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Design and Implementation of a Python-Based College Student Schedule Planning Program

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ABSTRACT

This study presents a project concept aimed at designing software to help college students improve work efficiency and quality of life. This is achieved by integrating user data collection, schedule planning, machine learning, and learning efficiency optimization. Initially, we describe the project's fundamental steps, including generating random schedules and capturing changes in user input attributes. Then, we discuss how the program analyzes trends in student performance and physical condition in comparison with randomly generated schedules to identify optimal study times and suitable learning environments. We also explore methods to determine when students perform best, which subjects or tasks are easier for them, and factors that may affect learning efficiency. Finally, we emphasize the potential of machine learning methods in developing more effective planning for students, thereby enhancing learning efficiency. Future scalability of this software is also discussed. This research introduces innovative methods to education and learning, potentially impacting student academic performance and learning experiences positively.

KEYWORDS: *Python; Student Schedule Planning; Machine Learning*

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1. INTRODUCTION

With societal development, there is an increasing focus on the importance of time and activity management. While national mental health strategies highly regard mental health, the psychological well-being of youth remains a concern. For students, effective time management is crucial not only for learning efficiency but also for physical health. The root cause of insufficient proactive learning in college students is often unclear learning objectives and lack of motivation. In university, the freer learning environment compared to the strict high school regime can lead to relaxation and a loss of future ambitions, weakening their proactive learning spirit. Additionally, external factors like job market pressure also affect student motivation.

Survey data shows that only 11.99% of students can create detailed study plans, 21.92% occasionally do, and a significant portion rarely or never plans. This indicates a lack of ability in many students to create and follow study plans, likely due to unclear learning goals and insufficient motivation, potentially affecting their self-directed learning outcomes. Therefore, it is advised that students establish clear study plans and manage their study time to achieve better learning outcomes, which can also enhance their motivation and goal clarity.

Thus, this paper designs a Python-based student schedule planning program to help students better manage their time and activities. Planned learning can help students better grasp their progress and content, enhancing learning efficiency. In modern society, the effective use of limited time is particularly important. This program's innovation lies in calculating and generating the best time management suggestions based on user feedback and personal preferences, thereby helping users arrange their study, rest, and activities more efficiently.

2. Program Overview

2.1. Data Recording and Schedule Generation Phase

The program begins by collecting personal information and questionnaire responses from users,

as shown in Figure 1, and uses this data to generate various schedule options. It also records changes in attributes under different schedules, organizes the data, and provides effective schedule options for user reference.

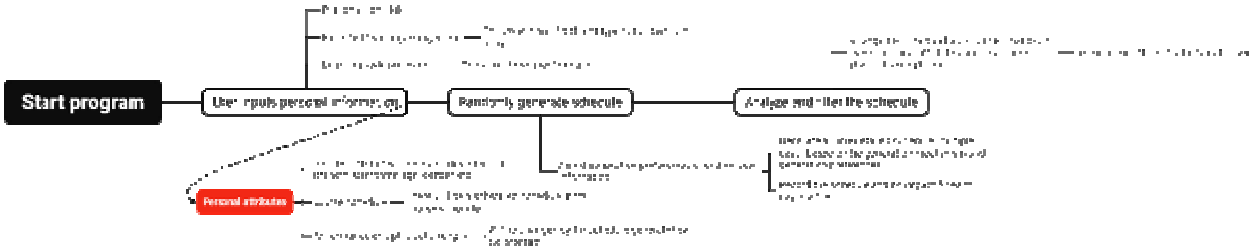

Figure 1: Data Recording and Schedule Generation Illustration

2.2 Personalized Schedule Planning and Optimization Phase

As shown in Figure 2, users follow a generated schedule, record daily feelings and attribute changes, and after some time, the program predicts future performance and physical condition based on this data. This prediction is compared with the schedule's forecast to evaluate its effectiveness and match with the user's capabilities, analyzing how to optimize the existing schedule to accurately assist users.

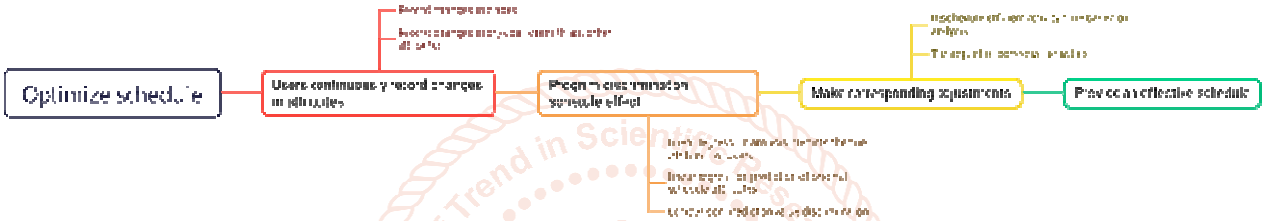

Figure 2: Personalized Schedule Planning and Optimization Illustration

3. Program Design and Implementation

3.1. Overall Program Structure

The program's structure, as shown in Figure 3, begins with user input of personal information, random daily planning, generation of recommended (filtered) schedules, and personalized scheduling with continuous optimization.

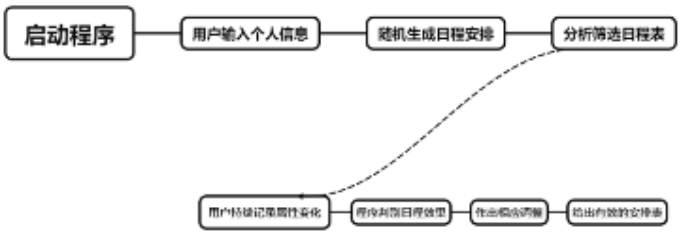

Figure 3: Overall Program Structure

3.2. Functionality

3.2.1. Interactive Visual Interface

1. This interface manages user personal information and generates schedules.
2. Main interface: It includes two buttons for "User Personal Information" and "Generate Schedule."
3. User Personal Information Interface: This pops up for managing personal info with options for "User Management," "Schedule Management," and "Learning Preferences."
4. Schedule Generation Interface: This opens for generating and viewing personalized schedules with options for "Input Date" and "View Schedule."

3.2.2. Schedule Recording

This function records schedules with the following logic:

1. Initialization: Creates a course data list.
2. Course Data File Creation: Prompts for file selection or creation.
3. Adding Courses: Users input and save course information.
4. Deleting Courses: Users select and delete courses.
5. Updating Courses: Users select and update course information.
6. Saving/Loading Course Data: Saves and loads course data.

3.3. Detailed Program Design

The detailed design of the program is as follows:

1. User Input of Personal Information:

Upon starting the program, users need to enter personal information including grades, physical fitness, username, age, etc., and their personal course schedule. They are also required to complete three questionnaires to determine their learning style preferences.

2. Random Schedule Generation:

The program defines various student activities like studying, resting, entertainment, and sleeping. It adjusts the generation mechanism based on user information and randomly generates preliminary multi-day schedule plans, impacting user attributes, and saves data in CSV files.

3. Ongoing Recording of Attribute Changes:

Users enter perceived daily attribute changes into the program, providing a data source for machine learning.

A. Schedule Effectiveness Assessment:

Learning Efficiency Analysis:

1. Setting Learning Goals: Users must define their learning goals, ensuring they are specific, measurable, and quantifiable.
2. Recording Study Time: Users should log daily study hours for subsequent analysis.
3. Measuring Knowledge Acquisition: Users need to periodically assess the amount of knowledge gained through tests, exercises, project completion, etc.
4. Calculating Learning Efficiency: Learning efficiency is evaluated based on the Learning Absorption Rate (LP), measuring the balance of accuracy and speed.
5. Analyzing Learning Efficiency Trends: Helpful for observing progress, implemented through weekly or monthly efficiency reports. F
6. Assessing Learning Outcomes: Users regularly assess if they have achieved their learning goals and adjust strategies as needed.
7. Evaluating Learning Methods: Considering different learning methods like reading or practical work to find the most effective approach.

B. Making Adjustments:

Identifying optimal time slots, easier subjects or tasks, and factors affecting learning efficiency like fatigue or stress to provide a more suitable schedule for the user.

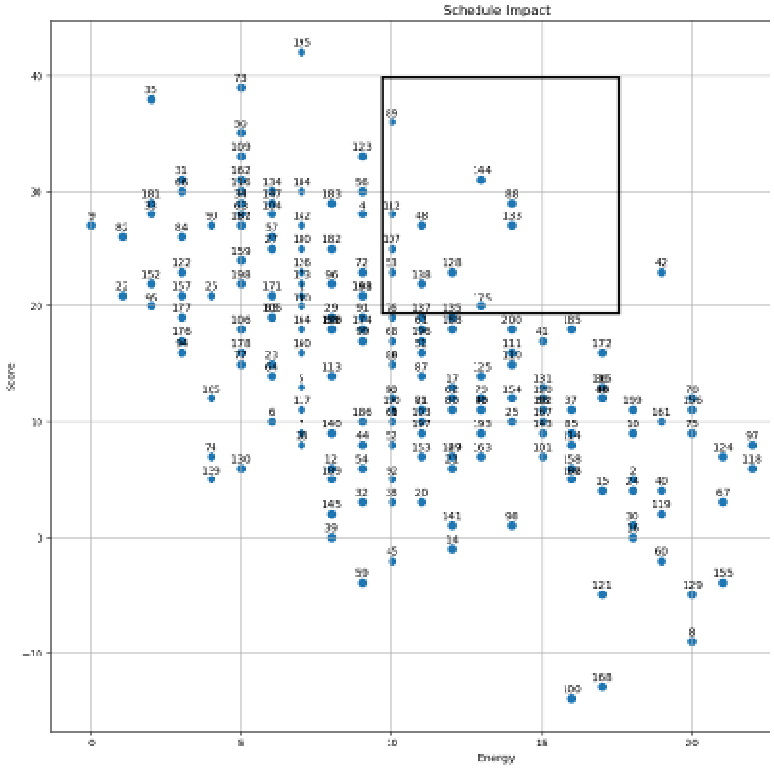

Figure 4: Recommended Schedule Generation Illustration

Table 1 Examples of calendars generated by the system and available for user selection

Time	Activities	Specific activities
1st hour	Sleep	night_sleep
The second phase	Sleep	night_sleep
The third hour	Sleep	night_sleep
The fourth hour	Sleep	night_sleep
The 5th hour	Sleep	night_sleep
6th hour	Sleep	night_sleep
The seventh hour	Entertainment	watch_movie
The eighth hour	Study	research
9th hour	Entertainment	read_novel
Tenth hour	Study	self_study
Eleventh hour	Entertainment	play_game
12th hour	Study	attend_class
13th hour	Study	research
Fourteenth hour	Sports	running
Fifteenth hour	Exercise	running
16th hour	Sports	bal_sport
17th hour	Break	walk
18th hour	Study	self_study
19 hours,	Break	walk
20 hours	movement	swimming
Twenty-one hour	Study	research
Twenty-second hour	Entertainment	watch_movie
Twenty-third hour	Study	do_homework
The 24th hour	Sleep	night_sleep

Figure 5: Detailed Schedule Example

3.4. Functional Principle Explanation

3.4.1. Schedule Generation Mechanism

The program generates schedules based on results from three questionnaires

1. The Chinese version morning/evening questionnaire (MEO) was developed by Horne and Ostberg and has good reliability and validity. This study used a Chinese version of the scale adapted by Zhang Bin et al. in 2006, with an internal consistency coefficient of 0.791.
2. The Pittsburgh sleep quality index (PSQI) is a scale used to test the sleep quality of participants and is suitable for evaluating the sleep quality of the general population. This study used the Chinese version of the scale developed by Liu Xianchen et al., with an internal consistency of 0.842.
3. The Knowledge Acquisition Methods Survey (KAMI) was developed by Richard Rancourt and referred to as the KAMI. This scale measures three different types of learning styles: Rational, Noetic, and Empirical.

understanding users' daily patterns, learning styles, and sleep quality, to offer more personalized scheduling. This helps users manage their time effectively, enhancing learning efficiency and overall life quality.

3.4.2. Learning Efficiency Calculation Method

The method used for calculating learning efficiency is based on literature, evaluating learning efficiency by geometrically weighting task completion accuracy (AC) and speed (1/RT) to calculate the Learning Absorption Rate (LP). Accuracy and speed are equally weighted. The formula for LP is given as:

$$LP = [AC^{0.5} \times (\frac{1}{RT})^{0.5}]^2$$

Where RT is the time taken to complete a learning activity, and AC is the accuracy rate, measured as a percentage.

Calculation accuracy:

Calculating accuracy (AC) requires two key parameters: the number of correctly completed tasks (CC) and the total number of tasks (TC).

Accuracy is the proportion of correctly completing tasks, which can be calculated using the following formula:

$$AC = \frac{CC}{TC} \times 100\%$$

The user records the number of correctly completed tasks during testing and the total number of tasks during testing. Then, use the above formula to calculate the accuracy and convert it into a percentage.

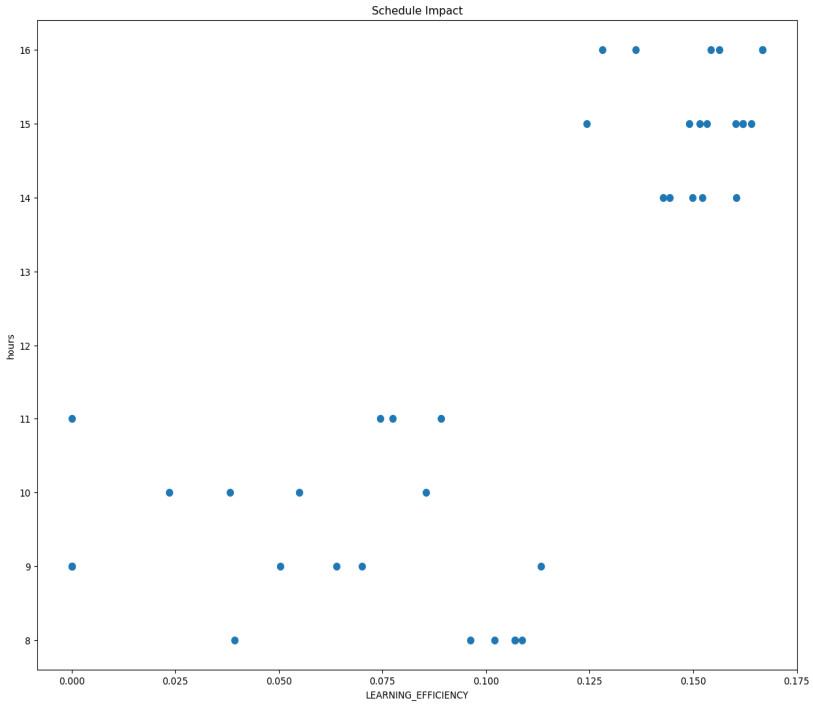

Figure 6: Learning Efficiency Examples at Different Times

For different learning activities, standardized processing of results is necessary for comparison.

In addition, for different learning activities, there is a significant difference in the time RT for participants to complete learning. To compare the indicator LP of different projects, it is necessary to standardize the test results. The processing formula is as follows

$$P_j(\%) = \frac{x_j}{\frac{1}{n}\sum_{j=1}^{n} x_j} \times 100$$

Pj - The standardized value of a certain indicator under activity j

Xj - a certain indicator of user activity j

N - Total number of activities (number)

3.5. Analyzing User Schedules and Improving Schedules

The program analyzes the user's ideal achievement and various attributes of their daily self perception to compare whether the schedule provided by the program matches the user's learning ability, and how to improve the schedule. The detailed design is as follows:

Based on the initial schedule provided to the user, the program can obtain the user's ideal harvest score, ideal harvest physical strength, and other attributes after a period of time through simple cumulative calculation.

After reading the user's daily self perceived performance, physical strength, and other attributes recorded in the device, the program performs data cleaning and relies on linear regression analysis to predict future user performance.

By comparing the predicted values of ideal and actual grades, it is possible to roughly compare whether the schedule aligns with the user's learning ability.

After reading the user's self perceived performance, physical strength, and other attributes of numerous daily activities, we can analyze the efficiency of various activities related to different time periods or activities within a day, and make corresponding adjustments to obtain a schedule that matches the user's abilities, more accurately helping the user learn and predict their learning ability.

3.6. Scalable Features

A. Analysis and improvement of time allocation

Analyze the time allocation of different activities in the schedule, compare the allocation of these time periods, and determine if there is any imbalance, such as spending too much time on entertainment while neglecting learning or rest. By analyzing user feedback data, confirm whether the user's schedule and activities are in line with their own learning time patterns. And improve the schedule to enable users to achieve higher learning efficiency.

B. Analysis and improvement of activity types

Further analyze the types of activities and understand the distribution of each type of activity to help determine individual priorities and preferences. Allow users to customize personal activities, analyze user feedback data, and confirm whether the user's schedule and activities are suitable for their own

athletic abilities. And appropriately improve the schedule to ensure the scientific and healthy living of users.

C. Analysis and improvement of changes in grades and energy levels

Analyze and record changes in grades and energy levels. Observing daily trends can help understand the impact of different activities on user learning performance and physical strength. If the learning time is long but there is no significant improvement in scores, it may be necessary to reassess the learning methods. Similarly, observe changes in energy levels to determine if there is sufficient rest and exercise. Add important forgetting mechanisms to better match the simulated schedule with the user's abilities based on research on forgetting. At the same time, based on research on forgetting, more scientific long-term learning methods can be generated to help users improve their learning abilities.

4. Conclusion and Future Prospects

This program not only assists students in managing their time and activities but also offers personalized recommendations based on user data and habits, enhancing learning efficiency and life quality. Future expansions can include more detailed time allocation, activity type analysis, and performance and energy level variation analysis, to further optimize user schedules. This research promises innovative approaches in education and learning, improving student experiences and academic performance, and inspiring time management and efficiency optimization in other fields. By integrating schedule planning, data collection, machine learning, and efficiency optimization, this project provides a new pathway to enhance students' academic performance and quality of life. The technology's application prospects are broad, promising a more efficient and intelligent learning experience for users, contributing to their academic goals. It also represents the potential and future of artificial intelligence in education, continually driving innovation and improvement in teaching methods.

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