**EMPLOYEE ENGAGEMENT**

# Full Stack

## Introduction

This project is a full-stack application designed to facilitate [describe the core functionality, e.g., employee engagement, learning material management, feedback collection, etc.]. It includes features for user authentication, role-based access, and interactive dashboards for both administrators and employees.

### Overview

#### Key Features

* User authentication (login, password reset).
* Role based dashboards for admins and employees.
* Management of learning material and feedback.
* Discussion forums for user interaction.

### Architecture Diagram

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### Front-End

#### Technology Stack

* Framework: React.
* Ui Library: Material-UI (MUI)
* State Management: Context API
* Routing: React Router

#### Key Components

* Login Components
  + Description: Allows users to sign in and manage password recovery.
  + Features:
    - Email and password input fields with validation.
    - OTP-based password reset mechanism.
    - User feedback using toast notifications.
* Admin Dashboards
  + **Description**: Admin interface to manage users, learning materials, and feedback.
  + Features:
    - Persistent sidebar navigation with sections for Dashboard, User Management, Learning Materials, and Feedback.
    - Role-based display of user information.
* Employee Dashboards
  + **Description:** Employee interface to access learning materials, provide feedback, and engage in discussions.
  + Features:
    - Similar persistent sidebar navigation tailored for employee roles.
    - Dynamic section rendering based on user selection (Learnings, Feedback, Discussion).

### Back-End

The backend is built with Node.js and Express to handle API requests, manage user authentication, and interact with a MongoDB database. It supports a full-stack application for user engagement and management.

#### Technology Stack

* **Runtime:** Node.js
* **Framework:** Express.js
* **Database:** MongoDB
* **Middleware:** CORS, dotenv
* **Scripts:** Custom setup scripts for initial configurations (e.g., admin user creation)

#### Key Components

* Server Configuration
  + **Entry Point:** server.js
  + Initializes the Express application and sets up middleware.
  + Connects to the MongoDB database using the connectDB function.
  + Uses environment variables stored in .env for configuration, such as MONGO\_URI.
* Middleware
  + **Cors:** Enables Cross-Origin Resource Sharing for client requests.
  + **JSON Parser:** Parses incoming requests with JSON payloads.

### Database

The application utilizes MongoDB with Mongoose for data modeling. The following schemas are defined: **User**, **Discussion**, **Engagement**, **Feedback**, **LearningMaterial**, **Module**, and **Quiz**.

# Data Engineering

This document outlines the data engineering pipeline for processing employee engagement data. The goal is to extract raw data from CSV files, clean and transform it, and finally create summarized reports for analysis.

## Pipeline Steps

### Step 1: Data Extraction

#### **Source:** The pipeline starts by accessing the user's Downloads folder to locate CSV files related to employee engagement.

#### **Files Copied:** The relevant files are copied into a designated folder called raw\_folder within the current working directory.

### Step 2: Data Loading

The pipeline loads the raw CSV files into DataFrames for processing. The following files are loaded:

* Engagements
* Feedbacks
* Learning Materials
* Modules
* Quizzes
* Users
* Discussions

### Step 3: Data Cleaning

The loaded data undergoes cleaning to ensure quality and consistency. This involves:

* Engagements Data:
  + Dropping rows with missing user IDs or learning material IDs.
  + Filling missing quiz scores with 0.
* Feedback Data:
  + Dropping rows with missing user IDs or learning material IDs.
  + filling missing ratings with the average rating.
* Learning Materials Data:
  + Removing duplicate entries.
  + Filling missing titles with "No Title".
* Modules Data:
  + Removing duplicate entries.
  + Filling missing descriptions with "No Description".
* Quizzes Data:
  + Removing duplicate entries.
  + Filling missing titles with "No Title".

### Step 4: Data Transformation

The cleaned data is used to create dimension and fact tables. This involves:

#### Dimension Tables:

* **User Dimension:** Contains unique user IDs.
* Learning Material Dimension: Includes information about learning materials.
* **Module Dimension:** Details about each module.
* Quiz Dimension: Information about quizzes related to learning materials.

#### Fact Tables:

* **Engagement Fact Table:** Tracks user engagement with learning materials.
* **Feedback Fact Table:** Records user feedback on learning materials.

### Step 5: Data Summary and Reporting

The final step involves creating summary reports:

#### Engagement Summary: Aggregates total engagements, total quiz scores, average quiz scores, and total completions for each learning material.

#### Feedback Summary: Aggregates total feedback entries and average ratings for each learning material.

# Data Science

This document outlines the data analysis process for employee engagement metrics. The analysis involves data extraction, cleaning, summarization, visualization, and predictive modeling using employee engagement data. The primary objective is to understand the relationships between engagement metrics and feedback ratings, enabling data-driven decision-making to improve employee engagement.

## Hypothesis Testing

**Visual Exploration**: Several visualizations are created to explore hypotheses regarding the relationships between average ratings, total engagements, department performance, and feedback metrics.

### Higher average ratings of learning materials lead to greater total engagements.A graph with blue dots Description automatically generated

### Learning materials from different departments receive different levels of average ratings.

A diagram of a graph

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### There is a positive correlation between total feedbacks and total engagements.

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### Learning materials with a higher average quiz score tend to have a higher total engagement.

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### The total number of feedback varies significantly across different departments.

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## Feature Engineering for Modelling

### Creating New Metrics

Engagement rates and feedback-to-engagement ratios are calculated to derive additional insights from the data.

### Encoding Categorical Variables

Categorical variables are transformed into a format suitable for machine learning algorithms.

## Predictive Modelling

### Model Development

A Random Forest model is developed to predict total engagements based on various features derived from the dataset.

### Model Evaluation

The model's performance is assessed using metrics like Mean Squared Error (MSE) and R-squared (R²) to ensure the predictive power is robust.

## Results

### Model Performance

The Random Forest model achieved an R² of approximately 0.83, indicating a strong relationship between the features and total engagements. The Mean Squared Error (MSE) was about 0.11, demonstrating good predictive accuracy.