MAKERERE   **UNIVERSITY**

LABOR OPTIMIZATION SYSTEM

By

BSE 20-25

MACHINE LEARNING

DEPARTMENT OF NETWORKS

SCHOOL OF COMPUTING AND INFORMATICS TECHNOLOGY

A Project Report Submitted to the School of Computing and Informatics Technology

For the Study Leading to a Project in Partial Fulfillment of the

Requirements for the Award of the Degree of Bachelor of

Science in Software Engineering of Makerere University

Supervisor

Department of Networks

School of Computing and Informatics Technology, Makerere University

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DECEMBER, 2020

Declaration

We, group BSE 20-25, hereby declare that the work presented is original and has never been submitted for an award to any university or institution of higher learning

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Git repository: https://github.com/muwongeemmanuel/seemlos

Approval

This project report titled Labor Optimization System has been submitted for examination with my approval as the supervisor of group BSE 20-25.

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Dedication

We dedicate this work to the almighty God for helping us push through all these four years. This work is also dedicated to our supervisor, whose input and guidance helped us complete this project. Finally we dedicate it to our parents, guardians and sponsors for all the financial and emotional assistance that enabled us complete our studies and this project.

Acknowledgements

First, we would like to thank God the Almighty for blessing us with life, good health and the continuous financial provision throughout all the four years of this course till this stage.

We would like to thank our parents, guardians and friends for providing us with financial and moral support throughout the course of this program and project.

We also acknowledge with great appreciation our supervisor Dr. Moses Ntanda who guided us throughout the conception, realization, design and completion of this project. She has been very supportive and present whenever we needed her.

Finally, we thank our fellow students for always being supportive, updating us about the relevant class information and contributing to our newly learnt skills during the development of this project.

Abstract

The Labor optimization System will provide a solution to the problem of labor underutilization and labor over utilization in many organizations in Uganda which may at first not seem as a big issue to business and yet it actually is.

Labor is a factor of production and therefore it equally affects the growth of a business just as much as any other factors such as capital and land. Labor as a resource is mainly measured in terms of labor productivity which is a key measure for business efficiency. Uganda has lowest labor productivity of 1,085 in comparison to its neighboring countries (Tanzania 2,016; Zambia 2,680; Kenya 3,457) in terms of value added per worker in US dollars. This therefore lowers the economy of the country despite the fact that we are undergoing the industrial revolution. Following the National Employment Policy of the republic of Uganda which states that Increasing Decent Employment Opportunities and Labor Productivity for Socio - Economic Transformation, this much more causes a great need for the improvement of the labor productivity as this is of great importance to both the business and the country at large.

The UBOS report suggests use of technology as one of the solutions to the decrease in labor productivity. The LOS system will be developed to provide a solution to the problem in the above paragraph. It will be a web based system with a machine learning predictive model that can predict the amount of work and distribute it basing on the labor available. It will also help in the business analysis.

BSE20-25

LABOR OPTIMIZATION SYSTEM

Software Design Document

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Date: February, 19th 2020

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1. Introduction

1.1. Purpose

This document's purpose is to provide a high-level design framework around which to build our Labor Optimization System. This document will define the design of the Labor Optimization System. It contains specific information about the expected input, output, classes, and functions. It also provides a list of requirements against which to test the final project and determine whether we were able to successfully implement the system according to design.

1.2. Scope

This Design Specification is to be used by Software Engineering and Software Quality Engineering as a definition of the design to be used to implement the Labor Optimization System]. It provides the architecture and design of Release 1.0 of the Labor Optimization System. It will show how the design will accomplish the functional and non-functional requirements detailed in the Labor Optimization System Software Requirements Specification (SRS) document.

1.3. Overview

Product Perspective

This product will contain an intelligent model that will help organizations optimize labor at their disposal by making predictions on the workload.

Design Method

The design of this product utilizes an object-oriented approach.

User Interfaces

The user of this product will be interfacing with the system to help put in some inputs when required. The product allows the user to get familiar with the software with the least computer knowledge.

Hardware Interfaces

This software can run on most computers with compatible graphics card which is required due to need of graphical visualization of the analysis.

Software Interfaces

This system will execute on all operating systems platform through a browser connected to the internet.

Memory Constraints

This program takes up about 7 KB of memory. The output results are modest in size and take up about 7 KB.

Operations

The user will be required to enter the parameters/values for the system from the user interface.

Site Adaptation Requirements

This software is intended to execute on any operating system platform with no modifications needed to support different sites.

User Characteristics

The general characteristics of the intended users are computer literates and people with some knowledge about labor related information.

1.4 Reference Material

None

1.5 Definitions and Acronyms

1. KB: Kilobytes
2. LOS: Labor Optimization System
3. UBOS: Uganda Bureau of Statistics
4. UI: User Interface
5. GUI Graphical User Interface

2. SYSTEM OVERVIEW

The Labor optimization System will provide a solution to the problem of labor underutilization and labor over utilization in many organizations in Uganda which is a problem to businesses.

Labor is a factor of production and therefore it equally affects the growth of a business just as much as any other factors such as capital and land. Labor as a resource is mainly measured in terms of labor productivity which is a key measure for business efficiency. [1] Uganda has lowest labor productivity of 1,085 in comparison to its neighboring countries (Tanzania 2,016; Zambia 2,680; Kenya 3,457) in terms of value added per worker in US dollars. This therefore lowers the economy of the country despite the fact that we are undergoing the industrial revolution. [2] Following the National Employment Policy of the republic of Uganda which states that Increasing Decent Employment Opportunities and Labor Productivity for Socio - Economic Transformation, this much more causes a great need for the improvement of the labor productivity as this is of great importance to both the business and the country at large[3].

The UBOS report suggests use of technology as one of the solutions to the decrease in labor productivity. The LOS system will be developed to provide a solution to the problem in the above paragraph. It will be a web based system with a machine learning predictive model that can predict the amount of work and distribute it basing on the labor available. It will also help in the business analysis[4].

3. SYSTEM ARCHITECTURE

3.1 Architectural Design

The Labor Optimization System will function in such a way that data is drawn from the database which will then be used to train the predictive model. This predictive model will then predict the possible result for a query made by the user and display the outcome to the user interface. The data shall also be analyzed.
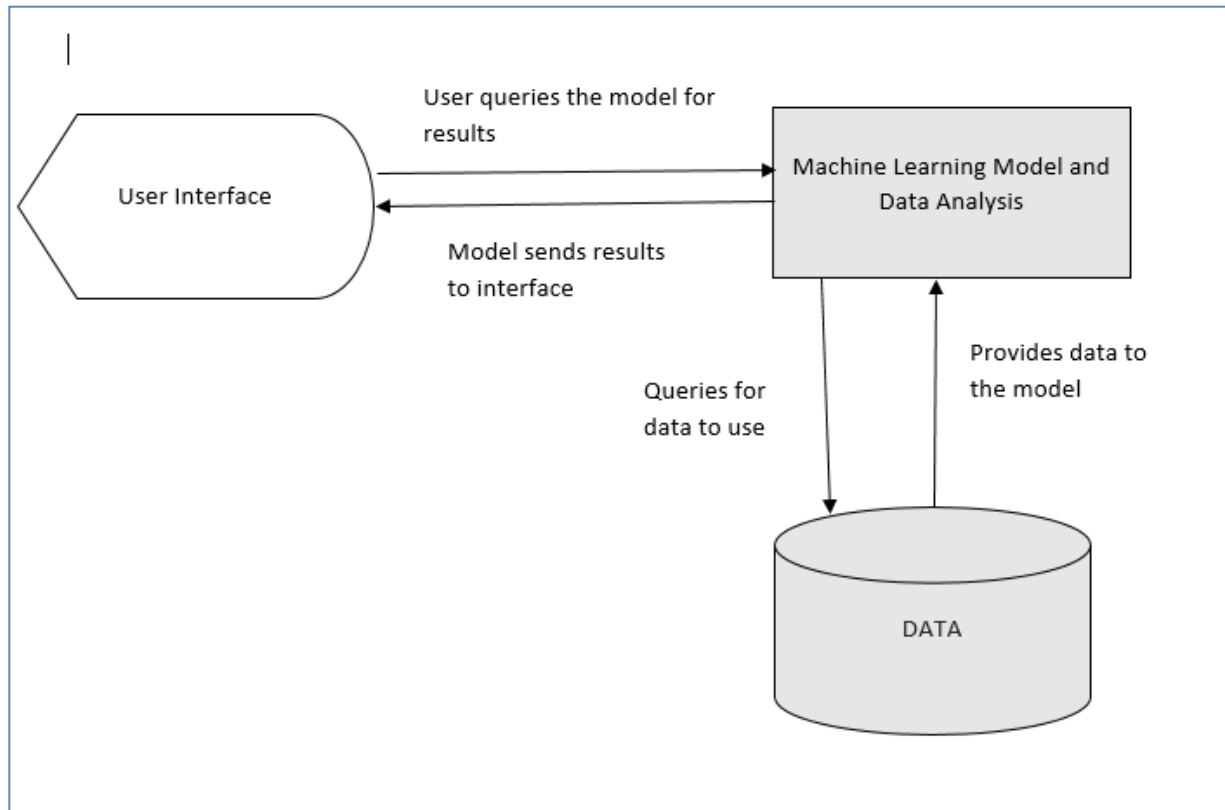

Figure 3. 1 Architectural design of LOS

The System comprises of mainly three modules that is;

The User Interface: This is meant to enable the user interact with the system. This will provide the user with a mechanism of querying the system with specific instructions and all displaying the results of the query in a more understandable way to the user.

Database: This provides a mechanism with which the data is going to be collected overtime. This is meant to enable the system work and predict with a view of following the current trends in the data.

4

The Machine Learning Predictive Model And Analysis: This is the artificial intelligence setup that is meant to use the data stored in the database to train the model and make predictions about the future that are viable to coming up with necessary decisions in labor management.

How they work

The user accesses the user interface and queries the system to do something. The user interface sends the query to the trained model. The model processes the query and sends the result to the user interface where the user views and makes the intended decisions based on the system's output.
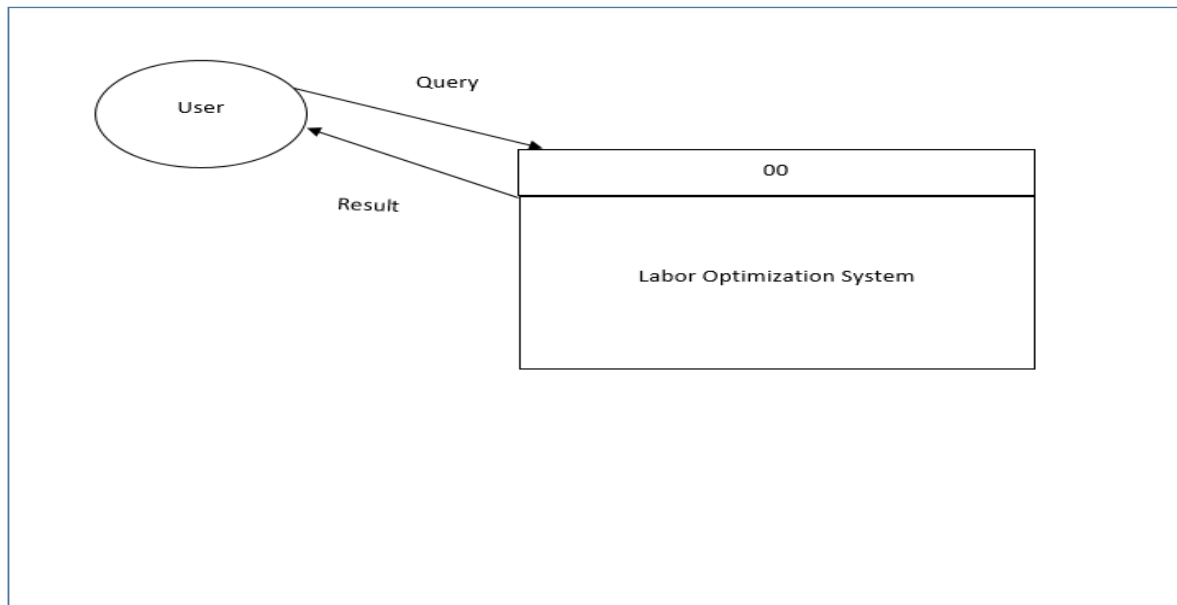
3.2 Decomposition Description

Figure 3. 2 Context diagram of LOS

The user queries the system for prediction or analysis. The system makes prediction or analyses the data and displays the outcome to the user.
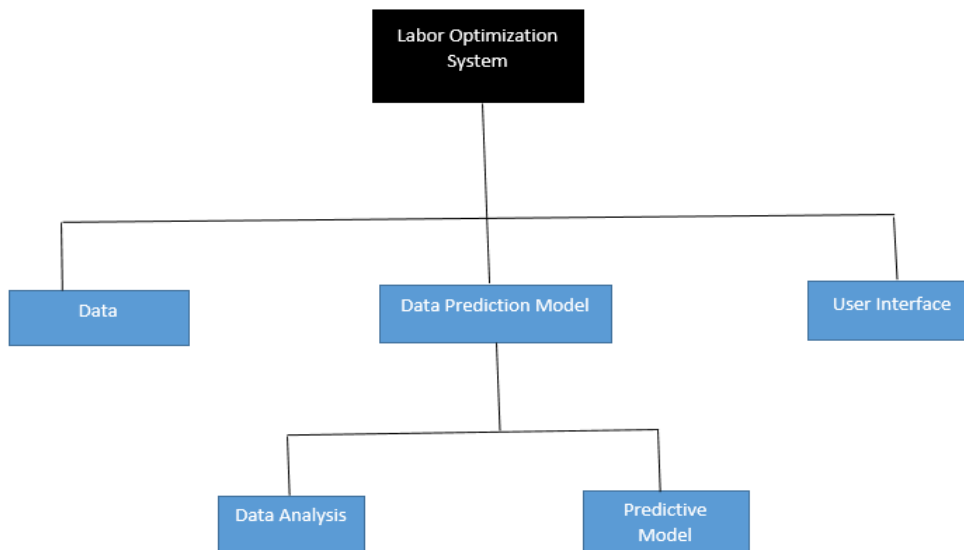

Figure 3. 3 Structural decomposition diagram of LOS

3.3 Design Rationale

We used three-tier architecture with a logical layer of the data prediction model and analysis, user interface and data. We chose this architecture because it provides a means of continuous improvement of the model and a means to analyze and predict the outcome before displaying it to the user through the user interface.

4 DATA DESIGN

4.1 DATA DESCRIPTION

The data will be flowing through three different modules of the system that is the web interface, predictive model and data analysis modules.

Each module will be implemented as a component and it will allow flow of data in and out of the module using various parameters and variables.

The data will be stored in a database and it will be used for analysis and training the predictive model. The data from the database will be first exported to the csv file and then used to train the predictive model at a given interval.

5. Component Design

5.1. User Interface Component

5.1.1. Definition

A component that displays detailed results from analysis conducted. It also displays the results from the predictive model component.

5.1.2. Responsibilities

- Display analysis and prediction results.
- Provide interface for end user interaction with the system.

5.1.3. Constraints

- Requires a browser
- Changes made here shouldn't affect the system.

5.1.4. Composition

Contains graphs and statistical figures

5.1.5. Uses/ Interactions

This component interacts with the Predictive model and analysis module.

5.1.6. Resources

- Hard disk
- RAM
- Processor

5.1.7. Processing

Here analysis results are graphically displayed on the monitor for the users to view. Queries generated by user clicks are transferred to the Predictive model component for response generation.

5.1.8. Interface

A graphical user interface with clickable buttons and menus are provided to facilitate user friendliness and interactions with the end users.

5.1.9. Typical Operation Flow (Pseudo code)

User selects display type;

If analysis results is selected;

    User selects analysis results type;

        If statistical table is selected;

            Render Table;

        If graph is selected;

            Render Graph;

Else if predictive results is selected;

    User selects preferred time range;

    Render Predictive Output;

When user is done;

    Close Session;

5.2. The Machine Learning Predictive Model And Analysis component

5.2.1. Definition

This component conducts analysis on the dataset and also performs machine learning aided predictive modeling.

5.2.2. Responsibilities

- Import dataset from where they are stored.
- Create new datasets from existing ones.
- Conduct analysis on imported datasets.
- Perform relevant predictive modeling.

5.2.3. Constraints

- Only accessible to developers.
- Requires availability of reasonable space on Main Memory.

5.2.4. Composition

It has machine learning and analysis scripts.

5.2.5. Uses/Interactions

It imports data from the Dataset/Database component and displays analysis and prediction result in the User Interface component.

5.2.6. Resources

- Hard disk storage
- RAM
- Processor

5.2.7. Processing

Machine Learning and analysis scripts are executed to produce results.

5.2.8. Interfaces/Exports

The main interfaces here are the script window and the console. The exported item from this component is analysis and prediction results to the User Interface component.

5.2.9. Typical Operation Flow (Pseudo code)

Fetch dataset from where it is stored;

Clean dataset;

Perform statistical analysis to get general outlook and overview of the dataset;

Use past workload information to predict the amount of workload over a range of time period that is on a particular day, in a week, in a month; (All these options have to be available for the user selection during interaction.)

Use workload to predict which areas might need man power improvement and in what quantity;

Render analysis results in tabular and graphical formats;

Render prediction results;

When user is done;

    Close Session;

5.3. Data component.
5.3.1. Definition

This component contains the dataset(s) to be analyzed.

5.3.2. Responsibilities

Store the data. It acts as a feeder to the Machine Learning Predictive Model And Analysis component.

5.3.3. Constraints
- Requires physical storage space.
- End users can't interact with this component. This is to avoid them altering the content of the dataset

5.3.4. Composition

It contains dataset.

5.3.5. Uses/Interactions

It interacts with the Machine Learning Predictive Model And Analysis component that imports the dataset from data component.

5.3.6. Resources

It uses the physical storage (The hard disk).

5.3.7. Processing

The datasets are imported from it using scripts written in the Machine Learning Predictive Model And Analysis component.

5.3.8. Typical Operation Flow (Pseudo code)

Establish Database Connection;

Fetch Data;

Close Connection;

6. Human Interface Design

6.1 Overview of User Interface

The landing page is the login page that authorizes and authenticates users into the system. From the login page, the user can reach the home page only after successfully logging in. From the home page, the user can reach several other pages that include: data analysis, help and workload pages. All these pages cover necessary functionality of system. It is easy to navigate between these pages. User constantly has access to all pages through the menu on top of each page. Each page has its own menu on the left side of the page, which contains all required operations that could be performed with that page.

Login page has descriptive characters; it contains a list of main system's functionality and contact information. After login, Home page is displayed and guides user on how to work with system. Home page covers main functionalities of the system.

6.2 Screen Images

Used GUI components are menus, submenus, buttons, textboxes and checkboxes, down drop lists, links, and tables. The only means of access to the entire system, by all users, is through this UI. Some examples of UI are presented below:

Figure 6. 1 Login Page of the LOS System

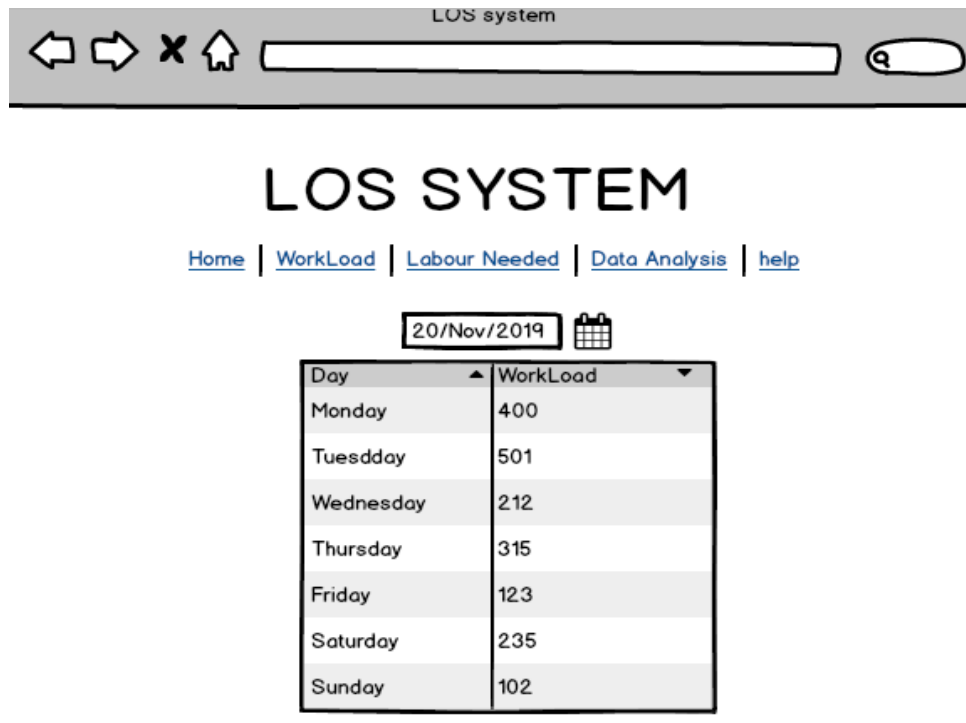*Figure6.2 Home Page of the LOS System*

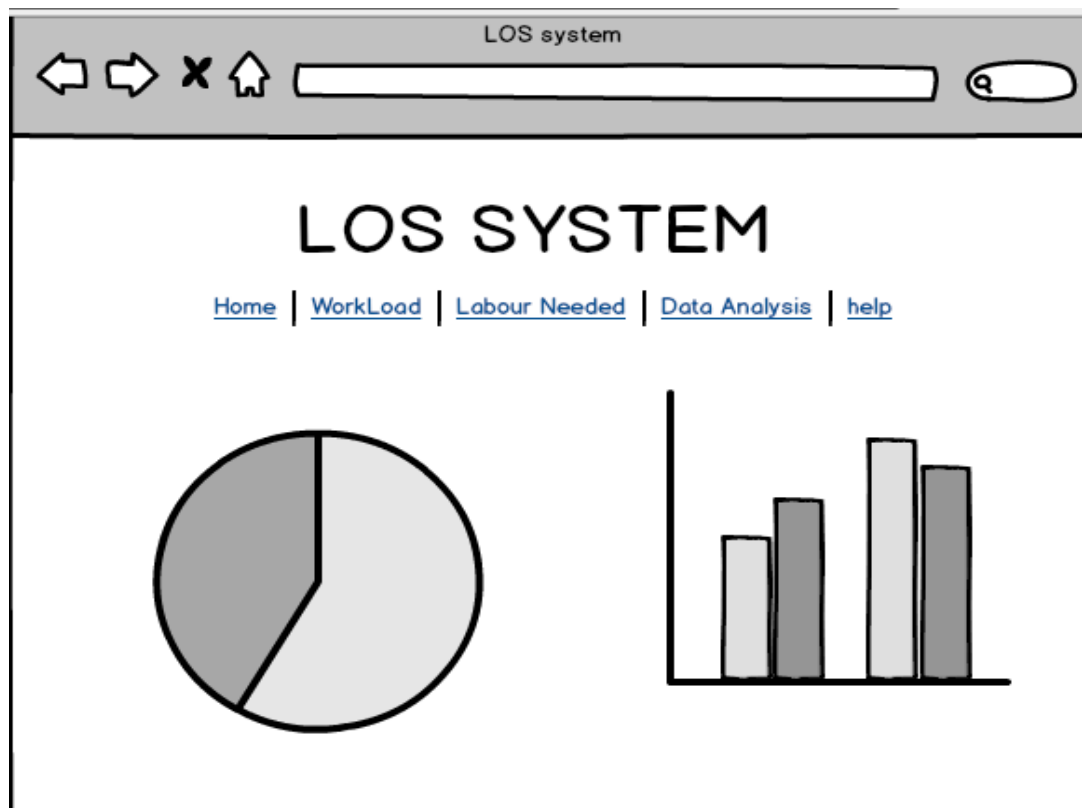*Figure6. 3 Screen showing workload for a given week*

Figure6. 4 Data Analysis interface

6.3 Screen Objects and Actions

In the Login page, user provides login and password in appropriate text boxes and confirms this operation by clicking on Login button.

After logging in, Home page is available to user. It contains following menu: Home, Workload, Data Analysis and link to Logout the current user. User clicks on necessary item in the menu in order to navigate to the next page.

Workload Page has a time menu (Days, Weekly and Monthly) on left side of the page and a text input to specify the quantity of the time for which the prediction can be made. When any of the menus is clicked, a predictive machine learning model is invoked to make predictions. The prediction results are displayed on the interface in a well formatted table.

Data analysis page has a menu of three (3) items (Graphs, Tables, Numbers) on left side of the page.

7. REQUIREMENTS MATRIX

Table7. 1Requirements Matrix

REQUIREMENTS	SYSTEM COMPONENTS
LOS shall predict the workload expected by the organization for a specific period of time	The Machine Learning Predictive Model And Analysis Component
LOS shall analyze some of the data recorded overtime	The Machine Learning Predictive Model And Analysis Component
LOS shall allow an Admin to register users	User Interface Component
LOS shall allow users to login	User Interface Component

References

[1]   G. Ssemogerere, *Productivity Performance in Developing Countries*. 2009.

[2]   *THE NATIONAL EMPLOYMENT POLICY FOR UGANDA*. .

[3]   "No Title." [Online]. Available: https://newz.ug/uganda-will-not-achieve-middle-income-status-with-the-current-low-labour-productivity/.

[4]   Ubos, *Report national labour force survey*. 2017.

System implementation, testing and validation report for SEEM Labor Optimization System

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Document Approval

Name	Role	Date	Signature
<Author>	Author(s)		
	Validation		
	Client		

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Chapter 1: Introduction

1.1 Background and scope of the project

The Labor Optimization System – LOS provides a solution to the problem of labor underutilization and over utilization in organizations. The Labor Optimization System will provide a solution to the problem of labor underutilization and labor over utilization in many organizations in Uganda.

Labor is a factor of production and therefore it equally affects the growth of a business just as much as any other factors such as capital and land. Labor as a resource is mainly measured in terms of labor productivity which is a key measure for business efficiency. [1]Uganda has lowest labor productivity of 1,085 in comparison to its neighboring countries (Tanzania 2,016; Zambia 2,680; Kenya 3,457) in terms of value added per worker in US dollars. This therefore lowers the economy of the country despite the fact that we are undergoing the industrial revolution. [2]Following the National Employment Policy of the republic of Uganda which states that Increasing Decent Employment Opportunities and Labor Productivity for Socio - Economic Transformation, this much more causes a great need for the improvement of the labor productivity as this is of great importance to both the business and the country at large. [3]

[4]The UBOS report suggests use of technology as one of the solutions to the decrease in labor productivity. The LOS system will be developed to provide a solution to the problem in the above paragraph. It will be a web-based system with a machine learning predictive model that can predict the amount of work and distribute it basing on the labor available. It will also help in the business analysis.

The LOS system seeks to solve the above problem by using a predictive machine learning model which predicts the workload at hand at a given time which information can then be used to estimate the amount of labor required in a given data following the company's employee to customer ratio. The system is also to analyze the data of the organization to help give a better understanding of the data at hand and the decision-making process of the company.

In order to use the system, the user will be required to sign into the system using details that are provide by the admin, who can create and delete a use account. The user then can access the predictive and the analytical modules of the system. The predictive module predicts the amount of work in form of patients for a given day, number of days, weeks or months. Therefore, the user will be required to input the number for which he/she needs to know the anticipated workload. After getting this, user can then use the information to estimate the amount of labor needed. The analytics module on the other hand is a dashboard displaying the data in the connected database in terms of graphs and tables. The user will basically be required to click the various buttons on the dashboard which display the data he/she needs to see.

1.2 Overview of the document

This document describes the implementation, testing and validation findings for the LOS system. It is divided into the following sections:

Section 1: Introduction

This section gives an overview of the LOS system. It describes the different features of the entire application and the functionality offered by each feature to the application.

Section 2: System Specifications

This section describes and specifies the system completely and is the basis for the validation process. It includes the version of requirements and version control, input, output, functionality, limitations and safety, default settings, special requirements and errors and alarms.

Section 3: Design Output

This section describes the development tools used to implement the system notes on the anomalies, module and integration details of the system. The section also entails a description of all the device interfaces and equipment to be supported.

Section 4: Inspection and testing

This section describes the system inspection and testing plan and documentation of the test plan. It also contains the test objectives and types, configuration tests and calculation test.

Section 5: Installation and system acceptance test

It describes the installation and system acceptance tests. It details all relevant files supplementary files, the installed components and the installation qualification that the users must possess to use the application.

Section 6: Performance, servicing, maintenance and phase out

This section contains descriptions of performance, servicing, maintenance and phase out stages. It describes the different problems that may be encountered in the use of the system and the possible solutions to overcome those problems.

Section 7: Conclusion and recommendations

This section summarizes the whole project and makes remarks and highlights several issues about the project.

Chapter 2: System Specifications

2.1 Version of requirements and Version control

This is the first release of the LOS system and the version of the application is labelled version 1.0 and it includes the features described in section 1.1. Though some of the requirements of the systems were changed during the system development.

Version of requirements

a. Version 1.0

Included an interface for the users enter data and be inserted into the database which data was to be collected and be used by the analytics module and also for keeping the predictive model up to date.

b. Version 1.1

Removed the user interface for inserting data into the database and concluded on using already existing data for both the predictive and analytics modules.

2.2 Input

The following are the system inputs according to the requirements specification document.

The system has got two modules, the predictive module and the analytic module.

Login details: The system will require the use to input a correct username and password before using it.

Day, week, month: For the predictive module, the inputs are day, week and month for which one needs to get a prediction.

Data: the analytical module, uses the data from the database as its input.

2.3 Output

The system gives the following output:

Predictions: The predictive module of the system will output predictions in form of numbers, basing on what the input requires to be predicted.

Analytical dashboard: the analytic module is to output an analytics dashboard that displays the analytics of the data input.

2.4 Functionality

The LOS system has majorly two functionalities:

I.   Predicting the work load for a given day, the LOS system predicts the amount of work load available for a given day in term of patients. The user can input a day, week or month depending on the required prediction.

II.   Analyzing data, the LOS system analyses the data in the system database and displays it on the dashboard in form of graphs and tables. The analysis is to help with the proper understanding of the various business processes.

2.5 Limitations and safety

The analysis module will require to first be connect to a database that contains the data to be analyzed. This database must contain the data that was/is to be used in creating the predictive model.

2.6 Default settings

When first installed, the system will only have one username and password for the administrator, who can then register the other different users in the system following the company policy.

The analysis module on reload will give analysis of the most recent data in the database.

2.7 Special Requirements

The system requires that there is an already built database from which we are pick the data for analysis and also the csv to build and update the built model.

2.8 Errors and Warnings

The system errors are caught as exceptions while coding and the possible errors due to user interaction are either caught or warning are flagged off to the user to reminder them input the right data or ask a different type of user to perform a given task on the system.

Chapter 3: Design Output

3.1 Implementation

The Labor Optimization System has three components: the web app, the API and the predictive model which have all been developed using the python programming language because it's supports deep learning, readable and efficient for creating front and back ends of a web- based system with greater interoperability. Python is also an open source, cross platform language with a standard library and a rich supportive Community.

The Web app (user interface) has been developed using Django python framework and bootstrap. The API component has been developed using flask which is a lightweight python framework. The predictive models were developed using Jupyter notebook in anaconda environment. We used MySQL database (a free to use open source database, stable, reliable with advanced data security) to store the dataset we used for analysis.

The system has three predictive models to predict daily, weekly and monthly workload. They have been developed using TensorFlow using the Keras which required TensorFlow deep learning framework for developing machine learning applications. TensorFlow is a low-level library used for developing neural networks. We used the Keras deep learning framework because it's high level API with strong multiGPU support and distributes training support and makes it easier to deploy models across a great range of platforms than any other deep learning framework. Keras is user friendly and easy to use when built on top of TensorFlow compared to its alternatives.

Tools like Git and GitHub were used for version controlling so that all changes of the software code can be tracked. We also used visual studio code and Jupiter notebook as our IDE and Jupiter notebook for training our model.

The system components where integrated in such a way that the web app receives user input and forwards it to the API to process the input and return the required output that the web app receives and displays it to the user. The predictive model is embedded in the API. In case the received input has to be processed by the neural model, the API interacts with the necessary predictive model to process the input and return the required output that the API receives and forwards it to the web app that displays it to the user.

3.2 Documentation

Our system has user manual and the design documents that we have generated as our output from the design. The user manual document gives details of how the Labor Optimization System can be used and the design document gives details of how the system was designed. The readers of these documents will have to read them according to what they want to know about the system.

The design details of the system about the programming practices and dynamic tests we used have been shown in the table below.

Table 3. 1 Design Output Checklist

Topics	Design output	
Good programming practice	Source code is... ☑ Modulized ☑ Encapsulated ☐ Functionally divided ☐ Strictly compiled ☐ Fail-safe (handling errors)	Source code contains... ☑ Revision notes ☑ Comments ☑ Meaningfull names ☑ Readable source code ☑ Printable source code
Windows programming	☑ Interface implemented using standard Windows elements ☐ Interface implemented using self-developed Windows elements ☐ Application manages single/multiple running instances Comments:	

Topics	Design output
Dynamic testing	☑ All statements have been executed at least once ☑ All functions have been executed at least once ☐ All case segments have been executed at least once ☐ All loops have been executed to their boundaries ☐ Some parts were not subject to dynamic test Comments:

Chapter 4: Inspection and Testing

4.1 Introduction

The inspection and testing of the Labor Optimization System was planned and documented in a test plan. The extent of the testing is in compliance with the requirements, the system acceptance test specification, the approach, complexity, risks, and the intended and expected use of the system.

Table 4. 1 Inspection Plan and Performance

Topics	4.1.1 Inspection plan and performance	Date / Initials
Design output	☑ Program coding structure and source code ☑ Evidence of good programming practice ☑ Design verification and documented reviews ☐ Change-control reviews and reports Comments: Tested and agreed upon by team members	4/11/2020 E.K S.D M.E M.W
Documentation	☑ System documentation, flow charts, etc. ☑ Test results ☑ User manuals, On-line help, Notes, etc. ☐ Contents of user manuals approved Comments: No user manual but online blog to help	4/11/2020 E.K S.D M.E M.W

Topics	4.1.1 Inspection plan and performance	Date / Initials
Software development environment	☑ Data integrity ☑ File storage ☑ Access rights ☑ Code protection ☐ Installation kit, replication and distribution Comments:	5/11/2020 E.K S.D M.E M.W
Result of inspection	☑ Inspection approved Comments: Inspection was approved by system developers and project supervisor	6/11/2020 E.K S.D M.E M.W

4.2 Test Plan and Performance

4.2.1 Test Objectives

The test was conducted to check whether the system conform to the requirements and the system acceptance test specification. The system was tested under both development and production environment conditions. The system documentations, source code and running system were all tested to see whether they conform to the set requirements and usability and user acceptance standards.

4.2.2 Scope and Relevancy of Tests

The system was tested starting from Requirements documents, Design documents against which the system source codes, structures, inputs and outputs were tested. Using the mentioned documents was relevant in reaching the final user acceptable system.

4.2.3 Levels of Tests

Module Test: Here the system modules namely Data, Analysis and Predictive Model and User Interface were each tested for optimum functionality.

Integration Testing: The three modules were integrated to form a complete system. The integrated system was then tested to see that the combined modules are working together to realize the overall functionality of the system.

System Acceptance Testing: Inputs and outputs were tested using predefined parameters. This was conducted on the fully integrated running system. This was done so that the system conforms to the user requirements.

4.2.4 Types of Tests

Input: Different inputs were tested to check whether relevant predefined outputs are realized.

Functionality: Here all the functionalities specified in the system requirements were tested for availability.

Performance: The system was tested basing on the following performance parameters; user satisfaction, average response time, error rates, request rate, application and server CPU, application availability.

Usability: The system was also tested against usability parameters for effectiveness, efficiency and satisfaction.

4.2.5 Sequence of Tests

Table 4. 2 Sequence of Tests

Test Case	Test Procedure	Test Data	Expected Results
Test predictive model for accuracy	1- Insert training data into the model 2- Use ML accuracy testing algorithm to output accuracy value	A cleaned dataset	Accuracy of above 75%
System Response Time	1- User clicks on the "prediction" button 2- User waits for response	N/A	Average response time should be less than one second on local host

4.2.6 Configuration and Calculation tests

Platform: The system was tested to see how it performs after it is hosted on the database and web hosting servers.

Network testing to check for internet and network security. Calculation tests confirm that known inputs lead to specified outputs.

4.3 Precautions

4.3.1 Anomalous Conditions

New dataset used by organizations not up to standard requirements.

Organizations database servers being slow.

4.3.2 Precautionary steps taken

Inherent system checks for new data from organization for conformity to set standards

Resorting to lightweight database to host the dataset that the system maybe using at a particular time

Chapter 5 Installation and System Acceptance Test

5.1 Input Files

Fully integrated system files for hosting on a web server

5.2 Supplementary Files

Read Me Files

License Agreements

5.3 Installation Qualification

Table 5. 1 Checklist of the Installation and system acceptance test

Topics	**Installation summary**
Installation method	☐ Automatic - installation kit located on the installation media ☑ Manual - Copy & Paste from the installation media Comments:
Installation media	☐ Diskette(s) ☐ CD-ROM ☑ Source disk folder (PC or network) ☐ Download from the Internet Comments:
Installed files	• HTML files • HEX files • CSS files • Python files • CSV files

Table 5. 2 Installation and Procedure Check

Topics	Installation procedure	Date / Initials
Authorization	Person responsible: Muwonge Emmanuel	8/11/2020 M.E
Installation test	☑ Tested and approved in a test environment ☑ Tested and approved in actual environment ☑ Completely tested according to test plan ☐ Partly tested (known extent of update) Comments: System tested by all project members with guidance from supervisor	8/11/2020 M.E S.E K.E M.W

Chapter 6: Performance, servicing, maintenance, and phase out

6.1 Service and maintenance

We are hopeful of keeping hold of the project and try to improve it with time.

We plan to keep track of the users' experiences. This in turn, will enable us to be able to get to know where we need to change and where to uphold. We plan to add some new features and modify the present ones so as to ensure that the users are having the perfect experience of the system.

We plan to have timely quarterly updates with a view of keeping the system with the best user experience for its users. These updates will be consisting of system upgrades to newer versions with the user feedback taken in to modification plus other changes resulting from modifying code to ensure that the system is faster and more reliable.

6.2 Performance and Maintenance

Table 6. 1 Performance and maintenance details

Topics	Performance and maintenance	Date / Initials
Problem / solution	Our first burden is to try and fix all the probable problems that are found out shortly before and after deployment. This means that we need to keep in touch with the users of the system.	Dates must be filled.
Functional maintenance	This system is subject to the user's demands and is meant to adapt to what the users demand of it	

Topics	Performance and maintenance	Date / Initials
Functional expansion and performance improvement	1. Look for areas where we can improve on code used so achieve a faster website 2. Updating some packages used with time so as to ensure the system earns from the improvements made in the source code used.	
Model Improvement	The system's model is meant to be improved and optimized with time. This requires that we be updating the database daily. In this way the system is able to keep up with the trends in the data.	
User Experience Improvement	The system's outlook is meant to be continually updated with feedback from the end users. This is to enable us ensure that the users have a wonderful; experience of the system.	
Additional Features	The system, is meant to have new features based on the users' feedback. These new features are meant to cover for the user's needs that are discovered later.	

Chapter 7: Conclusion and Recommendations

This report validates all the documented and approved activities that have been done to develop and test the Labor Optimization System. This is evident with the subsequent signatures of approval for the project.

Appendix A: User Manual

The system loads to a landing page which includes the user log in and a brief description of the system.
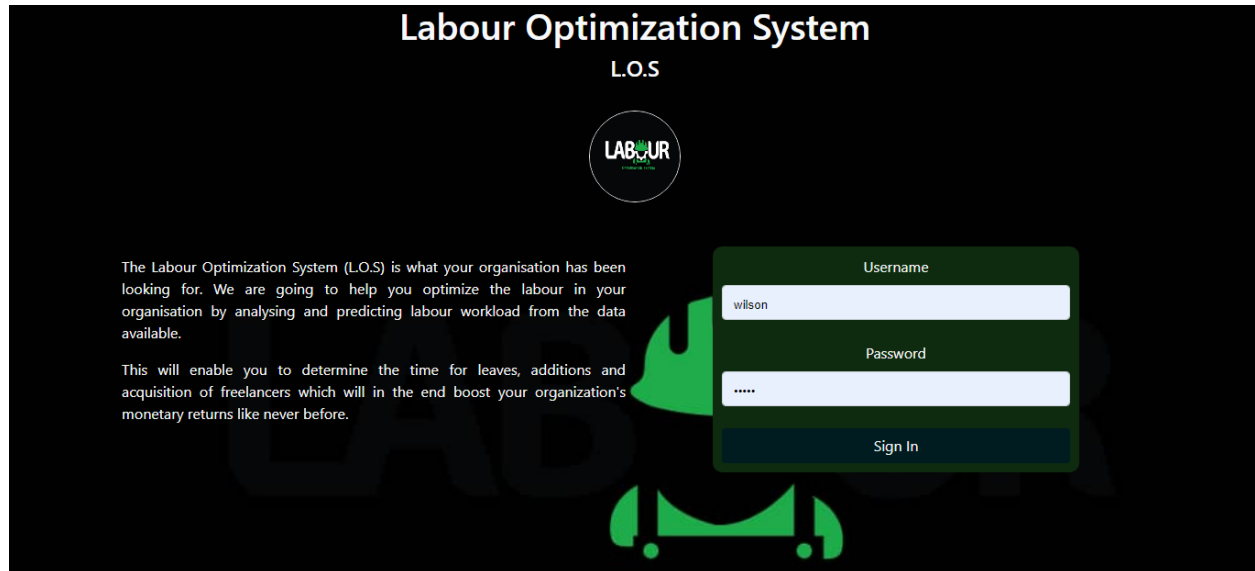

Figure 1 The landing page

The user logs in with a credential provided by the system administrator and is met with the below interface, which consists of the different menu and analysis page as the default page. More analysis pages are shown basing on user requests. The interfaces are shown below.
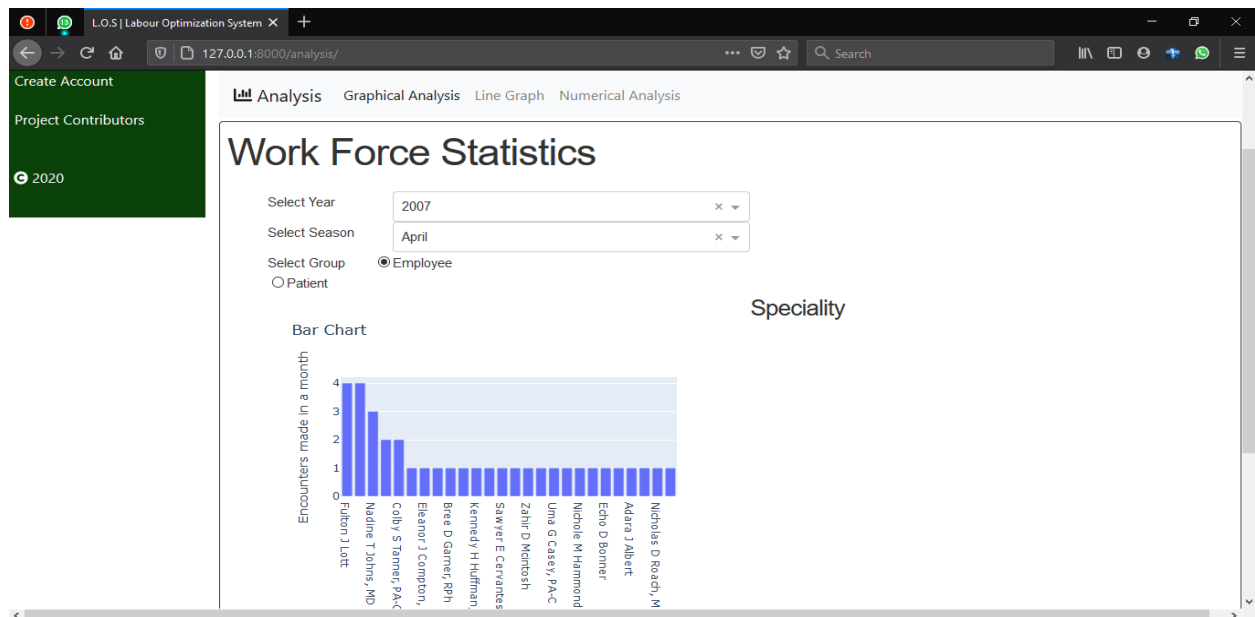
Figure 2 The default analysis page
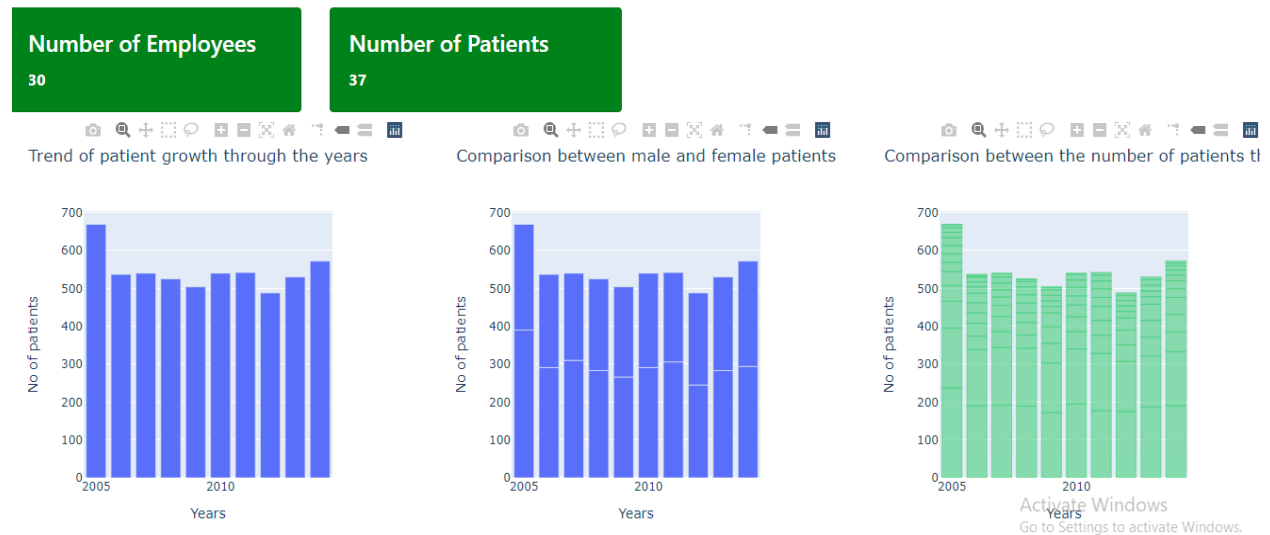
Work Force Statistics

Number of Employees	Number of Patients
30	37

Trend of patient growth through the years | Comparison between male and female patients | Comparison between the number of patients th

Figure 3 Analysis 1

Select Year

2006

Select Month

February

Select Group

● Employee ○ Patient

Number of encounters made by each employee | Number of employees that worked in a given speciality in a month

Figure 4 Analysis2

Select Year

2007

Select Month

October

Select Group

○Employee ●Patient

Number of patients per weekly day in the month
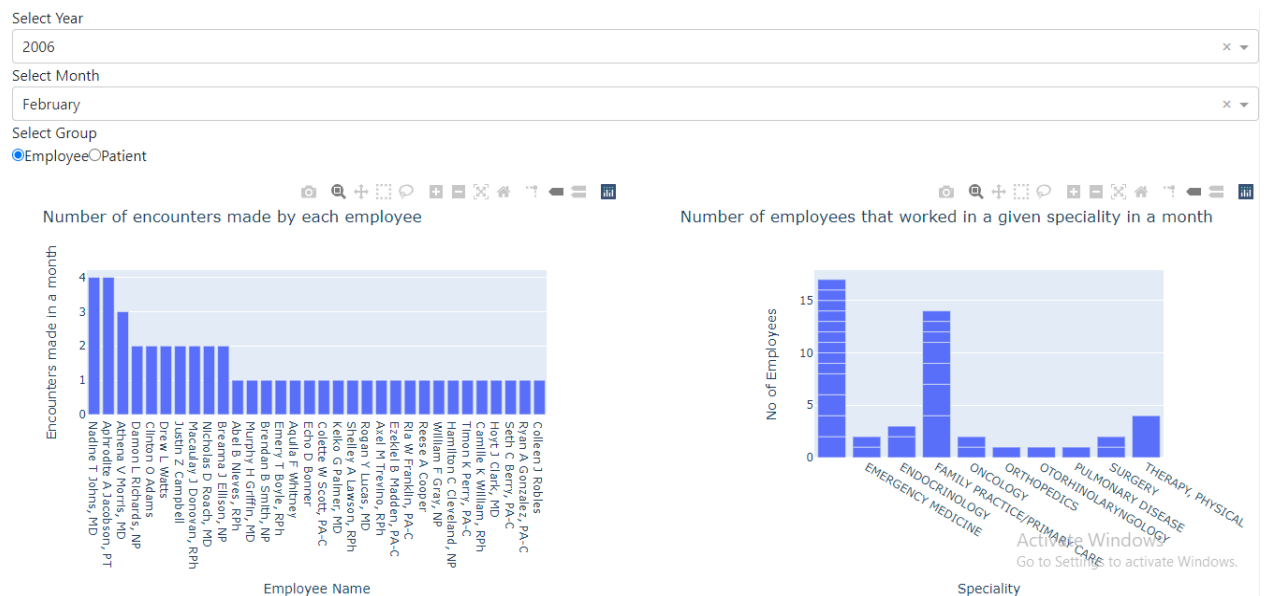
Number of patients that visited a given speciality in the month

Figure 5 Analysis 3

The user once logged in can manipulate the analysis menu options by selecting the monthly or yearly options, and also decide whether to perform analysis based on Employees or Patients.

When the user selects the prediction menu option, he or she is requested whether the predictions should be monthly or daily. Depending on the option chosen, a page similar to below is displayed.
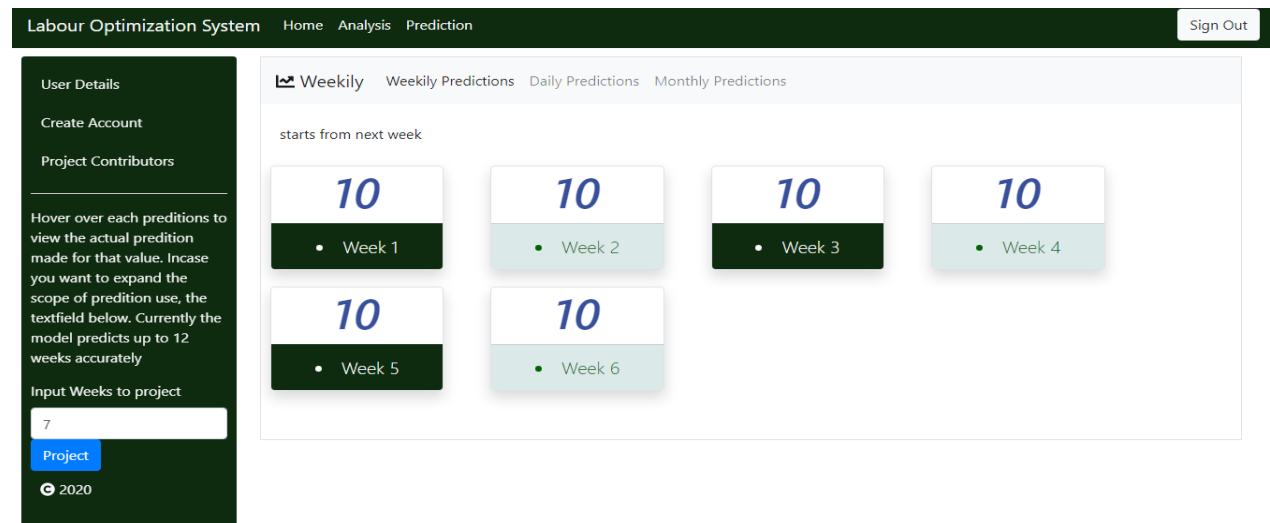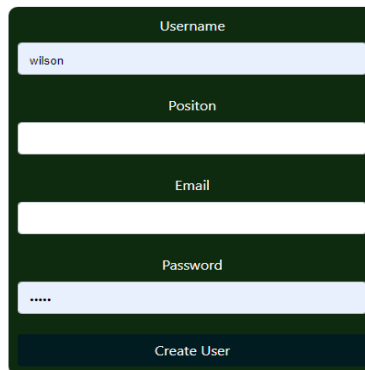

Figure 6 A prediction screen

It should be noted that only the admin has a default log in and its only him/her that can add new users using the screen below.

Labour Optimization System
L.O.S

Username

wilson

Positon

Email

Password

.....

Create User

Figure 7 Admin page for adding new users

Our system provides a rich menu options that can be explored once logged in. The screenshots above provide brief highlights. We hope you enjoy using our system

References

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