

A PROJECT REPORT
ON
“NEXT-GEN POWER ERM”

Submitted to
UNIVERSITY OF MUMBAI

In Partial Fulfilment of the Requirement for the Award of

BACHELOR’S DEGREE IN
COMPUTER ENGINEERING

BY

Ansari Haaid

17DCO64

Harnerkar Reema Salahuddin Ridwana

16CO02

UNDER THE GUIDANCE OF
PROF. KALPANA BODKE



DEPARTMENT OF COMPUTER ENGINEERING
Anjuman-I-Islam’s Kalsekar Technical Campus
SCHOOL OF ENGINEERING & TECHNOLOGY

Plot No. 2 and 3, Sector - 16, Near Thana Naka,
Khandagaon, New Panvel - 410206

2019-2020

AFFILIATED TO
UNIVERSITY OF MUMBAI

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CERTIFICATE

This is certify that the project entitled

“Next-gen Power ERM“

submitted by

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is a record of bonafide work carried out by them, in the partial fulfilment of the requirement for the award of Degree of Bachelor of Engineering (Computer Engineering) at *Anjuman-I-Islam's Kalsekar Technical Campus, Navi Mumbai* under the University of MUMBAI. This work is done during year 2018-2019, under our guidance.

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Acknowledgements

I would like to take the opportunity to express my sincere thanks to my guide **AAMER SAYED**, Assistant Professor, Department of Computer Engineering, AIKTC, School of Engineering, Panvel for his invaluable support and guidance throughout my project research work. Without his kind guidance & support this was not possible.

I am grateful to him/her for his timely feedback which helped me track and schedule the process effectively. His/her time, ideas and encouragement that he gave is help me to complete my project efficiently.

We would like to express deepest appreciation towards **DR. ABDUL RAZAK HONNUTAGI**, Director, AIKTC, Navi Mumbai, **Prof. TABREZ KHAN**, Head of Department of Computer Engineering and **Prof. PROJECT COORDINATOR NAME**, Project Coordinator whose invaluable guidance supported us in completing this project.

At last we must express our sincere heartfelt gratitude to all the staff members of Computer Engineering Department who helped me directly or indirectly during this course of work.

Ansari Haaid
Reema Harnekar

Project I Approval for Bachelor of Engineering

This project entitled *Next-gen Power ERM* by *Ansari Haaid and Reema Harnekar* is approved for the degree of *Bachelor of Engineering in Department of Computer Engineering*.

Examiners

1.

2.

Supervisors

1.

2.

Chairman

.....

Declaration

I declare that this written submission represents my ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Ansari Haaid

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ABSTRACT

Today in the world of growing technology the domain of artificial intelligence is the pioneer. There are majority of the advancements and applications of Artificial Intelligence that we hear about refer to a category of algorithms known as Machine Learning. Self-learning algorithms use statistics to draw models from huge amounts of data. Machine learning is able to make very precise assumptions about what we do, about the next activity we might want to do. Our project will be using machine learning in order to facilitate working of an employee management system and will help the HR manager to analyse the performance and growth of individual employee.

Our project will also find any unusual pattern in the performance of employees. Our project will be using Deep learning in order to facilitate the employee attrition that will lead to reduce the employee turnover for the company, which is huge amount of cost for a big organisation. Organisations face huge costs from employee turnover. For a progress in organisation its important to know which of your employees are important to the organisation. Our project will be using h2o package and lime package to implement employee attrition.

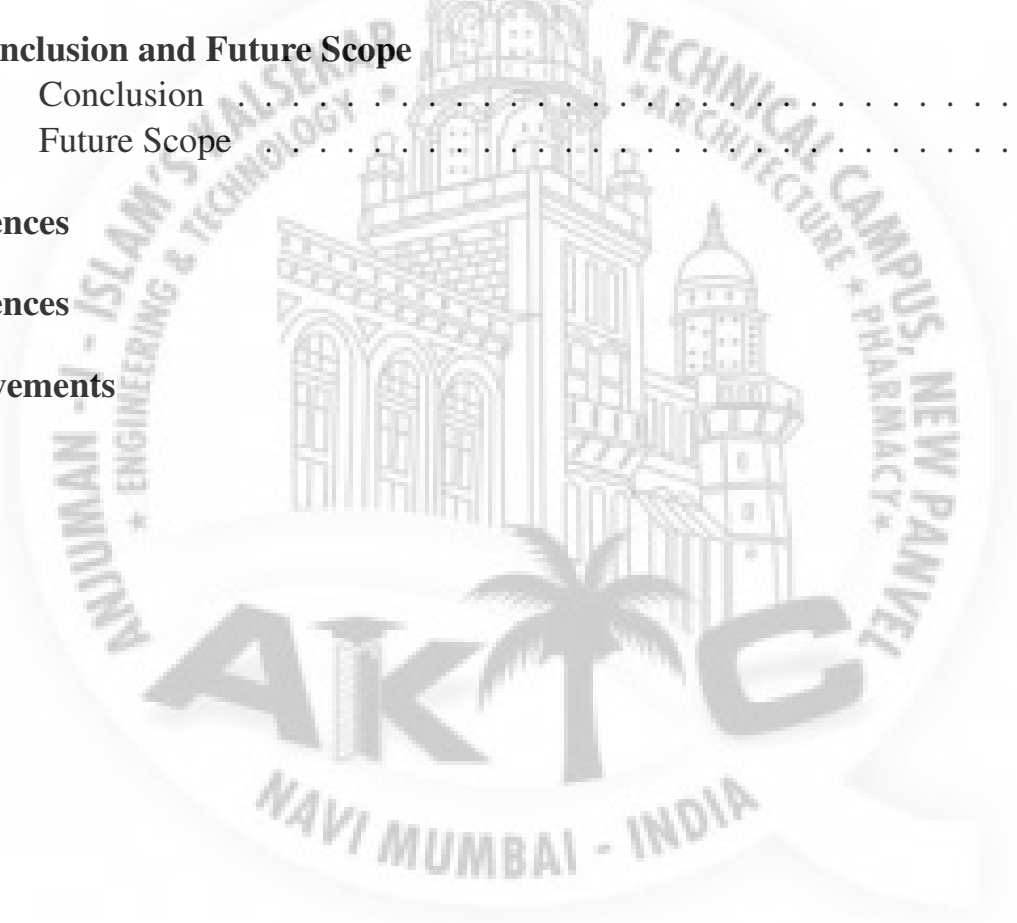
Keywords: Attrition, Machine Learning, Data Mining, Training set, Training Data, Automated System, pattern Recognition, Deep learning, Knowledge extraction, Data preprocessing, knowledge extraction, Web module, Artificial Intelligence.

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Chapter 1

Introduction

During the past decade, employee turnover has become a very serious problem for organizations. When a well-trained and well-adapted employee leaves the organization for any of the reason, it creates an empty space in an organization (i.e) there occurs a vacuum in the organization. It creates a great difficulty for a Human resource personnel to fill the gap that has occurred. Modern Human resource managers is taking various steps to reduce the employee attrition rate and it has been a pivotal challenge for today's Managers. Many of the employees may also tend to leave the job for various undisclosed factors such as lack of job security, lack of career advancement, desire for change in new opportunities, anticipating higher pay, problems with supervisors and few other personal reasons. This study helps in knowing why attrition occurs, reasons for employee attrition, challenges faced by managers in retaining employees and also suggest some measures in retaining employees. Managing retention and keeping the turnover rate below target and including norms is one of the most challenging issues facing business. Managing employee retention is a practical guide for manager to retain their talented employees. The aim of the project is to identify factors like salary, superior – subordinate relationship, growth opportunities, facilities, policies and procedures, recognition, appreciation, suggestions, co- workers by which it helps to know the Attrition level in the organizations and factors relating to retain them. For an example- If an employee in an ongoing project leaves the project in the middle. Here some other employee has to be replaced to fill that gap. The new employee has to be trained and they should understand the idea and context of the project. This would affect the other team member's attitude to a significant extent. The current paper explains about employee attrition challenges and suggestions in retaining the employees

1.1 Purpose

The problem for an HR manager to keep a track of individual employee is to be tackled. We have to built a platform that can automate the analysing process for the data given for individual employee such as attendance and DSR(daily status report) and generate a graphical information for individual employee and for group. After analysing the data the system will also be able to find any unusual pattern in the behaviour of the employee in with respect to daily work.

1.2 Project Scope

Given a situation at a company, building a platform that can automate the analysing process of the employee data and successfully generating a pictorial description of the work progress of that particular employee, also the system will monitor for any unusual pattern in the behaviour of individual employee. Performance management also known as performance monitoring, describes the tools and processes in place to analyze data from a company performance with the intention of discovering unusual pattern and dealing with problems accordingly.

1.3 Project Goals and Objectives

1.3.1 Goals

1. Identify employee attrition.
2. To know the Various Reasons of employee Attrition.
3. Keeping record of employees daily work completion.
4. Graphical representation of employees progress graph.

1.3.2 Objectives

1. Maintain the employee turnover effectively.
2. Improve planning for employee retention.
2. Plan replacement if an employee is about to leave.
3. Work done in the organisation should be done with effective flow.

1.4 Organization of Report

Chapter Introduction shows how this idea popped up and motivation we got to develop this project. We checked if there any system exist for this problem. We found paper based and computer based system. We studied their advantages, disadvantages and got to know how we can build solution to overcome those disadvantages. Chapter Literature Survey includes summary, advantages, disadvantages and ways we can improve those disadvantages of reference paper we studied. Review of literature helps to understand need of project, how project can improve situations and it helps developers to understand what exactly need to develop. Literature review helps clients to know in what areas project can be used. Chapter Project Planning is given so that other developers or clients can know what technologies, tools and software its estimated development cost, expected profit can be known from this chapter. System design chapter is provided with six diagrams to understand modules, users and architecture of project. Use case diagram is given to understand functionality of a system with users and usecases. To visualize database ER diagram is shown. Class diagram is provided to understand structure of project and to understand how data is passing through modules Data Flow Diagram(DFD) is given. Chapter Implementation describes each and every module of project in details. Also to understand interaction logic between object in system sequence diagram is shown. Activity diagram shows control flow from one activity to another. Flow chart for every module is given that shows overall structure of the process or system, traces the flow of information and work through it, and highlights key processing and decision points. Chapter System Testing and Screenshots of project discusses Test cases used for

testing the system, to check validation. The results occurred are given in this chapter. The analysis done after development is described here. Last chapter Conclusion and Future Scope describes how we can make project scope more broad. What are the limitations of system and conclusion.



Chapter 2

Literature Survey

2.1 Application of Classification Technique of Data Mining for Employee Management System

This paper presents the application of classification technique of data mining used for the Employee Management System (EMS). This paper discusses the classification techniques of data mining and based on the data, the process of Knowledge Discovery in Databases (KDD) is reformed for classifying large data into different categories such as Disability, Employee Performance, etc. This paper discusses, WEKA data mining toolkit classifier model to predict employee's performance based on the employee's age, date of joining and number of years of experience. This study helps to predict the employee's work-cycle and helps the management to find the employee's performance those who are disabled and enabled. The paper addresses the system to get the details of those employees who need special attention and guide the management to make policies to improve employees' performance. We demonstrate the application in a real-life situation.

2.1.1 Weaknesses

- a. Architecture is complex
- b. Not applicable for blind illiterate people.
- c. Maintenance cost is also not manageable.

2.1.2 How to overcome the problems mentioned in Paper

- a. More sophisticated technologies can be integrated so that the scalability of the application is increased.
- b. Open source technologies can be used to make the product user friendly with enhancement to ML based modules.

2.2 Orange HRM

a powerhouse human resources tool that any small or midsize business can benefit from using. With OrangeHRM, you have options: You can download and install the system on your own hardware, or you can purchase a hosted solution. To get prices for the hosted solution, you have to contact them from their Request a Quote page. OrangeHRM's features include: fully modular, add-ons (e.g., benefits, employee self-service, training, budget, job and salary history, etc.) for purchase, all standard HR functions (employees, leave, benefits, performance, etc.), and more. The installation is fairly straight-forward. With a self-extracting Windows installer or full-source installations for Windows, Mac, and Linux, you can get OrangeHRM up and running on nearly every platform. If you don't have the hardware or the skills to set up Orange onsite, you can request a quote for a hosted instance of OrangeHRM. You can also purchase support plans and customizations.

2.2.1 Weaknesses

- a. Architecture is complex.
- b. System would be costly.
- c. Not applicable for blind illiterate people.

2.2.2 How to overcome the problems mentioned in Paper

- a. More sophisticated technologies can be integrated so that the scalability of the application is increased.
- b. Open source technologies can be used to make the product user friendly with enhancement to ML based modules.

2.3 Predicting Employee Attrition using Machine Learning

The growing interest in machine learning among business leaders and decision makers demands that researchers explore its use within business organisations. One of the major issues facing business leaders within companies is the loss of talented employees. This research studies employee attrition using machine learning models. Using a synthetic data created by IBM Watson, three main experiments were conducted to predict employee attrition. The first experiment involved training the original class-imbalanced dataset with the following machine learning models: support vector machine (SVM) with several kernel functions, random forest and K-nearest neighbour (KNN). The second experiment focused on using adaptive synthetic (ADASYN) approach to overcome class imbalance, then retraining on the new

dataset using the abovementioned machine learning models. The third experiment involved using manual undersampling of the data to balance between classes. As a result, training an ADASYNbalanced dataset with KNN ($K = 3$) achieved the highest performance, with 0.93 F1-score. Finally, by using feature selection and random forest, F1-score of 0.909 was achieved using 12 features out of a total of 29 features. Employee attrition can be defined as the loss of employees due to any of the following reasons: personal reasons, low job satisfaction, low salary, and a bad business environment. Employee attrition can be categorised into two categories: voluntary and involuntary attrition. Involuntary attrition occurs when employees are terminated by their employer for different reasons, such as low employee performance or business requirements. In voluntary attrition, on the other hand, high-performing employees decide to leave the company of their own volition despite the company's attempt to retain them. Voluntary attrition can result from early retirement or job offers from other firms, for example. Although companies that realise the importance of their employees usually invest in their workforce by providing substantial training and a great working environment, they too suffer from voluntary attrition and the loss of talented employees. Another issue, hiring replacements, imposes high costs on the company, including the cost of interviewing, hiring and training.

2.3.1 weaknesses

- a. The model prediction had 55 percent average accuracy, which is obviously not very high.
- b. The research was done on completely numerical format and no modern technologies were used to enhance them.

2.3.2 How to overcome the problems mentioned in Paper

- a. Modern algorithms such as H2o and flask were used to enhance greater performance
- b. Using new technologies and algorithms we are able to achieve greater percentage of accuracy

2.4 Technical Review

Our system uses technologies such as follows:

2.4.1 H2O

There is a lot of buzz for machine learning algorithms as well as a requirement for its experts. We all know that there is a significant gap in the skill requirement. The

motive of H2O is to provide a platform which made easy for the non-experts to do experiments with machine learning. H2O architecture can be divided into different layers in which the top layer will be different APIs, and the bottom layer will be H2O JVM. H2O's core code is written in Java that enables the whole framework for multi-threading. Although it is written in Java, it provides interfaces for R, Python and few others shown in the architecture, thus enabling it to be used efficiently. In crux, we can say that H2O is an open source, in memory, distributed, fast and scalable machine learning and predictive analytics that allow building machine learning models to be an ease.

Advantages of Technology

H2O takes advantage of the computing power of distributed systems and in-memory computing to accelerate machine learning using it's industry parallelized algorithms which take advantage of fine grained in-memory mapreduce.

Reasons to use this Technology

AutoML or Automatic Machine Learning is the process of automating algorithm selection, feature generation, hyperparameter tuning, iterative modeling, and model assessment. AutoML tools make it easy to train and evaluate machine learning models. Automating the repetitive data science tasks allows people to focus on the data and the business problems they are trying to solve.

2.4.2 Flask

Flask is a lightweight WSGI web application framework. It is designed to make getting started quick and easy, with the ability to scale up to complex applications. It began as a simple wrapper around Werkzeug and Jinja and has become one of the most popular Python web application frameworks. Flask offers suggestions, but doesn't enforce any dependencies or project layout. It is up to the developer to choose the tools and libraries they want to use. There are many extensions provided by the community that make adding new functionality easy.

Advantages of Technology

Flask is the most policed and feature-rich micro framework. Flask comes with all its benefit of the fast template, strong WSGI features, and extensive documentation. Flask gives lots of good features, vast no of extension facility for a new project.

Reasons to use this Technology

Flask is considered more Pythonic than the Django web framework because in common situations the equivalent Flask web application is more explicit. Flask is also

easy to get started with as a beginner because there is little boilerplate code for getting a simple app up and running.

2.4.3 Binary Models

When saving an H2O binary model with `h2o.saveModel` (R), `h2o.savemodel` (Python), or in Flow, you will only be able to load and use that saved binary model with the same version of H2O that you used to train your model. H2O binary models are not compatible across H2O versions. If you update your H2O version, then you will need to retrain your model. For production, you can save your model as a POJO/MOJO. These artifacts are not tied to a particular version of H2O because they are just plain Java code and do not require an H2O cluster to be running. In R and Python, you can save a model locally or to HDFS using the `h2o.saveModel` (R) or `h2o.savemodel` (Python) function. This function accepts the model object and the file path. If no path is specified, then the model will be saved to the current working directory. After the model is saved, you can load it using the `h2o.loadModel` (R) or `h2o.loadmodel` (Python) function. You can also upload a model from a local path to your H2O cluster.

2.4.4 AutoML: Automatic Machine Learning

In recent years, the demand for machine learning experts has outpaced the supply, despite the surge of people entering the field. To address this gap, there have been big strides in the development of user-friendly machine learning software that can be used by non-experts. The first steps toward simplifying machine learning involved developing simple, unified interfaces to a variety of machine learning algorithms (e.g. H2O).

Although H2O has made it easy for non-experts to experiment with machine learning, there is still a fair bit of knowledge and background in data science that is required to produce high-performing machine learning models. Deep Neural Networks in particular are notoriously difficult for a non-expert to tune properly. In order for machine learning software to truly be accessible to non-experts, we have designed an easy-to-use interface which automates the process of training a large selection of candidate models. H2O's AutoML can also be a helpful tool for the advanced user, by providing a simple wrapper function that performs a large number of modeling-related tasks that would typically require many lines of code, and by freeing up their time to focus on other aspects of the data science pipeline tasks such as data-preprocessing, feature engineering and model deployment.

H2O's AutoML can be used for automating the machine learning workflow, which includes automatic training and tuning of many models within a user-specified time-limit. Stacked Ensembles – one based on all previously trained models, another one on the best model of each family – will be automatically trained on collections

of individual models to produce highly predictive ensemble models which, in most cases, will be the top performing models in the AutoML Leaderboard. The H2O AutoML interface is designed to have as few parameters as possible so that all the user needs to do is point to their dataset, identify the response column and optionally specify a time constraint or limit on the number of total models trained.

In both the R and Python API, AutoML uses the same data-related arguments, `x`, `y`, `trainingframe`, `validationframe`, as the other H2O algorithms. Most of the time, all you'll need to do is specify the data arguments. You can then configure values for `maxruntimesecs` and/or `maxmodels` to set explicit time or number-of-model limits on your run.



Chapter 3

Project Planning

3.1 Members and Capabilities

Table 3.1: Table of Capabilities

SR. No	Name of Member	Capabilities
1	Reema Harnekar	Python, Algorithm design, Program Integration
2	Ansari Haaid	Database, UI Design, Documentation

Work Breakdown Structure

3.2 Roles and Responsibilities

Table 3.2: Table of Responsibilities

SR. No	Name of Member	Role	Responsibilities
1	Reema Harnekar	Co Leader	python, Algorithm design, Program Integration
2	Ansari Haaid	Co Leader	Database, UI Design, Documentation

3.3 Assumptions and Constraints

- People who are using this module will be employees of different level in the organisation.
- This application is useful for the company who care about their employees in order to main employee turnover.
- User of this application will be given different access levels.
- The device should have atleast windows 7 and further versions.

3.4 Project Management Approach

The project model we are going to use is waterfall model. The Waterfall Methodology, on the other hand, is a traditional approach to project management and more commonly used in the manufacturing or construction sectors. A lot of experts believe that it was the first model to have been adopted in software engineering. The model takes a linear approach towards project management with the project being broken down into sequences with the kickoff of a phase dependent on the completion of the preceding one.

3.5 Ground Rules for the Project

- a. Properly planning and gathering relevant information is very important.
- b. Developing a Blueprint of the project and work accordingly.
- c. All the members should report to the guide whenever required
- d. Setting up small goals every week.
- e. Achieving the small goal within that span of time.
- f. Keeping tracks of the progress towards project.

3.6 Project Budget

- a. It is a cost-effective project.
- b. Almost no expenses were spent during development.

3.7 Project Timeline

Practical Solution(Next-gen Power ERM)					
Project Estimation					
WEB Portal					
Work items		Start Date	End Date	Working Days	Days
Requirement gathering and analysis		8/23/19	9/27/19	24/8,7/9,19/9,26/9	7
FRS & system understanding					
Project Scheduling					
project architecture & User interface					44
System architecture		9/27/19	9/27/19	9/27/19	1
Prototype creation (Only design using corel)		10/4/19	10/4/19	10/4/19	1
	Landing page(Employee search and notificattion panel)				
	Individual employee performance				
	Notification panel	10/11/19	11/1/19	11/10,31/10,1/11,	3
User Interface creation and implimentaion					
	HTML Prototype creation for				
	Landing page				
	Individual employee performance				
	Notification panel				
	and others				
Data Preprocessing		11/8/19	12/13/19		10
	Data Mining				
	Data Cleaning				
	Data Visualisation				
Implementing Algorithm		12/20/19	12/27/19		4
	Researching and Selecting an appropriate algorithm				
Building Model		12/27/19	1/10/20		15
Training Model		1/10/20	1/24/20		10
	Training the model with Data				
Testing Model		1/24/20	2/14/20		10

Landing Page					
Landing Page	Application:				
	New Section in the existing Dashboard				
	User Interface for HR				
	Search section for Employee search				
	Sections for List of Employees and List of Notifications				
	Script to autoupdate list of notifications				
	Graph and Visualization (Chart script and API call)				
	Database:				
	Procedure creation and integration				
	Security and validations				
	Testing:				
	Validation and unit testing				
Employee Search					
Default Search	Application:				
	Default Search				
	Saved Search (API integration)				
	Customizing save search with name creation				
	Database:				
	Procedure creation and integration				
	Security and validations				
	Testing:				
	Validation and unit testing				

Employee Performance					
Employee Performance Page	Application:				
	User Interface				
	custom script for auto update count				
	Single page for each employee having their complete details				
Graph and Visualization	Graph to show Attendance				
	Graph to show DSR				
	Graph to show unusual pattern				
	Script for to auto-update graphs				
	Download				
	Database:				
	Procedure creation and integration				
	Security and validations				
	Testing:				
	Validation and unit testing				
Notification Panel					
Notification Section	Application:				
	User Interface				
	custom script for auto update count				
	Notification of particular employee				
	Direct link to employee performance of each employee				
	Database:				
	Procedure creation and integration				
	Security and validations				
	Testing:				
	Validation and unit testing				

Internal QA and Bug-Fixing					10
Module base testing					
bug-Fixing					
Retesting and Final Fixing					
UAT					15
UAT environment readiness					3
UAT deployment					2
UAT (client testing)					5
Bug fixing as per UAT					
Final testing and approvals					
Buffer with UAT sign-off					5
Production deployment & go live					10
Production deployment					

Chapter 4

Software Requirements Specification

4.1 Overall Description

4.1.1 Product Perspective

Describe the context and origin of the product being specified in this SRS. For example, state whether this product is a follow-on member of a product family, a replacement for certain existing systems, or a new, self-contained product. If the SRS defines a component of a larger system, relate the requirements of the larger system to the functionality of this software and identify interfaces between the two. A simple diagram that shows the major components of the overall system, subsystem interconnections, and external interfaces can be helpful[?].

4.1.2 Product Features

Most of the work we do in the field of people analytics is oriented to helping organizations understand what is most important to their employees, with the goal of making improvements to increase employee engagement and productivity, and reduce unwanted attrition. Our Project specifically focused on identifying why employees voluntarily leave, what might have prevented them from leaving, and how we can use data to predict attrition risk. Most importantly, this type of employee predictive analytics can be used to help organizations understand and design the interventions that will be most effective in reducing unwanted attrition.

4.1.3 User Classes and Characteristics

This project is specifically made for the managers and HR to analyse the behaviour of the employee and identify their progress and find if the employee desires to leave the company.

4.1.4 Operating Environment

Server Side - Software Requirements

- Microsoft Windows 7 or later / Ubuntu 12.0 LTS or later/ MAC OS 10.1 or later.
- HTML 5 compatible Browser
- Flash support plugins.
- Bootstrap, .chart.js, Ajax .
- Python 3.7.
- MySQL.
- .NET

Server Side - Hardware Requirements

- Intel Core i5 3rd gen processor or any equivalent.
- 8 GB RAM & 20 GB Disk Space (for Desktop)

Client Side - Software Requirements

- Microsoft Windows XP or later / Ubuntu 12.0 LTS or later/ MAC OS 10.1 or later
- HTML 5 compatible Browser
- Flash support plugins

Client Side - Hardware Requirements

- Intel Core i3 3rd gen processor or any equivalent (For Desktop).
- 4 GB RAM & Disk Space (for Desktop)

4.1.5 Design and Implementation Constraints

The system can only work smoothly if the company provides its employees data regularly. the data that is to be worked on should be useful and relevant. Providing data that is irrelevant will create problems in computation and results.

4.2 System Features

The system collects data from the company's database and feeds it to our project. The module of our project cleans the data and then it feeds it to the algorithm to extract the required and important data. The algorithm then computes and gives out favorable output.

4.2.1 System Feature

Pattern recognition is used to identify if there is some difference in the working of employees working and whether or not the pattern is changing or it remains the same.

Description and Priority

The feature that finds out employee attrition is the most important feature and for it to work right, we need the correct samples of data and at the correct time so that the system accumulates the data and feeds to the algorithm.

Stimulus/Response Sequences

Stimulus: HR logs in his login credentials on the starting page.

Response: The system will grant access to the HR.

Stimulus: HR taps on the employee's name for which he wants to retrieve information.

Response: Employee is selected and his data is retrieved.

Stimulus: HR will check for change in the pattern of his/her working progress.

Response: The system will notify the HR for the employee if there is identification of employee attrition.

Functional Requirements

REQ-1: Access to company's database.

REQ-2: Permission to modify company employee management system.

4.3 External Interface Requirements

4.3.1 User Interfaces

Describe the logical characteristics of each interface between the software product and the users. This may include sample screen images, any GUI standards or product family style guides that are to be followed, screen layout constraints, standard buttons and functions (e.g., help) that will appear on every screen, keyboard shortcuts, error message display standards, and so on. Define the software components for which a user interface is needed. Details of the user interface design should be documented in a separate user interface specification.

4.3.2 Hardware Interfaces

Describe the logical and physical characteristics of each interface between the software product and the hardware components of the system. This may include the supported device types, the nature of the data and control interactions between the software and the hardware, and communication protocols to be used.

4.3.3 Software Interfaces

The system consist of front end that is been made using HTML, CSS, JAVA script . The database is been created using mysql. python scripts is used for programming and computing. H2O is used for prediction.H2O architecture can be divided into different layers in which the top layer will be different APIs, and the bottom layer will be H2O JVM.Flask is a micro web framework written in Python. It is classified as a microframework because it does not require particular tools or libraries. It has no database abstraction layer, form validation, or any other components where pre-existing third-party libraries provide common functions. we are using flask for the integration of all the objects in the software.

4.4 Nonfunctional Requirements

4.4.1 Performance Requirements

Flask is a micro web framework written in Python. It is classified as a microframework because it does not require particular tools or libraries. Performance of overall system is very efficient and well optimize. From the time taken to retrieve data and process it everything is well organized.

4.4.2 Safety Requirements

The system will only receive the data that will be permitted to it from company and no other information will be taken. therefore no data from company will be hindered and loss or damage will not happen.

4.4.3 Security Requirements

privacy will be ensured as there will be different level of accessibility provided to different levels of ranking or positions of employees. employees of same level will not be able to see other employees data. only HR will be given access to data and progress of all the employees. the data of individual employee will be secured.

Chapter 5

System Design

5.1 System Requirements Definition

5.1.1 Functional requirements

The basic functions that the system must provide and focus on the needs and goals of the end users.

Use-case Diagram

A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. In our system User will interact with use web module that will be connected to company's software.

Use Case Diagram: Power ERM

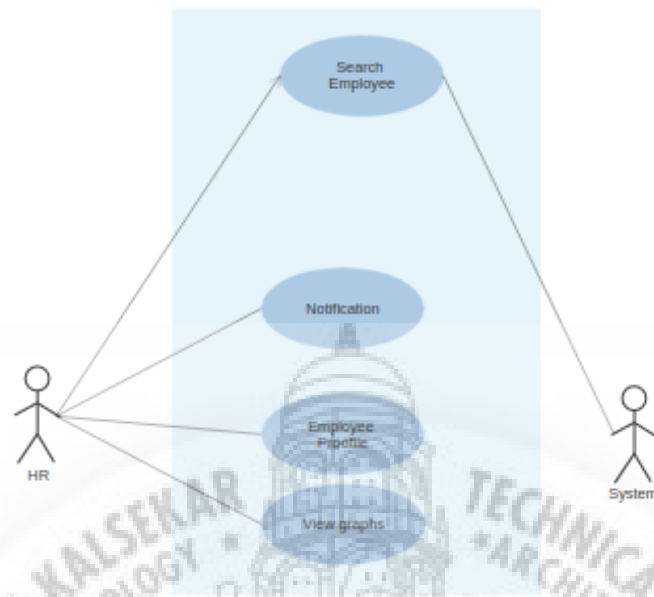


Figure 5.1: Use Case Diagram

Data-flow Diagram

A data-flow diagram is a way of representing a flow of a data of a process or a system. The DFD also provides information about the outputs and inputs of each entity and the process itself. Given below is Level 0 Level 1 and Level 2 DFD of system.

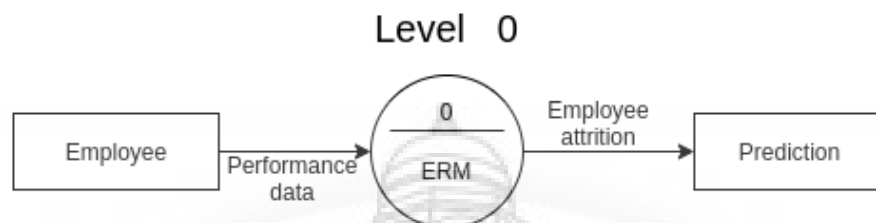


Figure 5.2: DFD level 0

DFD Level 0 depicting main outcome of the system, mentor gets the report of an Employees performance, An Employees DSR details will depict his performance in the report.

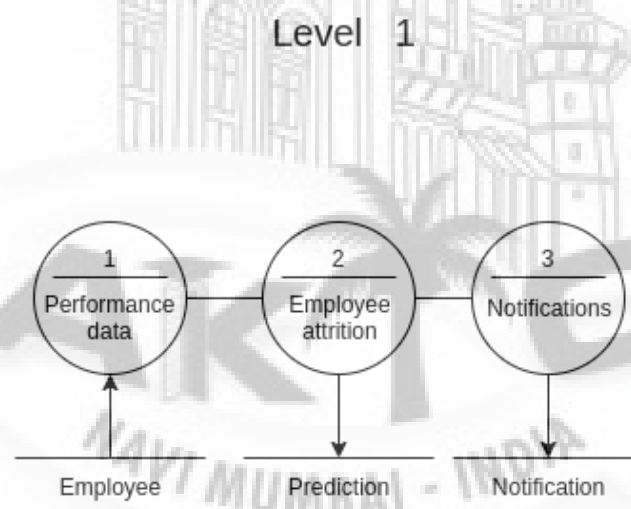


Figure 5.3: DFD level 1

DFD Level 1 the DSR will be retrieved from the data base of the company, Attendance data will be fetched from the biometric system . On calculating these data report will be generated that will go into the database, and performance of the employee will also be recorded to the database of the system.

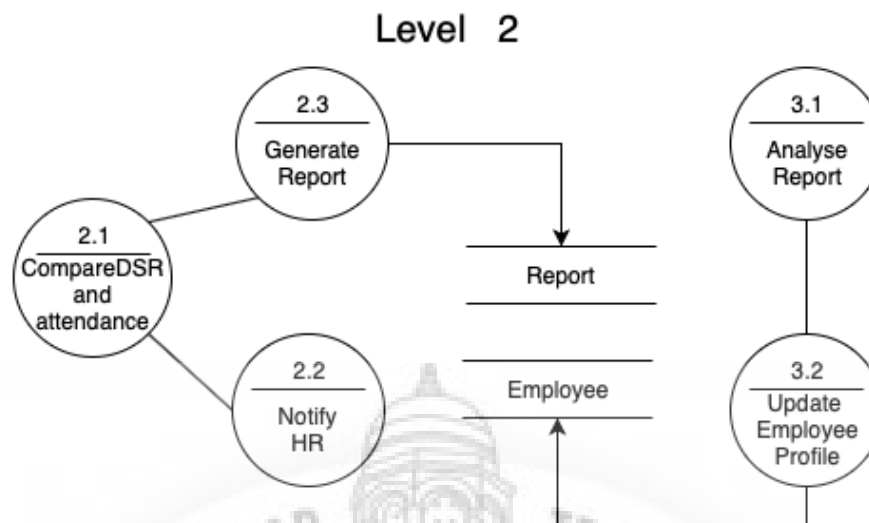


Figure 5.4: DFD level 2

DFD Level 2 the comparison will be done between DSR and Attendance and a report will be generated that will be saved in the Database, if there is some unusual behaviour or the employee then it will notify the HR. These reports will be analysed and the employee profile will be updated.

5.1.2 System requirements (non-functional requirements)

These are non-functional system properties such as availability, performance and safety etc. They define functions of a system, services and operational constraints in detail.

- a. Time Efficiency - The execution of the system takes very less time.
- b. Portability - The system needs to be installed in any android device which is so portable.
- c. Performance - The system will work fine in every AR supported android devices.
- d. Multi User System - This application can be used in different devices independently.
- e. User Interactive - The application have a very simple User Interface though AR application is different than other.
- f. Security - There are no vulnerability in its security.

5.2 System Architecture Design

A system architecture is the conceptual model that defines the structure, behavior, and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviors of the system.

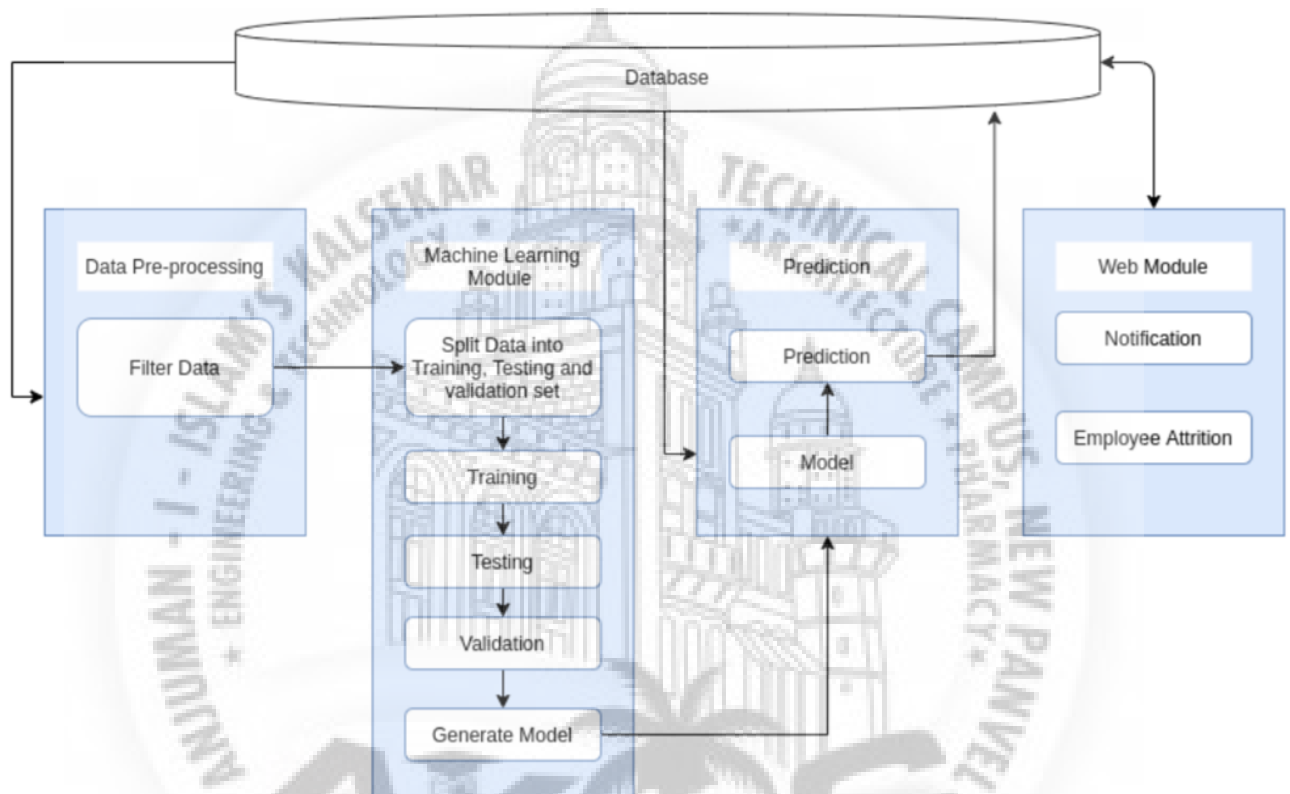


Figure 5.5: System Architecture

5.3 Sub-system Development

WRITE HERE overview of all modules

5.3.1 Data preprocessing

In this module the data that is retrieved for attendance and Daily status Report(DSR) is filtered and cleaned. The main aim of Data Cleaning is to identify and remove errors duplicate data, in order to create a reliable dataset. This improves the quality of the training data for analytics and enables accurate decision-making.

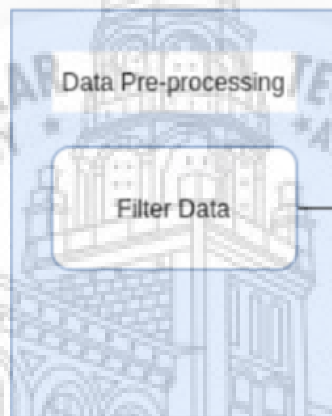


Figure 5.6: Data pre processing

5.3.2 Machine Learning Module

This module is most important module. In this module we are going to implement the machine learning, we are going to train the given data set using our algorithm and then extract the knowledge. the extracted knowledge will be converted into certain file format such as JSON. the elements of module are explained below:

Data Preprocessing

It is a technique that is used to convert the raw data into a clean data set. In other words, whenever the data is gathered from different sources it is collected in raw format which is not feasible for the analysis.

Training data set

It is the one used to train an algorithm to understand how to apply concepts such as neural networks, to learn and produce results. It includes both input data and the expected output.

Test data set

It is used to evaluate how well your algorithm was trained with the training data set. In AI projects, we can't use the training data set in the testing stage because the algorithm will already know in advance the expected output which is not our goal.

Machine Learning algorithm

Machine learning algorithms are programs (math and logic) that adjust themselves to perform better as they are exposed to more data. The “learning” part of machine learning means that those programs change how they process data over time, much as humans change how they process data by learning.

Knowledge extraction

Machine learning deals with understanding intelligence for the design and development of algorithms that can learn from data and improve over time. The original definition was “the artificial generation of knowledge from experience”. The challenge is to discover relevant structural patterns and/or temporal patterns (“knowledge”) in such data.

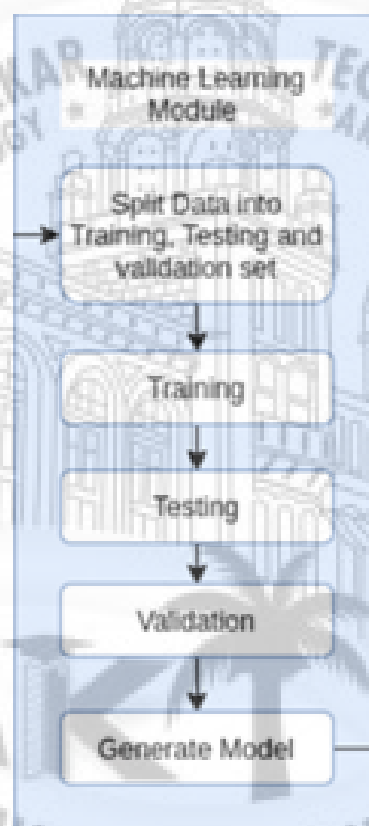


Figure 5.7: Machine Learning Module

5.3.3 Data Processing

This module deals with data or extracted knowledge processing. The pattern or temporal data is the extracted knowledge is and it will be evaluated and will go to the database. Data Processing is a task of converting data from a given form to a much more usable and desired form i.e. making it more meaningful and informative. Using Machine Learning algorithms, mathematical modelling and statistical knowledge, this entire process can be automated. The output of this complete process can be in any desired form like graphs, videos, charts, tables, images and many more,

depending on the task we are performing and the requirements of the machine.

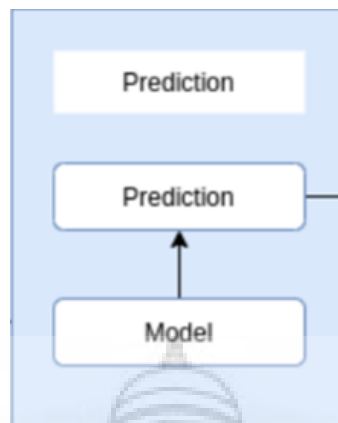


Figure 5.8: Data processing

5.3.4 Web Module

This module is the GUI module of the webpage that deals with user side. this webpage displays notification, various information about the the performance of employee and also it uses graphs as well.

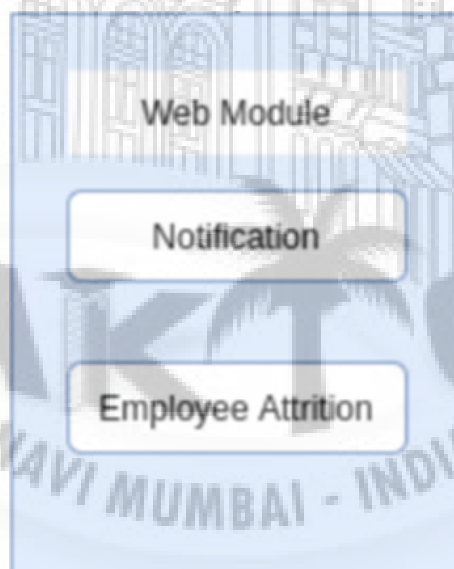


Figure 5.9: Web Module

5.4 Systems Integration

System integration (SI) is an engineering process or phase concerned with joining different subsystems or components as one large system. It ensures that each integrated subsystem functions as required. SI is also used to add value to a system through new functionalities provided by connecting functions of different systems

5.4.1 Activity Diagram

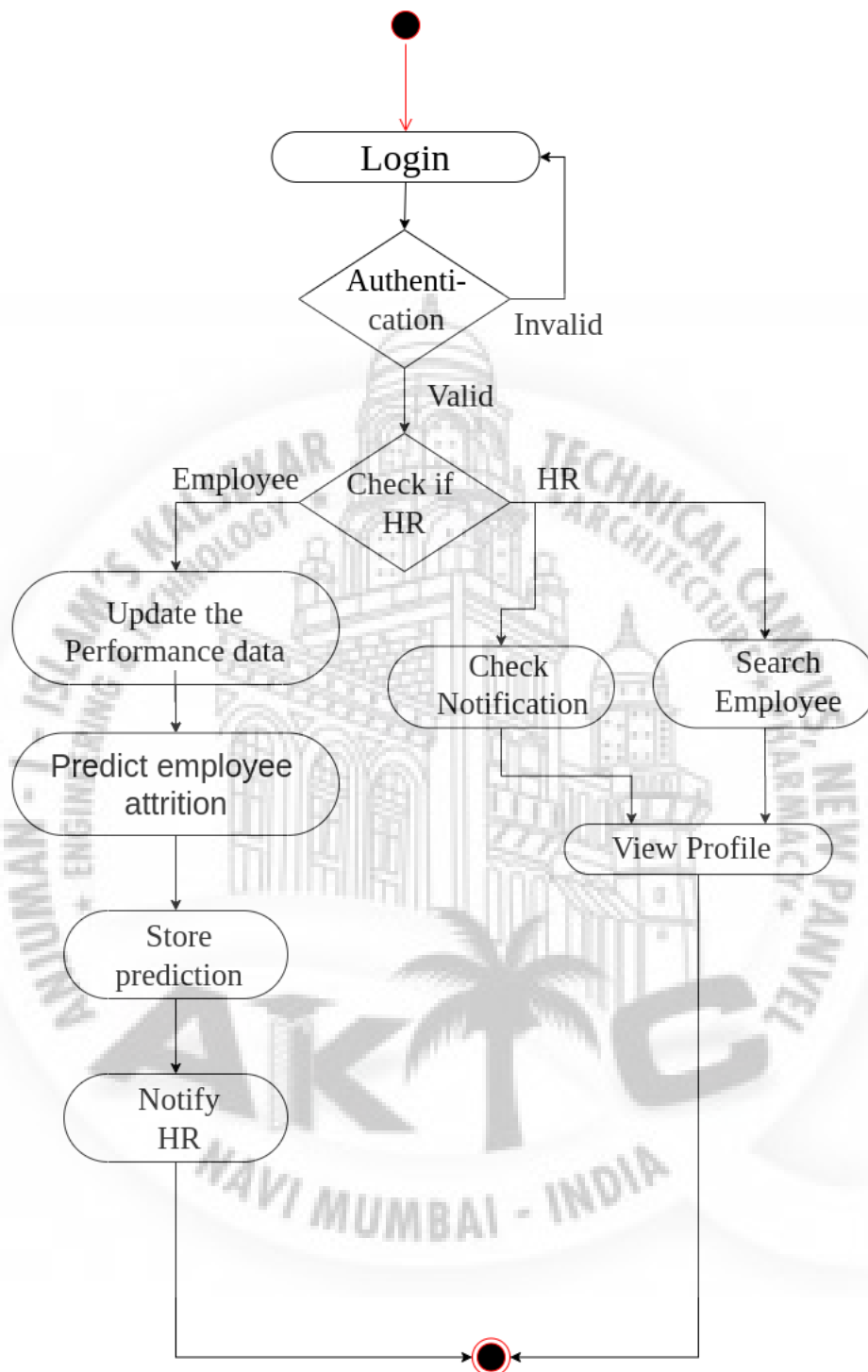


Figure 5.10: Activity Diagram

Activity diagram, representing how the flow of a system is taking place beginning from sign up of HR manager. Validation of HR and getting access to appropriate rights facilities.

Chapter 6

Implementation

6.1 EMPLOYEE SEARCH PAGE

This is the first page of module which allows you to search for employees data.

```

1 <div id="main">
2   <form>
3     <div class="topnav">
4       <button class="btn-search" type="button">SEARCH</button>
5       <div class="input-field first-wrap">
6         <input id="search" type="text" placeholder="Employee ID" />
7       </div>
8       <div class="input-field first-wrap">
9         <input id="search" type="text" placeholder="Employee Name" />
10      </div>
11    </div>
12  </form>
13 </div>
14
15 <div id="wrapper">
16   <section id="maincontent">
17     <div class="container">
18       <div class="row">
19         <div class="span3 features e_pulse">
20           
22           <div class="box">
23             <div class="divcenter">
24               <h4><a href="{{url_for('profile')}}">Haris Khan</a><br /></h4><h5>Data Scientist</h5>
25             </div>
26           </div>
27         </div>
28         <div class="span3 features e_pulse">
29           
31           <div class="box">
32             <div class="divcenter">
33               <h4><a href="{{url_for('profile')}}">Reema Harnekar</a><br /></h4><h5>ML Engineer</h5>
34             </div>
35           </div>
36         </div>
37       </div>
38     </div>
39   </section>
40 </div>

```



```

37     <div class="box">
38         <div class="divcenter">
39             <h4><a href="{{url_for('profile')}}">Tony Stark </a><br /></h4><h5>Data Analyst </h5>
40         </div>
41     </div>
42 </div>
43 <div class="span3 features e_pulse">
44     
45     <div class="box">
46         <div class="divcenter">
47             <h4><a href="{{url_for('profile')}}">Steve Rogers </a><br /></h4><h5>DB Administrator </h5>
48         </div>
49     </div>
50 </div>
51 </div>
52 <div class="row">
53     <div class="span3 features e_pulse">
54         
55         <div class="box">
56             <div class="divcenter">
57                 <h4><a href="{{url_for('profile')}}">Thor Odinson </a><br /></h4><h5>Tech Support </h5>
58             </div>
59         </div>
60 </div>
61 </div>
62 <div class="span3 features e_pulse">
63     
64     <div class="box">
65         <div class="divcenter">
66             <h4><a href="{{url_for('profile')}}">Bruce Banner </a><br /></h4><h5>Data Scientist </h5>
67         </div>
68     </div>
69 </div>
70 </div>
71 <div class="span3 features e_pulse">
72     
73     <div class="box">
74         <div class="divcenter">
75             <h4><a href="{{url_for('profile')}}">Nick Fury </a><br /></h4><h5>General Manager </h5>
76         </div>
77     </div>
78 </div>
79 </div>
80 <div class="span3 features e_pulse">
81     
82     <div class="box">
83         <div class="divcenter">
84             <h4><a href="{{url_for('profile')}}">Natasha Romanoff </a><br /></h4><h6>Full Stack Developer </h6>
85         </div>

```

```
86         </div>
87     </div>
88 </div>
89 </div>
90 </section>
91 </div>
```



6.2 profile page

This page shows employee details.

```

1 <link rel="stylesheet" type="text/css" href="{{url_for('static',filename='css/
  profile3.css')}}">
2 <script src="https://cdnjs.cloudflare.com/ajax/libs/Chart.js/2.9.3/Chart.min.js"
  ></script>
3 {% endblock %}
4
5 {% block main_content%}
6 <div id="wrapper">
7   <div id="profile_card">
8     <div id="content">
9       <a href="profile3.html"></a>
10      <div class="name-info">
11        <a href="#" class="name"><h1>Haris Khan</h1></a>
12        <h4 class="designation">Data Scientist</h4>
13        <label>Employee Id:</label> 12MSK8922 <br>
14        <label>Date of joining:</label> 12/5/1998 <br>
15        <label>Phone No:</label> 7728558904 <br>
16        <label>Email:</label> hariskhan@gmail.com <br>
17        <label>Address:</label> 504/A, Neel Residency, sai nagar road,
  Old panvel - 410206
18      </div>
19    </div>
20  </div>
21 <div class="container-fluid">
22   <div class="chartcontainer">
23     <canvas id="profileChart" width="400" height="250"></canvas>
24   </div>
25   <div class="chartcontainer">
26     <canvas id="profileChart1" width="400" height="250"></canvas>
27   </div>
28 </div>
29 </div>

```

6.3 Pictorial data (graphs)

progress graph of employee is shown in this section.

```

1 {%macro createchart(div_element , labelchart , labels_chart , data_chart)%}
2 <script>
3 var chart_labels = []
4 {%for label_of_chart in labels_chart%}
5 chart_labels.push("{{label_of_chart}}")
6 {%endfor %}
7 var ctx = document.getElementById("{{div_element}}");
8 var myChart = new Chart(ctx, {
9   type: 'line',
10  data: {
11    labels: chart_labels ,
12    datasets: [{
13      label: "{{labelchart }}",
14      data: {{ data_chart }},
15      backgroundColor: [
16        'rgba(255, 99, 132, 0.2)',
17        'rgba(54, 162, 235, 0.2)',
18        'rgba(255, 206, 86, 0.2)',
19        'rgba(75, 192, 192, 0.2)',
20        'rgba(153, 102, 255, 0.2)',
21        'rgba(255, 159, 64, 0.2)'
22      ],
23      borderColor: [
24        'rgba(255, 99, 132, 1)',
25        'rgba(54, 162, 235, 1)',
26        'rgba(255, 206, 86, 1)',
27        'rgba(75, 192, 192, 1)',
28        'rgba(153, 102, 255, 1)',
29        'rgba(255, 159, 64, 1)'
30      ],
31      borderWidth: 1
32    }]
33  },
34  options: {
35    scales: {
36      yAxes: [{
37        ticks: {
38          beginAtZero: true
39        }
40      }]
41    }
42  }
43 });
44 </script>
45 {%endmacro%}

```

6.4 Notification page

This code is used for notification.

```

1 {% block htmlhead %}
2 <link rel="stylesheet" type="text/css" href="{{ url_for('static',filename='css/
   notification.css')}}">
3 {% endblock %}
4
5 {% block main_content%}
6 <div id="wrapper">
7   <div class="mainContainer">
8     <h1 id="topic">Latest Notification </h1>
9     <div class="container-fluid">
10      <div class="row">
11        <div class="col-xs-3 col-1" >
12          <a href="profile3.html"></a>
13          <div class="name-info">
14            <a href="{{ url_for('profile')}}" class="name"><h4>Haris Khan</h4
   ></a>
15            <p class="designation">Data Scientist </p>
16          </div>
17        </div>
18        <div class="col-xs-4 col-2" >
19          <div class="empinfo">
20            <label>Employee No : EMP128457 </label>
21            <label>Project Name : Power ERM</label>
22          </div>
23        </div>
24        <div class="col-xs-5 col-3">
25          <div class="notification">
26            <label class="not-date">Date : 25/12/2012 </label>
27            <p class="noti-p"><b> Inconsistency work and attendance.</b></
   p>
28          </div>
29        </div>
30      </div>
31      <div class="row">
32        <div class="col-xs-3 col-1" >
33          
34          <div class="name-info">
35            <h4 class="name">Reema Harnekar </h4>
36            <p class="designation">Python Expert </p>
37          </div>
38        </div>
39        <div class="col-xs-4 col-2" >
40          <div class="empinfo">
41            <label>Employee No : EMP128457 </label>
42            <label>Project Name : Power ERM</label>
43          </div>
44        </div>
45        <div class="col-xs-5 col-3" >
46          <div class="notification">
47            <label class="not-date">Date : 25/12/2012 </label>
48            <p class="noti-p"><b> Inconsistency work and attendance.</b></p>
49          </div>
50        </div>
51      </div>
52    </div class="row">

```

```

53     <div class="col-xs-3 col-1" >
54         
56         <div class="name-info">
57             <h4 class="name">Tony Stark </h4>
58             <p class="designation">Data Analyst </p>
59         </div>
60     </div>
61     <div class="col-xs-4 col-2" >
62         <div class="empinfo">
63             <label>Employee No : EMP128457 </label>
64             <label>Project Name : Power ERM </label>
65         </div>
66     </div>
67     <div class="col-xs-5 col-3" >
68         <div class="notification">
69             <label class="not-date">Date : 25/12/2012 </label>
70             <p class="noti-p"><b> Inconsistency work and attendance.</b></p>
71         </div>
72     </div>
73 </div>
74 <div class="row">
75     <div class="col-xs-3 col-1" >
76         
78         <div class="name-info">
79             <h4 class="name">Bruce Banner </h4>
80             <p class="designation">HR </p>
81         </div>
82     </div>
83     <div class="col-xs-4 col-2" >
84         <div class="empinfo">
85             <label>Employee No : EMP128457 </label>
86             <label>Project Name : Power ERM </label>
87         </div>
88     </div>
89     <div class="col-xs-5 col-3" >
90         <div class="notification">
91             <label class="not-date">Date : 25/12/2012 </label>
92             <p class="noti-p"><b> Inconsistency work and attendance.</b></p>
93         </div>
94     </div>
95 </div>
96 <div class="row">
97     <div class="col-xs-3 col-1" >
98         
100        <div class="name-info">
101            <h4 class="name">Chris Hemsworth </h4>
102            <p class="designation">Director </p>
103        </div>
104    </div>
105    <div class="col-xs-4 col-2" >
106        <div class="empinfo">
107            <label>Employee No : EMP128457 </label>
108            <label>Project Name : Power ERM </label>
109        </div>
110    </div>
111    <div class="col-xs-5 col-3" >
112        <div class="notification">
113            <label class="not-date">Date : 25/12/2012 </label>

```

```
111         <p class="noti-p"><b> Inconsistency work and attendance.</b></p>
112     </div>
113 </div>
114 </div>
115 </div>
116 </div>
117 </div>
118 {% endblock %}
```



6.5 prediction

This page contains python code that does employee attrition.

```
1 import h2o
2 from h2o.automl import H2OAutoML, get_leaderboard
3 import pandas as pd
4
5 path="/home/reema-harnekar/Desktop/Octaware/Employee_Attrition/
6     Employee_attrition/DRF_1-AutoML-20200921_030607.zip"
7
8 h2o.init()
9 data = h2o.import_file(path='tEmployee.csv')
10
11 imported_model = h2o.import_mojo(path)
12 predictions = imported_model.predict(data)
13
14 a = predictions.as_data_frame()
15
16 data_as_list = h2o.as_list(predictions, use_pandas=False)
17 data_as_df = h2o.as_list(predictions)
18
19 with pd.option_context('display.max_rows', None, 'display.max_columns', None):
20     print(data_as_df)
21 employee = h2o.as_list(data)
22 print(employee)
23 print(type(employee))
```


6.6 employee attrition

This code comprises of the computing that will use prediction and will identify employee attrition.

```

1 import h2o
2 from h2o.automl import H2OAutoML, get_leaderboard
3 import lime
4
5 h2o.init()
6 hr_raw_data = h2o.import_file("HR-Employee-Attrition.csv")
7 hr_raw_data['Attrition']=hr_raw_data['Attrition'].asfactor()
8 hr_raw_data['Department']=hr_raw_data['Department'].asfactor()
9 hr_raw_data['EnvironmentSatisfaction']=hr_raw_data['EnvironmentSatisfaction'].
    asfactor()
10 hr_raw_data['Gender']=hr_raw_data['Gender'].asfactor()
11 hr_raw_data['JobSatisfaction']=hr_raw_data['JobSatisfaction'].asfactor()
12 hr_raw_data['MaritalStatus']=hr_raw_data['MaritalStatus'].asfactor()
13 hr_raw_data['OverTime']=hr_raw_data['OverTime'].asfactor()
14 hr_raw_data['PerformanceRating']=hr_raw_data['PerformanceRating'].asfactor()
15 hr_raw_data['TotalWorkingYears']=hr_raw_data['TotalWorkingYears'].asfactor()
16 hr_raw_data['YearsAtCompany']=hr_raw_data['YearsAtCompany'].asfactor()
17 hr_raw_data['YearsSinceLastPromotion']=hr_raw_data['YearsSinceLastPromotion'].
    asfactor()
18
19 train_data , test_data , valid_data = hr_raw_data.split_frame(ratios = [.7, .15])
20 y = "Attrition"
21 x = train_data.columns
22
23 aml = H2OAutoML(max_runtime_secs = 30, max_models=2, include_algos=['DeepLearning',
    'DRF'])
24 #aml.train(x=x, y=y, training_frame=train)
25 aml.train(x=x, y=y, training_frame=train_data, leaderboard_frame=valid_data)
26
27 lb = aml.leaderboard
28 lb = get_leaderboard(aml, extra_columns='ALL')
29 print(lb.head(rows=lb.nrows))
30 print(aml.leader)
31
32 original_model = aml.leader
33 preds = aml.leader.predict(test_data)
34 print(preds)
35
36 prediction_pd = preds.as_data_frame(use_pandas=True)
37
38 path = "/home/reema-harnekhar/Desktop/Octaware/Employee-Attrition/
    Employee_attrition/"
39 original_model.save_mojo(path)

```

Chapter 7

System Testing

7.1 Test Cases and Test Results

Test ID	Test Case Title	Test Condition	System Behavior	Expected Result
T01	Searching employee	input employee ID	Window shows employee details	employee details are shown
T02	Graphs are been updated	employee data to be updated	on feeding data graph to be updated	graph changes with respect to new data
T03	notification	changed data is feeded	notifying on basis of attrition detection	notified on identification of attrition

7.2 Test Cases:

Title: Searching employee

Description: A registered users should be visible if correct employee ID is been feed.

Precondition: the user must already be registered.

Assumption: a supported browser is being used.

Test Steps:

1. Navigate to home page.
2. In the 'employee search' field, enter the employee name or ID.
3. Click the 'search' button.
4. view employee data.

Expected Result: employees data will be visible including a graph to show pictorial progress of employees work.

Actual Result: Employee data will be shown along with the graph of progress.

Title: Graphs are updated

Description: When new data of the user is added the graph should show gradual changes in the progress reflecting to new data.

Precondition: correct data must be added to the system in order to get updated graph.

Assumption: users behaviour and progress changes .

Test Steps:

1. users data is entered in system.
2. if theres changes in data the graph will be different from the one it was before.
3. the graph will be changed gradually with the change in the users performance data.

Expected Result: graph will change with respect to difference in data from the previous version of graph.

Actual Result: Employee data will be shown along with the graph of progress.

Title: Notification pop-up

Description: When changed data of the user is added the graph should show gradual changes in the progress reflecting to new data and the HR should receive notification of attrition.

Precondition: changed data to be added to the system in order to get notification graph.

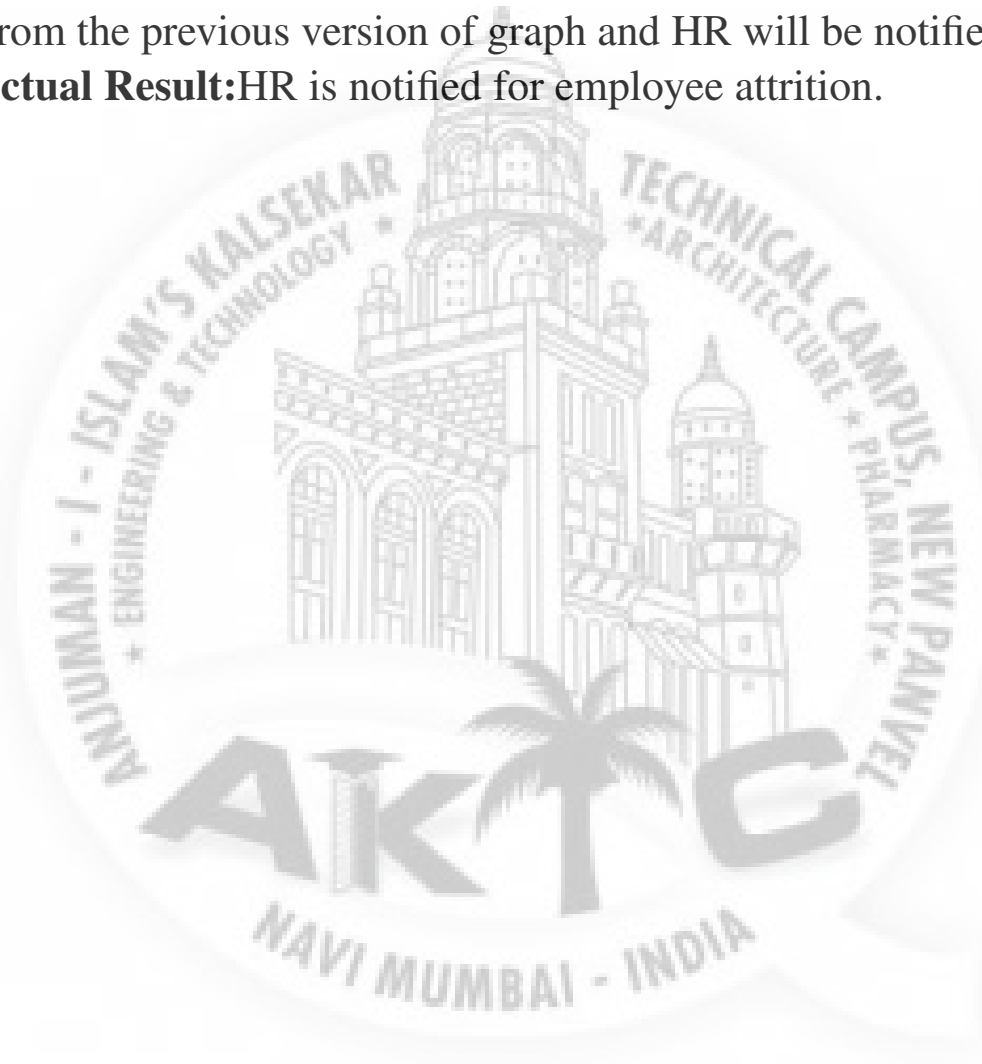
Assumption: users behaviour and work progress to be changed .

Test Steps:

1. changed users data is entered in system.
2. changes in data the graph will be different from the one it was before.
3. Notification will pop in the HR's tab and attrition prediction will be done.

Expected Result: graph will change with respect to difference in data from the previous version of graph and HR will be notified.

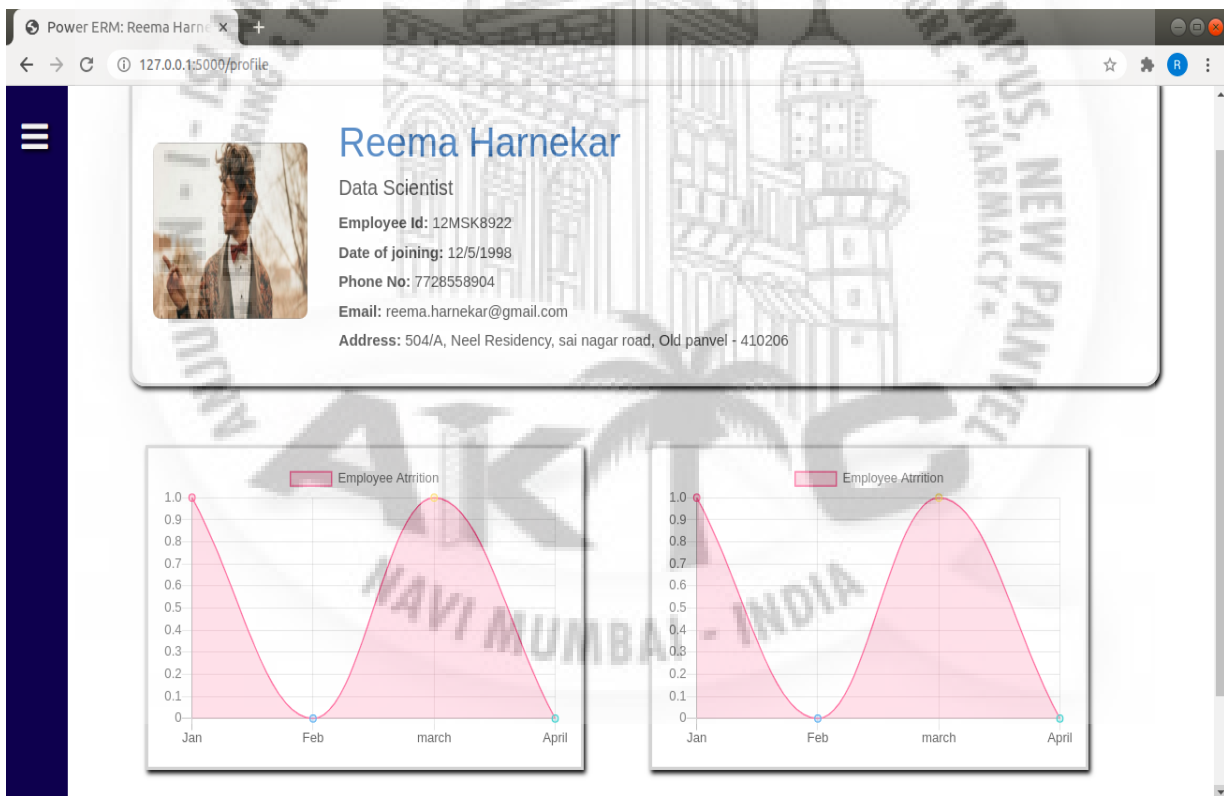
Actual Result:HR is notified for employee attrition.



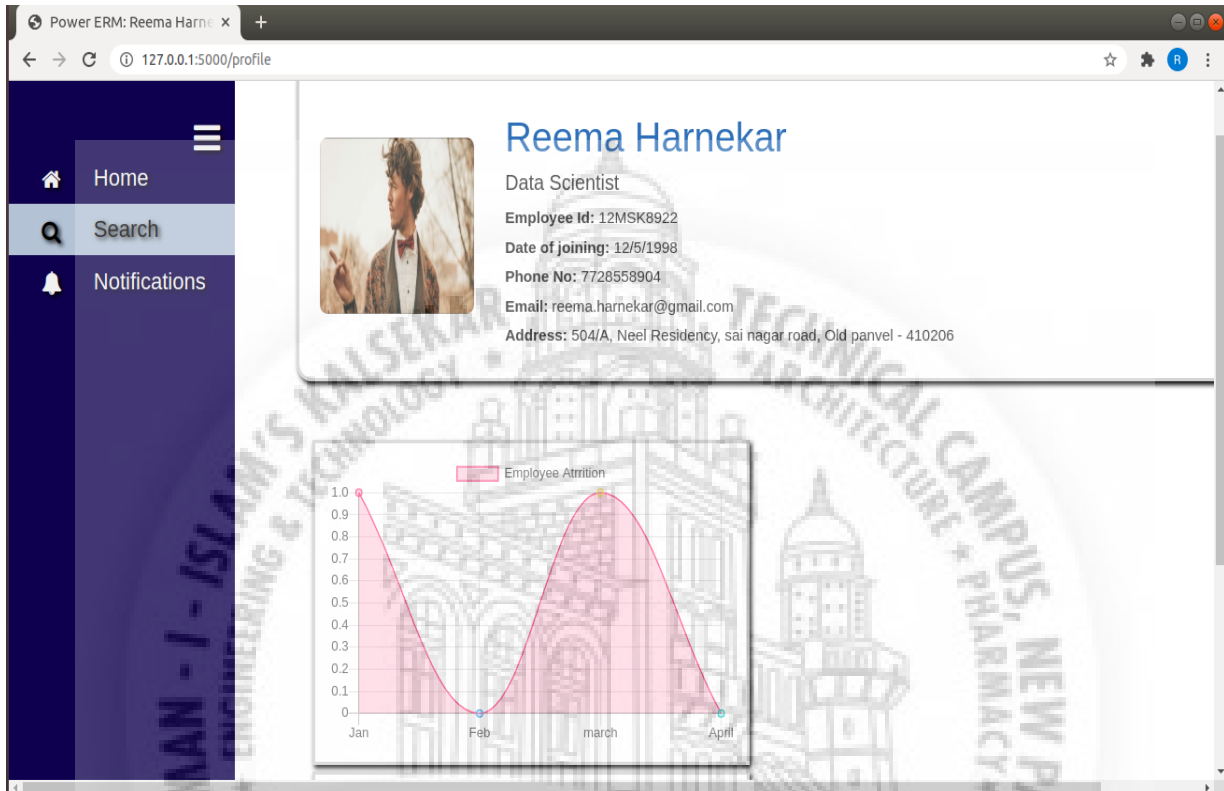
Chapter 8

Screenshots of Project

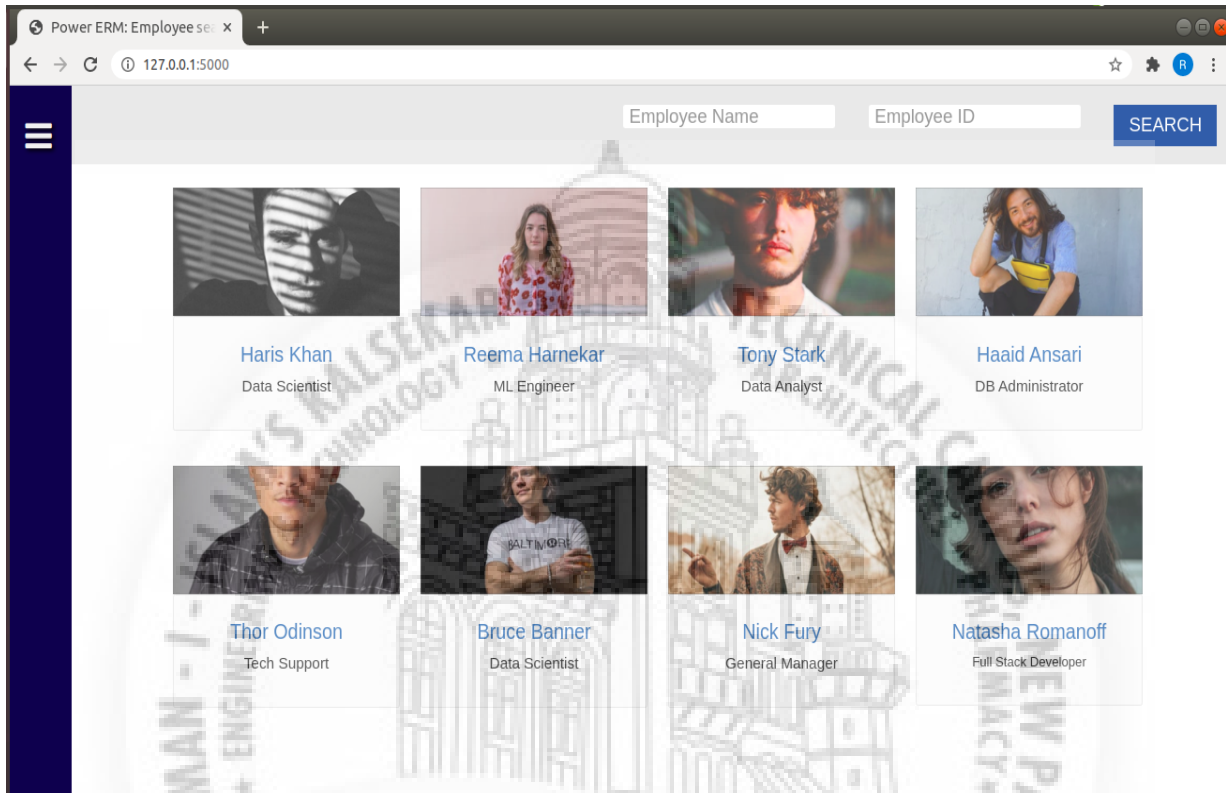
8.1 profile



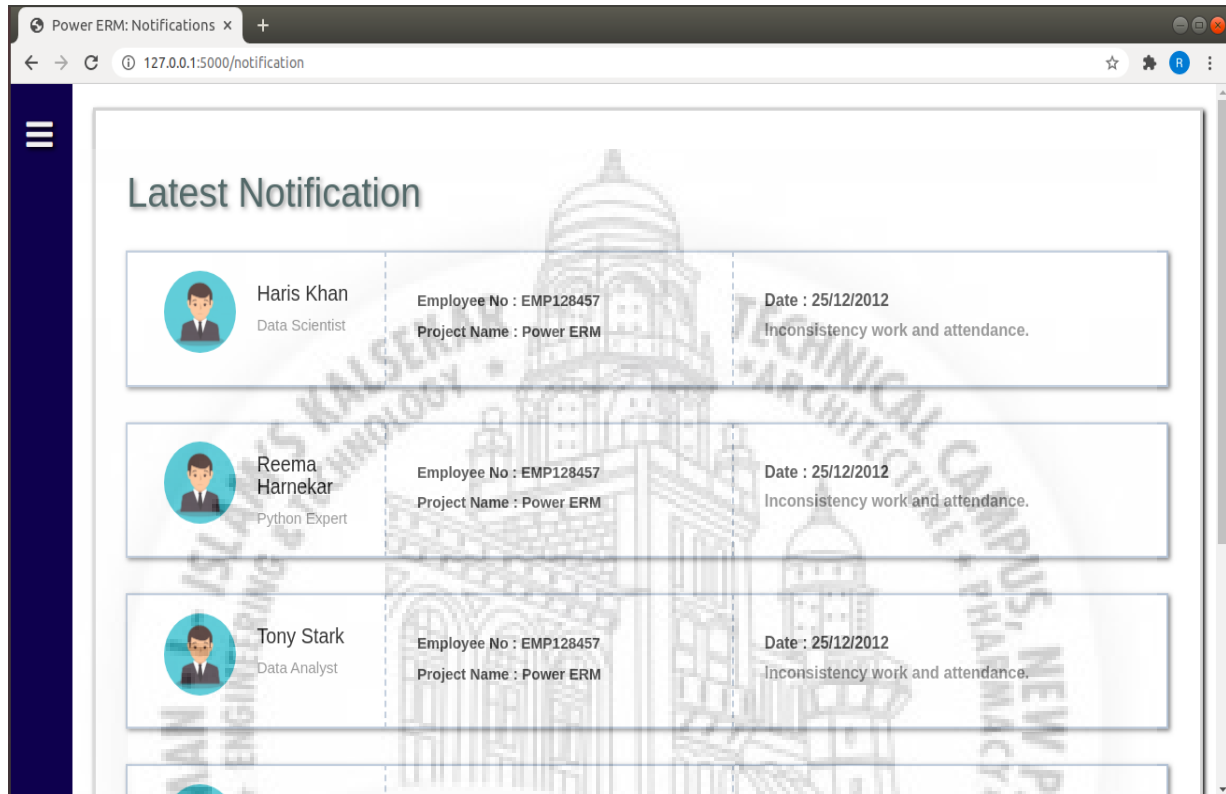
8.2 Navigation



8.3 Employee search



8.4 Notification



The screenshot displays a web browser window with the title "Power ERM: Notifications". The address bar shows the URL "127.0.0.1:5000/notification". The page content is titled "Latest Notification" and lists three notifications:

Employee Name	Employee No	Date	Project Name	Notification
Haris Khan Data Scientist	EMP128457	25/12/2012	Power ERM	Inconsistency work and attendance.
Reema Haneekar Python Expert	EMP128457	25/12/2012	Power ERM	Inconsistency work and attendance.
Tony Stark Data Analyst	EMP128457	25/12/2012	Power ERM	Inconsistency work and attendance.

Chapter 9

Conclusion and Future Scope

9.1 Conclusion

Predictive Attrition Model helps in not only taking preventive measures but also into making better hiring decisions. Deriving trends in the candidate's performance out of past data is important in order to predict the future trends, as well as to board new employees. Moreover, HR can use the employee data to predict attrition, the possible reasons behind it and can take appropriate measures to prevent it. Using the existing attendance record and DSR the performance of each employee can be analysed by plotting graphs based on given analysis. For example, the attendance of individual employee can be shown using a graph which will be easy to understand rather than the report in tabular format. Any unusual pattern encountered by the system through analysis of the individual employee would be notified to the HR through this module. Employee attrition will be detected

9.2 Future Scope

The system can be improved if the employee can give feedback. The feedback will help improve relation between employees and management. The existing dashboard does not contain a separate login for the HR manager. We need to add a module for explicit login for the HR so that the information about the analysis of an individual employee remains confidential. Using the existing attendance record and DSR the performance of each employee can be analysed by plotting graphs

based on given analysis. For example, the attendance of individual employee can be shown using a graph which will be easy to understand rather than the report in tabular format.



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Achievements

[1] Sponsorship



Our project was sponsored by *Octaware Technologies* Software company

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