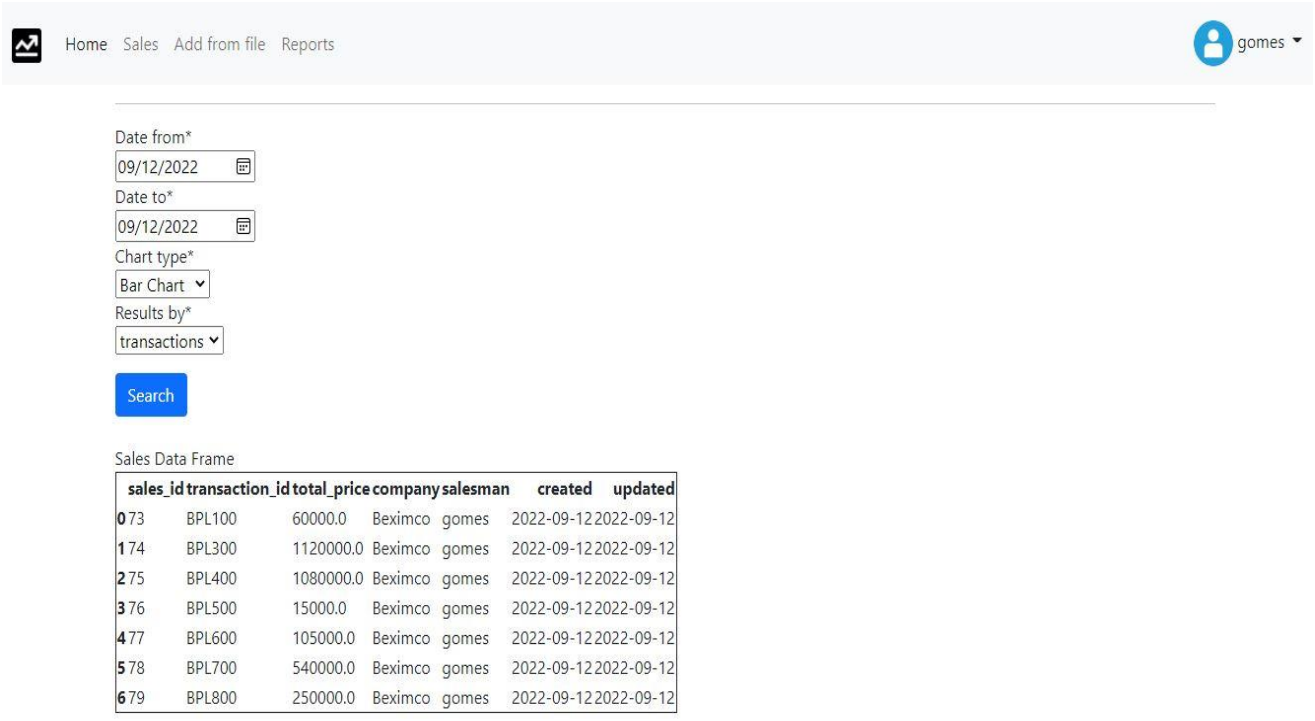


Fig 5.4.7 Add from file Page Output

- **Home page:**



	sales_id	transaction_id	total_price	company	salesman	created	updated
0	73	BPL100	60000.0	Beximco	gomes	2022-09-12	2022-09-12
1	74	BPL300	1120000.0	Beximco	gomes	2022-09-12	2022-09-12
2	75	BPL400	1080000.0	Beximco	gomes	2022-09-12	2022-09-12
3	76	BPL500	15000.0	Beximco	gomes	2022-09-12	2022-09-12
4	77	BPL600	105000.0	Beximco	gomes	2022-09-12	2022-09-12
5	78	BPL700	540000.0	Beximco	gomes	2022-09-12	2022-09-12
6	79	BPL800	250000.0	Beximco	gomes	2022-09-12	2022-09-12

Positions Data Frame

	position_id	product	quantity	price	sales_id
0	73	Napa	500	60000.0	73
1	74	Bexovid	800	1120000.0	74
2	75	Emorivir	900	1080000.0	75
3	76	Barri	100	15000.0	76
4	77	Vesinac 5	300	105000.0	77
5	78	Kaneva	1000	540000.0	78
6	79	Buflex	500	250000.0	79

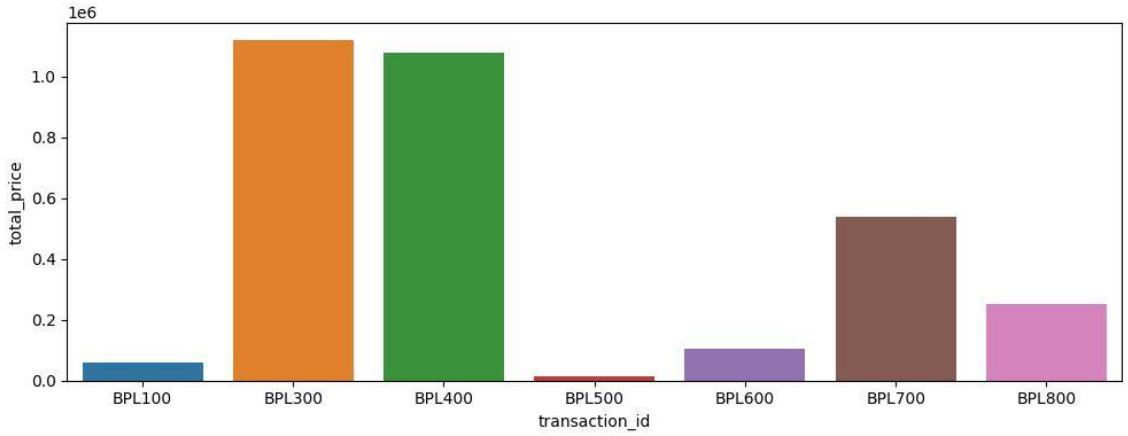
Merged Data Frame

	sales_id	transaction_id	total_price	company	salesman	created	updated	position_id	product	quantity	price
0	73	BPL100	60000.0	Beximco	gomes	2022-09-12	2022-09-12	73	Napa	500	60000.0
1	74	BPL300	1120000.0	Beximco	gomes	2022-09-12	2022-09-12	74	Bexovid	800	1120000.0
2	75	BPL400	1080000.0	Beximco	gomes	2022-09-12	2022-09-12	75	Emorivir	900	1080000.0
3	76	BPL500	15000.0	Beximco	gomes	2022-09-12	2022-09-12	76	Barri	100	15000.0
4	77	BPL600	105000.0	Beximco	gomes	2022-09-12	2022-09-12	77	Vesinac 5	300	105000.0
5	78	BPL700	540000.0	Beximco	gomes	2022-09-12	2022-09-12	78	Kaneva	1000	540000.0
6	79	BPL800	250000.0	Beximco	gomes	2022-09-12	2022-09-12	79	Buflex	500	250000.0

Grouped By Data Frame

	price
0	60000.0
1	1120000.0
2	1080000.0
3	15000.0
4	105000.0
5	540000.0
6	250000.0

Chart



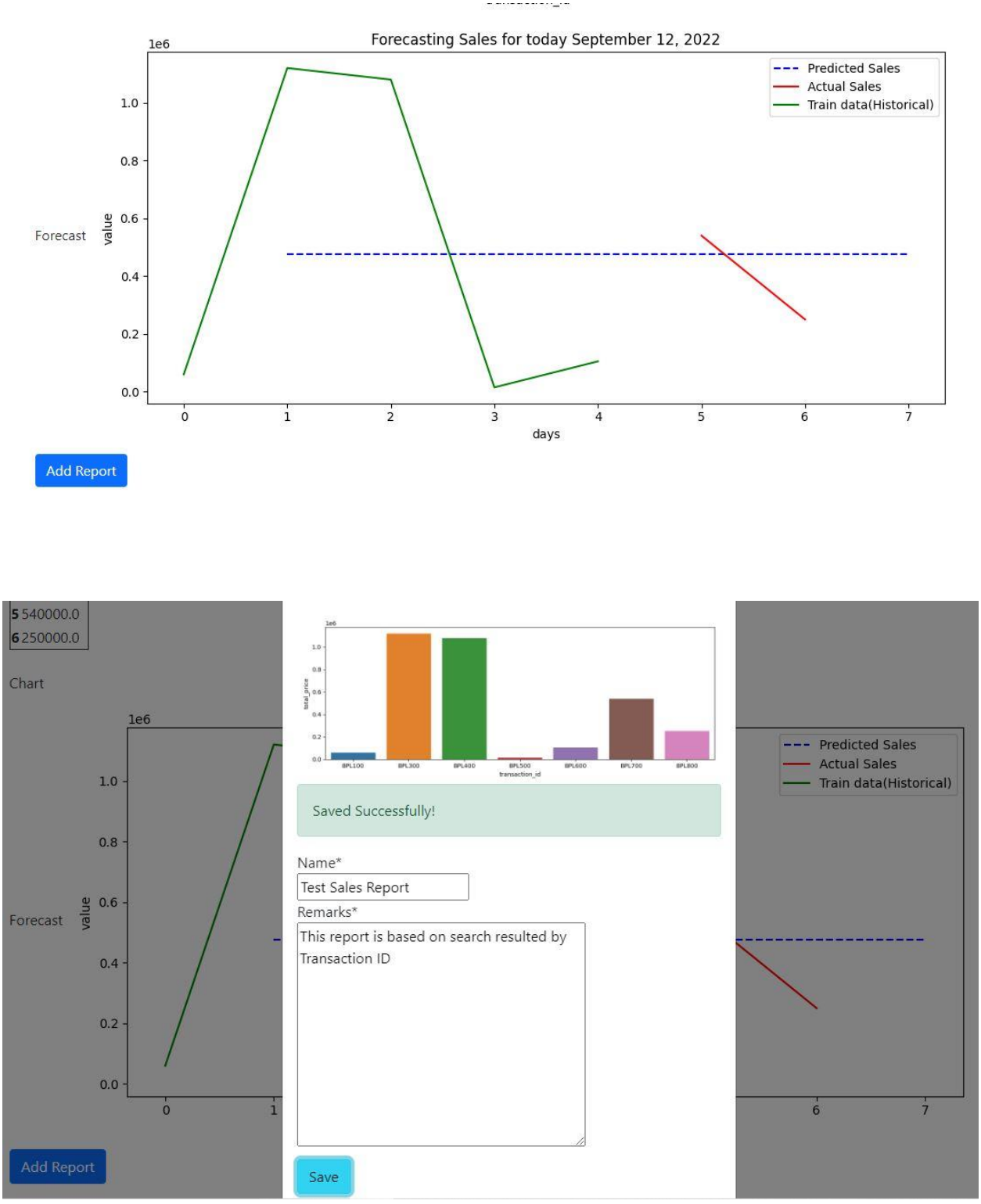


Fig 5.4.8 Home Page Output

- **Reports Page:**

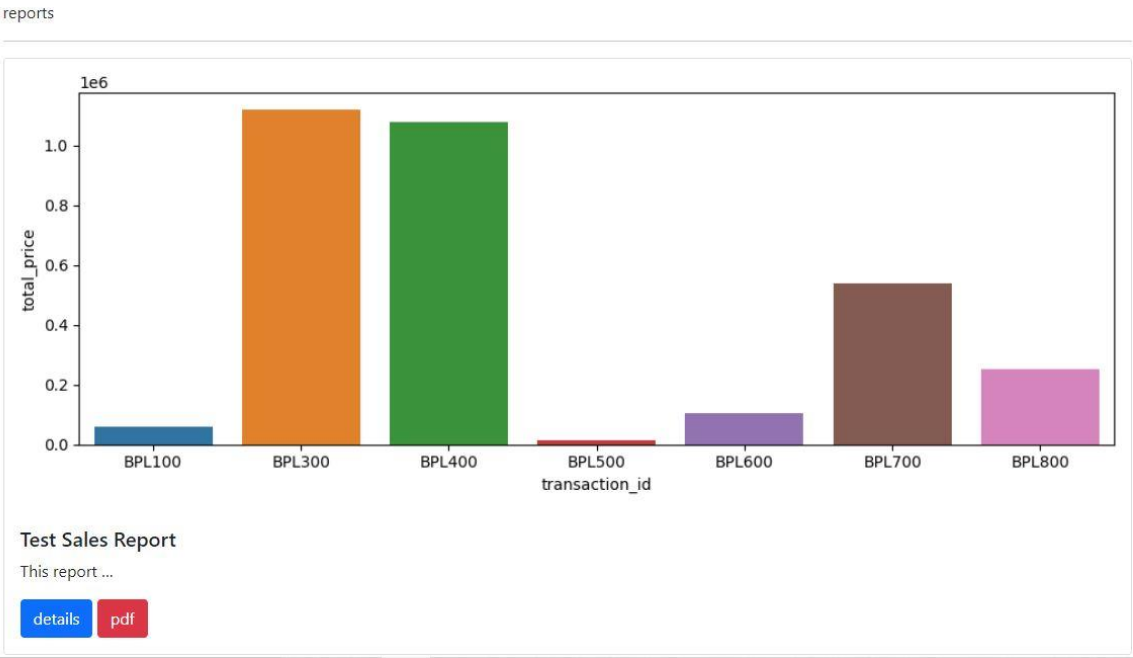


Fig 5.4.9 Reports Page Output

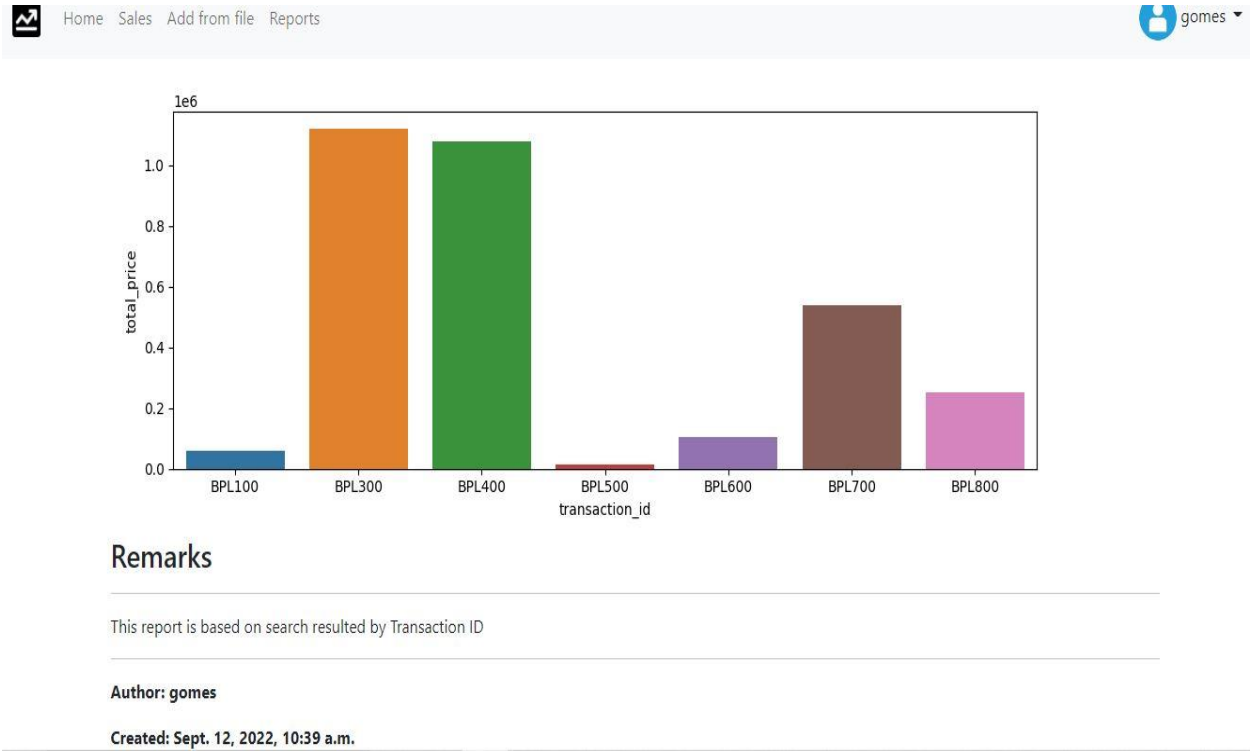


Fig 5.4.10 Reports Detail Page

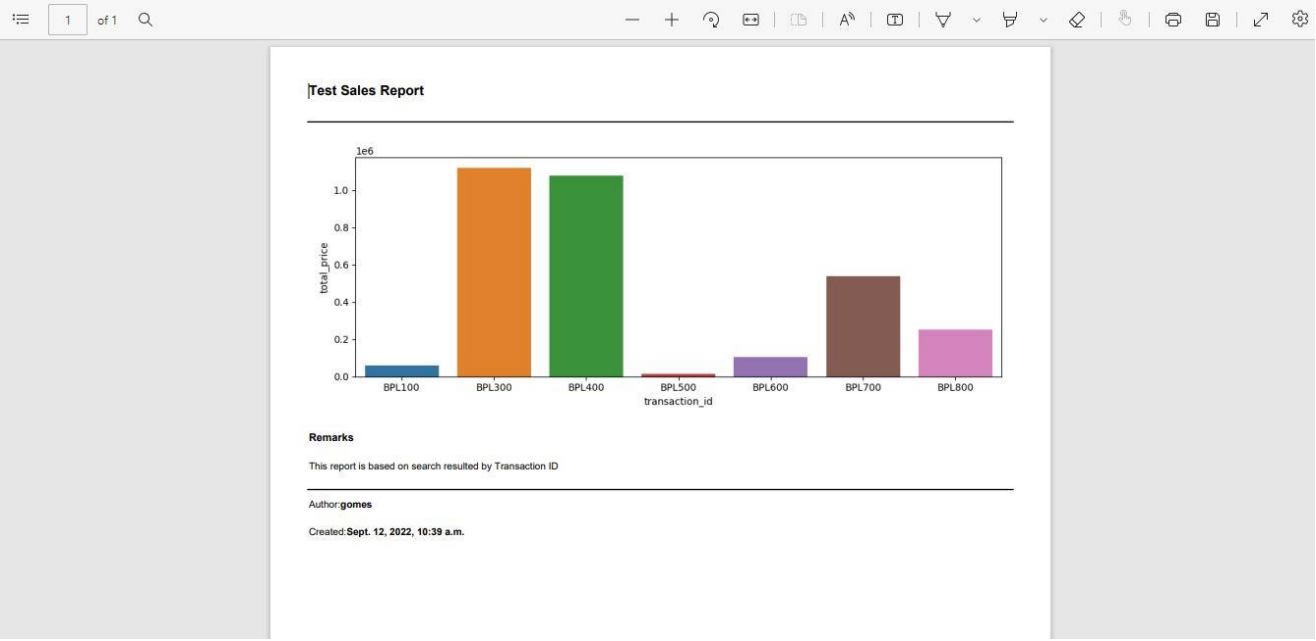


Fig 5.4.11 Reports PDF Page

- **Sales Page:**

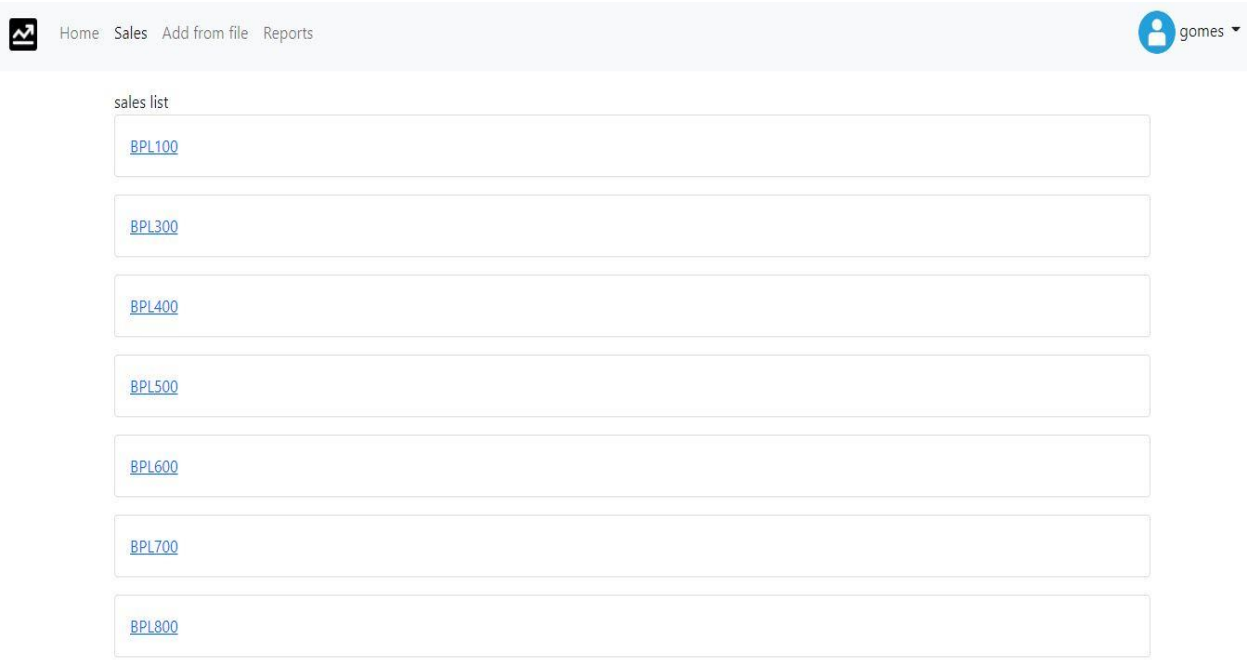


Fig 5.4.12: Sales Page



Fig 5.4.13: Sales Detail Page

- **Admin Page:**

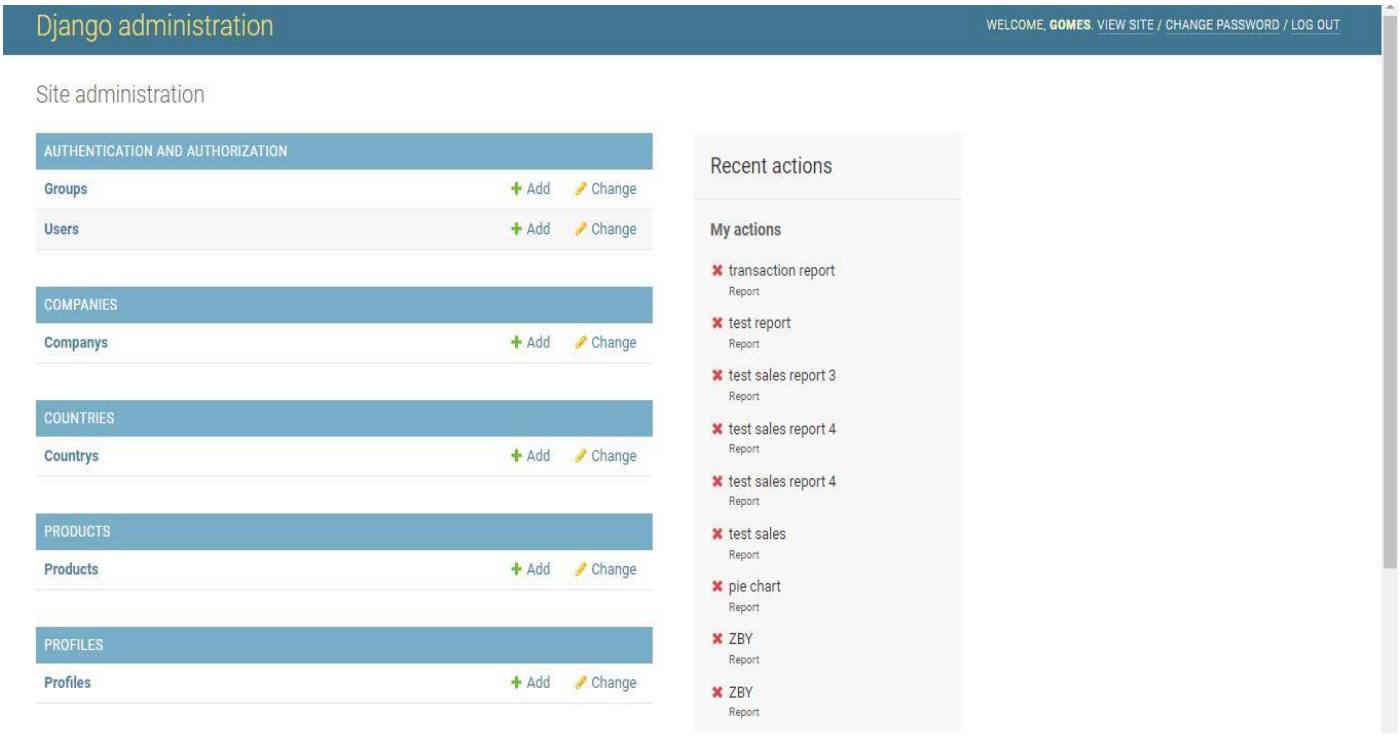


Fig 5.4.14: Admin Page

5.4.3 Architecture

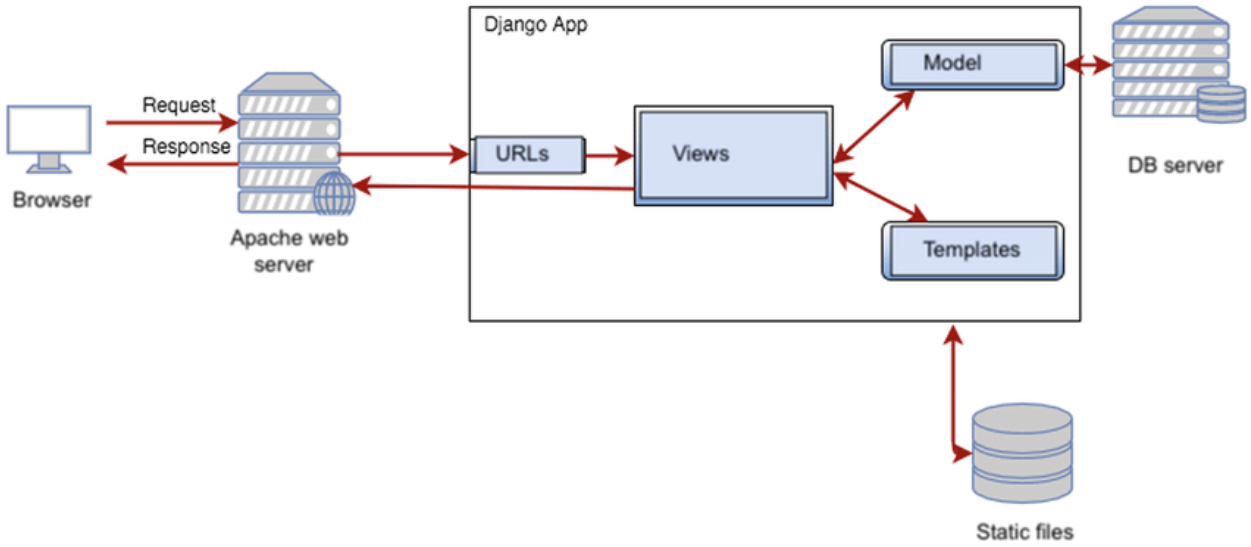


Fig 5.4.15: System Architecture

The architecture of web application describes how its components are connected and how they communicate with each other. In other words, it describes the connection between the client side and the server side. The server side is responsible for handling and managing the communication and the server. The web application that serves business must have the capacity to grow and expand with its increasing user demands and organizational expansion. For this project, I have used Django framework following the Django Architecture which is written in python language. The main advantage of Django architecture is to make the creation of complex databases easier, rapid development, Scalable and has excellent security. Django follows MTV architecture. It is similar to MVC architecture however, Django is responsible for getting the controllers part by using template files which is mixture of HTML. The template handles the UI and architecture part of the STMS application. The view controls the logical part of the STMS site and interacts with the Model to retrieve data and in turn modifies the template accordingly. Django gets the URL that is linked to the view part of the application and transports user responses to the application.

Chapter 6

Results & Analysis

6.1 Overview

The Sales Trend Monitoring System (STMS) web application was developed with the objective of extracting information from the existing sales data to project sales trend and forecast future trend using the ARIMA model to save time and effort. Beximco Pharma currently utilizes Sales Monitoring System (SMS) which is a dynamic application that lets the company monitor sales both in national and international market as well as keep track on every crucial details. However, the goal of STMS project was to develop a monitoring tool for analytical purpose by reducing the hassle of manually inputting data which is time consuming and somehow overwhelming. Since, sales people are mostly in a rush with work load on daily basis, the idea was to make simple and fast tool with dynamic functionality. Although the vision of building a web application with integrated AI modules to calculate with accuracy could not be met, I was able to tailor the basic functionality that met few of the client's expectation.

6.2 Test Result

The development of STMS web application has been partially yet successfully completed. While developing the application, the functionality of models, templates and views were tested for errors to make sure that program executed error free without the site crashing which would be a big disappoint in terms of experience and use. The ARIMA model was integrated after completing the basic development of the site and optimizations were made to the code in order to incorporate the model with the overall system. Since the sales data were created as sample test data, I was unsure if it was fit for testing the parameters such as the lag observations, raw observations and moving average window. Although, the ARIMA model was successfully implemented, there are errors with the data set which restrains the plot from aligning accurately for the forecasted graph. There were several test cases that failed which consumed a lot of time to fix the bugs and errors to improve the responsiveness of the site as well as optimize the codes to reduce execution time and avoid runtime error pitfalls. Since the sample dataset worked partially for the ARIMA time-series regression, I assumed that it would be insufficient for integrating the Apriori algorithm for basket analysis which could result inaccurately in predicting the product growth trend. All the issues were resolved and the application is finally ready for demonstration.

Chapter 7

Project as Engineering Problem Analysis

7.1 Sustainability of the Project/Work

In present time, sustainability in projects plays one of the most important roles with evolution of technology and corporate demands. Sustainability in project involves both the organization and engineers to ensure that outputs, outcomes and benefits are sustainable over life cycles during design, development and deployment phase. It encompasses on two main ideas which involves production teams make the solution cost-effective and secondly, the optimization of the quality of the product. When it comes to sustainability in software or application engineering it is important to keep the client satisfaction as one of the important priorities. Software and application systems are designed and developed with the motive of sustainability so that it can be continuously evolved with the changing corporate dynamics and requirements without having the issues and complexities for users and key stakeholders so that in the long run, the application is viable and accessible for the client's machine environment. The advantage of STMS web application is that it does have specific requirements such as the operating system, computer resolution or internet speed. The site can be accessed from anywhere as long as the client has access to the internet, web browser and a functional computer.

Although the application has not been installed on Beximco's server, the longevity and long-term sustainability can be achieved through maintenance and further development of the website and servers but only developers with python programming and Django framework knowledge can understand the system and architecture to develop and maintain the application further. The client side and backend side of the application is well organized and optimized to add more diverse features in the future. The MTV architecture gives an advantage of eliminating redundancy and repeated codes as it follows standard OOP procedures which implies that the classes and functions are well defined and organized and can be reused without requiring to write codes repeatedly. In terms of style and layout, the site is currently underdeveloped as my main vision was to develop a functional application fulfilling the basic requirements. The site is however suitable for users who prefer less complex interface and friendly user experience.

7.2 Social and Environmental Effects and Analysis

The STMS web application is a simple analytical web-based tool that is readily available to users seeking rapid data analytics and sales trend from current sales data. It is very user friendly in terms of use and experience. It saves time by eliminating the need to manually enter data as the website provides drag and drop option to upload existing csv files. It enables employees who seek to extract information from the existing sales data without requiring to perform complex calculations on spreadsheet.

The STMS web application is developed with maximum efficiency which implies that it was built rapidly with very few resources available. The codes and functionality are optimized to the extent to improve user experience and reduce space and energy requirement. It is more environment friendly since it eliminates the use of un-required energy that most websites consume by displaying loads of advertisements and animation. Additionally, it eliminates the necessity of paper usage which means that less trees will be cut down for extracting paper and the goal of achieving greener planet can be initiated.

7.3 Addressing Ethics and Ethical Issues

Ethics and Ethical issues are two important factors that every software or web developer must consider. While addressing questions such as functionality and project specifications, we fail to recognize how the product that we are developing could affect people's lives that could either lead to better or worse. Technology is rapidly changing business operations. As technology plays important role in our daily lives, it gets hard to separate the ethics of how we consume and create. It's the responsibility of engineers to consider ethical values to provide users with the sense of trust and security.

Security: The data stored at the backend or the models is accessible by the developer and the admin. Only the admin has the access as the super user to perform CRUD operations on the backend data server. The functions are protected using Django authentication library and the classes are secured with the login required mixin.

Storage: For STMS web application, SQLite is used for data storage as it provides alternative for applications that are predominantly read-only and smaller installation footprint.

User Data: The site collects user name, password of the employees.

Shared Data: Information such as salesperson name and creation time and date for particular sales will be available internally within the other employees.

Company Data: Since its company's strict policy to maintain privacy of sales data, no access was provided to external person.

Chapter 8

Lesson Learned

8.1 Problems Faced During this Period

During my internship at Beximco Pharma, I had learned a lot about their corporate culture and values which is a valuable experience for me. Additionally, it was a wonderful opportunity to work at a reputed company where I was allowed to pursue my project at the MIS department and unlock my new potentials and experiences while I learned to code and develop a Full-Stack web application with Django Framework. However, this was also one of the most difficult times for me as there were a lot of constraints in my personal life since I have lot of responsibilities in absence of my father as he unfortunately had passed away recently on 01/07/2021, suffering from brain stroke. As I had to document and develop my project at Beximco, I had to attend office 5 days a week, approximately 8 hours. While attending office, I also had to cooperate with the court and lawyer as there are three civil cases regarding a personal family issue with property which required me to be present at Dhaka Court. Additionally, I also had to run back and forth to Gazipur court as there are more 3 cases related to a lawsuit that my father had filed back in 2019, against a deception of a business partner. I am really grateful to my supervisor Mr. Arup Kanti Deb for considering my situation while allowing me to work on my project. I also had enrolled for three major courses while continuing my internship which was very tough for me as the location of my office to university is really far and commuting in the gird lock traffic of Dhaka city was overwhelming. In many cases I missed attendance as I got late to my class and had missed few classes as I was unable to make it on time.

More difficulties showed up during the requirements gathering phase as the constraints added up. Due to Beximco's strict company policy, I could not get access to the actual sales data which caused issues while developing the ARIMA model as I had to first test the codes in Jupyter notebook. It was difficult to work on the project by myself as nobody at the MIS department had experience with python and Django Framework. Additionally, I had to learn to code and refurbish my knowledge on MTV architecture to develop the STMS site rapidly within a short course of time. It was really exhausting to manage work life and personal life at the same time while aiming to finish the project within a really short time as I had joined 14 days later from the actual starting date. was waiting for confirmation for my briefing with my supervisor from the HR, however I was informed that there were more interns so there was schedule conflicts and I had to wait until they confirmed me the date of briefing.

8.2 Solution of those Problems

In order to counter these problems, I shared my issues with my supervisor Mr. Arup Kanti Deb, and I am really grateful that he considered all my problems and allowed me to continue with my internship. I was allowed to leave an hour earlier on days when I had classes at my university. However due to the traffic of Dhaka, I used to reach late. I was advised to inform my supervisor a day earlier from the date I had to be present at the court so that he acknowledged my reason and absence at office and so I followed his instructions and kept things clear between us through communication. The days I was unable to attend office, I tried to cover the work when I got home at night so that I did not fall behind the time line and progress. I utilized any time that was left from my day to develop the system as much as possible till I had a final full functional application ready for showcasing.

I used extra hours to learn more about programing and using the technology with the help of internet to gather more knowledge about the new technology. I spent a lot time researching about sales analytics and the models I could use to integrate the time series regression. However, it was a really wonderful experience to learn and constantly motivate myself to pursue my internship project. Testing for errors and bugs was also a big challenge as it consumed a lot of time as codes required to be optimized and retest until the application was error free. I was able to learn from my flaws and put maximum effort to build the whole website from ground up. In near future, these experiences will help me get a head start as now I am equipped with sufficient experience of a full stack developer.

Chapter 9

Future Works & Conclusion

9.1 Future Works

There are lot of scopes for development of the current project for near future. One of the main objectives will be making the website more attractive so that the users can find it visually appealing. With the expansion of Beximco's pharmaceutical products, the size of data will also increase thus implementing advanced ML Neural Networks will enhance the accuracy of sales prediction and trends. For product growth, Apriori algorthim could be integrated with the system for basket analysis to extract information of the product trends, that could help Beximco optimize its manufacturing capacity and cut production cost which will save a lot of money. Currently, I have used light frame database SQLite3 since my project is light frame but in future more advanced distributed database systems can be integrated to manage big data.

9.2 Conclusion

Having this wonderful opportunity to work as an intern while pursuing my project at Beximco Pharma has unlocked new experiences and knowledge. I had learned more about python programming as well as the Django Framework which is quite popular in the present time. I have gained experiences through writing codes in OOP standards which is very beneficial and advantageous. Throughout my project, I learned how to cooperate with my supervisor and trainer who helped me a lot to overcome obstacles. Although, there were lot of problems and constraints, I was able to pick myself up and push through every obstacle that seemed impossible and I am really glad that my supervisor's kind words and advice motivated me to complete my project. I still have more to learn and lot of new experiences to discover. I would like to thank my internal supervisor, Ajmiri Sabrina Khan and Coordinator Subrata Kumar Dey for this wonderful internship opportunity. I would like to express my humble gratitude towards my external supervisor Mr. Arup Kanti Deb for accepting my project idea and helping me through challenges to complete my project. I would like to thank everyone from the MIS department for treating me as a part of the MIS family. I look forward to learn more and work on creative projects in the future. I would like to conclude this report with my supervisor's advice which motivated me to complete my project, "The fruit of your labor shall be sweet if you have passion and love for your work."

Bibliography

1. Eric Stellwagen, Len Tashamn, ARIMA: The Models of Box and Jenkins, May 16, 2016 Available at : https://www.researchgate.net/publication/285902264_ARIMA_The_Models_of_Box_and_Jenkins [Accessed July 28, 2022].

2. Jamal Fattah, Ltifa Ezzine, Zineb Aman, Haj El Moussami, Abdeslam Lachhab, Forecating of demand using ARIMA model ,June 7, 2018. Available at : https://www.researchgate.net/publication/328633706_Forecasting_of_demand_using_ARIMA_model [Accessed July 28, 2022].

3. Mustafa M. Ali Alfaki, Dr.(Ms.)Shalini Bhawana Masih, Modelling and Forecasting by using Time Series ARIMA Models, March 03, 2015. Available at : https://www.ijert.org/research/modeling-and-forecasting-by-using-time-series-arima-models-IJERTV4IS030817.pdf [Accessed August 05, 2022].

4. Micheal R. Genesereth, Steven P. Ketchpel, Software Agents, Available at: https://www.engpaper.com/software-engineering-research-papers.html [Accessed August 05, 2022].

5. Christopher Theisen, Marcel Dunaiski, Laurie Williams, William Visser, Writing Good Software Engineering Research Papers: Revisited, 2017. Available at : https://www.researchgate.net/publication/318124777_Writing_Good_Software_Engineering_Research_Papers_Revisited [Accessed August 05, 2022].

An Undergraduate Internship

On

Sales Trend Monitoring System (STMS)

By

Daniel Gomes

Student ID: **1822007**

Summer, 2022

Consent Form

The student modified the internship final report as per the recommendations made by his/her academic supervisor and/or panel members during final viva, and the department can use this version for archiving.



Ajmiri Sabrina Khan

Department of Computer Science & Engineering

Independent University, Bangladesh