**REPORT ON**

Career Recommendation System

*Submitted in partial fulfilment of the requirements for the award of the degree of*

**BACHELOR OF COMPUTER APPLICATIONS**

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**Batch: 2021 - 24**

***Under the Guidance of Submitted By***

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Name of Students       Enrolment No. Signature

**CERTIFICATE**

This is to certify that the dissertation/project report entitled “Career Recommendation System” done by me is an authentic work carried out for the partial fulfilment of the requirements for the award of the degree of Bachelor of Computer Applications under the guidance of Mrs Ruchi Sawhney. The matter embodied in this project work has not been submitted earlier for award of any degree or diploma to the best of my knowledge and belief.

Signature of the student

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MAIN REPORT

Objective and Scope

**Objectives:**

* Develop a machine learning-driven recommendation system that analyzes students' academic performance, interests, strengths, and career aspirations which provides course, stream, and career recommendations based on content filtering.
* Identify and address subject-specific weaknesses that may hinder students' chosen career paths.
* Implement a user-friendly questionnaire to refine recommendations based on user tendencies and make further recommendations on things of their interest that they lack awareness of or even provide new things to get interested in for those who have exhausted their option.
* Suggest improvement strategies: For subjects in which students are weak, the system will offer tailored recommendations on strengthening their skills and improving their performance.

**Scope:**

* The project's scope encompasses providing students with informed career recommendations following their 10th-grade examinations.
* Recommendations are personalized through an in-depth analysis of academic data, interests, and subject weaknesses.
* Strategies to enhance proficiency in relevant subjects are offered.
* A user-centric questionnaire refines recommendations by evaluating user inclinations.

Theoretical Background Definition of Problem

Theoretical Background:

**Python:**

Python is a high-level, general-purpose, and versatile programming language. Python programming language is being used in web development, Machine Learning applications, along with all cutting-edge technology in Software Industry.Python’s Background in Desktop Application Development and Machine Learning comes from its cross platform nature and various libraries for Example: Pyqt5, Pandas, Numpy, Sci-kit Learn etc.

**Pyqt5:**

There are so many options provided by Python to develop GUI application and PyQt5 is one of them. PyQt5 is cross-platform GUI toolkit, it has a set of python bindings for Qt v5. One can develop an interactive desktop application with much ease because of the tools and simplicity provided by this library. A GUI application consists of Front-end and Back-end. PyQt5 has provided a tool called ‘QtDesigner’ to design the front-end by drag and drop method so that development can become faster and one can give more time on back-end stuff.

Due to the nature of Desktop Application development and Pyqt5 , Event Driven Programming come into play. It is a programming paradigm where different parts of the application or entities communicate by sending messages to one another through an intermediary. In the context of Gui development and desktop application development this refers to different components reacting to each other through signals and events written out by the programmer. For example, a button being clicked in a Pyqt5 gui interface is connected to function which would then be executed.

**Scikit-Learn:**

Scikit-learn is a powerful open-source library in Python used for machine learning tasks such as classification, regression, clustering, and more. It is built on top of other popular scientific computing libraries, such as NumPy, SciPy, and Matplotlib. It offers a wide range of tools for machine learning and statistical modelling, including various algorithms and utilities for data preprocessing, model selection, evaluation, and data visualization.

In practical terms, scikit-learn serves as a powerful toolbox for tasks such as data preprocessing, model training, and model evaluation. It includes utilities for handling data, implementing feature selection, and assessing model performance through cross-validation and grid search.

**Pandas:**

Pandas is an open-source Python library used for data manipulation and analysis. It provides powerful data structures and tools for working with structured data, primarily in the form of DataFrame objects. Pandas is widely utilized in machine learning for its ability to handle various data formats, such as CSV files, Excel sheets, SQL databases, and more. Its main data structure, the DataFrame, allows for easy indexing, slicing, cleaning, transforming, and aggregating data, making it an essential tool for data preprocessing in machine learning workflows.

It enables practitioners to load datasets, handle missing values, perform feature engineering by creating new features or transforming existing ones, encode categorical variables, and split data into training and testing sets. The ability to manipulate and prepare data efficiently using pandas is fundamental for ensuring that machine learning models receive high-quality input, leading to more accurate predictions or classifications.

**Numpy:**

NumPy, short for Numerical Python, is a fundamental open-source library in Python for numerical computing. It provides support for large, multi-dimensional arrays and matrices, along with a collection of mathematical functions to operate on these arrays efficiently.In machine learning, NumPy is extensively used for data manipulation and preparation. It plays a central role in handling datasets, transforming features, and performing mathematical operations required during the preprocessing phase. Many machine learning libraries, including scikit-learn, TensorFlow, and PyTorch, leverage NumPy arrays as the underlying data structure. NumPy's efficient implementation of array operations significantly speeds up computations, making it an essential tool for implementing algorithms and models efficiently in machine learning workflows.

**Machine Learning:**

Machine Learning is a branch of artificial intelligence that develops algorithms by learning the hidden patterns of the datasets used it to make predictions on new similar type data, without being explicitly programmed for each task.   
Machine learning is used in many different applications, from image and speech recognition to natural language processing, recommendation systems, fraud detection, portfolio optimization, automated task, and so on. Machine learning models are also used to power autonomous vehicles, drones, and robots, making them more intelligent and adaptable to changing environments.  
A typical machine learning tasks are to provide a recommendation. Recommender systems are a common application of machine learning, and they use historical data to provide personalized recommendations to users.  
Types of Machine Learning:

1. Supervised Machine Learning
2. Unsupervised Machine Learning
3. Reinforcement Machine Learning

**Supervised Learning:**

In this project supervised learning has been chosen for usage, supervised learning is a type of machine learning in which the algorithm is trained on the labeled dataset e.i. the data may have correct values as well. It learns to map input features to targets based on labeled training data. In supervised learning, the algorithm is provided with input features and corresponding output labels, and it learns to generalize from this data to make predictions on new, unseen data.

There are two main types of supervised learning:

1. Regression
2. Classification

**Classification:**

Classification is a type of supervised learning where the algorithm learns to assign input data to a specific category or class based on input features. The output labels in classification are discrete values. Classification algorithms can be binary, where the output is one of two possible classes, or multiclass, where the output can be one of several classes. The different Classification algorithms in machine learning are: Logistic Regression, Naive Bayes, Decision Tree, Support Vector Machine (SVM), K-Nearest Neighbors (KNN), etc.

**KNN Algorithm:**

In this project the KNN algorithm has been chosen from classification type supervised learning, K-Nearest Neighbours is one of the most basic yet essential classification algorithms in Machine Learning. It belongs to the supervised learning domain and finds intense application in pattern recognition, data mining, and intrusion detection. It can also handle both numerical and categorical data, making it a flexible choice for various types of datasets in classification and regression tasks. It is a non-parametric method that makes predictions based on the similarity of data points in a given dataset. K-NN is less sensitive to outliers compared to other algorithms. The applications of KNN are data preprocessing, pattern recognition, Recommendation Engines.

**Content based filtering:**

Content-based filtering is a machine learning approach used in recommendation systems to suggest items to users based on the characteristics of the items and the preferences of the users. Instead of relying on the collaborative behavior of users (as seen in collaborative filtering), content-based filtering considers the features or attributes of items and recommends new items that are similar to those a user has liked or interacted with in the past.

In machine learning applications, content-based filtering finds its use in various recommendation systems, such as suggesting movies, music, articles, or products to users based on their historical preferences or explicit feedback.

Using content based filtering in machine learning models can recommend new items that align with users' tastes, making the recommendation process more personalized and potentially increasing user satisfaction and engagement.

**Problem Statement:**

**Problem:**

The "Career Recommendation System" project addresses a pressing issue in the educational landscape, primarily concerning students transitioning from their 10th-grade examinations. At this critical juncture, students often find themselves at a crossroads, faced with the formidable task of choosing academic courses or streams that will significantly shape their future careers. However, the educational system currently lacks a structured and comprehensive decision-making framework to guide students through this crucial phase of their academic journey.

In particular, students grapple with several challenges:

* **Lack of Systematic Guidance:** The absence of a systematic guidance system leaves many students in the dark, unsure of which path to follow. Without clear direction, they may make ill-informed decisions that can impact their career prospects for years to come.
* **Balancing Performance and Aspirations:** Striking the right balance between their academic performance, personal interests, and inherent strengths is a complex and often bewildering task. Students must align their educational choices with their career aspirations, a process that is far from straightforward.

As a result, many students are left navigating this critical decision-making process with minimal support or personalized advice. This lack of guidance can have profound consequences on their educational and career trajectories, potentially leading to mismatches between their chosen paths and their true potential.

**Background:**

The existing educational framework has long grappled with the challenge of equipping students with the tools and knowledge necessary to make informed career choices. Traditionally, students have relied on a mix of limited resources, including career counsellors and educational advisors, which often fall short of providing the personalized guidance needed.

The complexities of aligning academic performance, personal interests, and career goals further exacerbate the problem. The evolving job market demands that students choose their paths with care, as they prepare for careers in fields that are continually changing and diversifying. Consequently, there is a growing need for an innovative solution that addresses these challenges effectively.

**Relevance:**

The "Career Recommendation System" project is profoundly relevant in the context of today's educational landscape. It directly addresses the critical issue of career decision-making for students, offering a tailored and data-driven approach to support their academic and vocational aspirations. Several key aspects underline the system's relevance:

* **Personalized Recommendations:** By leveraging data on academic performance, personal interests, and strengths, the system provides personalized course and career recommendations. This tailoring ensures that students are directed toward paths that genuinely resonate with their capabilities and aspirations.
* **Subject Weakness Mitigation:** The system goes a step further by diagnosing subject-specific weaknesses. This critical feature empowers students to address these weaknesses and bolster their educational foundations, thereby enhancing their chances of success in their chosen careers.
* **Improved Academic and Career Trajectories:** The project holds the potential to significantly improve students' academic and career trajectories. By offering precise, data-driven recommendations, it helps students make more informed decisions, reducing the likelihood of misaligned choices.

System Analysis & Design

Use Case:

