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DESIGN AND DEVELOPMENT OF A CAREER GUIDANCE SYSTEM FOR STUDENTS AFTER CLASS 10 USING A RULE-BASED RECOMMENDATION APPROACH

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Abstract

Selecting an educational pathway after Class 10 is an important decision for students. Options may include higher-secondary streams, diploma programmes, and vocational courses, each with different learning experiences, entry requirements, and future opportunities. This paper proposes the design and development of a rule-based career guidance system that helps students explore educational pathways through a transparent, preference-based process. The system collects information about preferred subjects, interests, learning activities, and goals. A knowledge base stores pathway descriptions and verified eligibility information, while an IF–THEN recommendation engine matches student responses to relevant options. The proposed prototype uses Python and Streamlit to provide an accessible web interface and explain why each option is suggested. Evaluation is planned around recommendation consistency, test-case performance, explanation clarity, and usability. The system is intended as a decision-support tool and not as a substitute for professional counselling. Actual effectiveness will be established through implementation and evaluation rather than assumed in advance.

Keywords: *Career Guidance; Rule-Based System; Educational Technology; Decision Support; Class 10; Explainable Recommendations; Python; Streamlit*

2. PROBLEM STATEMENT AND MOTIVATION

Students completing Class 10 may not have a clear, accessible method for connecting their interests and preferred learning activities with educational pathways. Course information may be spread across school resources, institution websites, admission brochures, and counselling services. A student can therefore overlook alternatives or misunderstand the conditions required for admission. The problem addressed by this project is to design an accessible prototype that organizes pathway information and offers explainable recommendations based on students' stated preferences. It must present suggestions as options to investigate, not as a definitive assessment of aptitude, eligibility, or future success.

2.1 RESEARCH OBJECTIVES

• Identify the information students need when exploring educational pathways after Class 10. • Design a transparent rule base connecting interests and preferences to relevant pathways. • Develop a web-based prototype using Python and Streamlit. • Test consistency and expected behaviour using predefined scenarios. • Assess explanation clarity and usability, where a suitable pilot study is feasible. • Document limitations and propose improvements for future guidance systems. 2.2 Scope The prototype focuses on educational exploration after Class 10. It may cover higher-secondary streams, diploma programmes, and vocational courses, provided each entry is supported by current, reliable information. It will not make admission decisions, predict academic performance, or replace advice from teachers, parents, or qualified career counsellors.

3. RELATED WORK

Research on educational recommender systems has explored the use of student profiles and programme information to guide university-major and career-domain choices. Lahoud et al. (2023) compare recommendation approaches in this context, illustrating the importance of representing both learner preferences and educational options. Gunwant (2022) reviews careerguidance expert systems, including rule-based, case-based, and fuzzy-logic methods, providing context for explicit knowledge-driven guidance. Reviews of AI-supported career counselling further emphasize the need to consider recommendation quality, transparency, usability, and ethical safeguards. The present project is narrower than a predictive career model: it proposes a lightweight system for Class 10 students whose rules can be inspected and updated by responsible educators. A stronger final literature review should compare more studies by population, method, evaluation design, and limitations.

3.1 DESIGN RATIONALE

Explicit rules make the system easier to explain and audit than an opaque model. The approach is also practical for a student prototype because the rule set can be implemented without a large labelled dataset. Its main trade-off is that recommendation quality depends on the completeness, accuracy, and maintenance of the knowledge base.

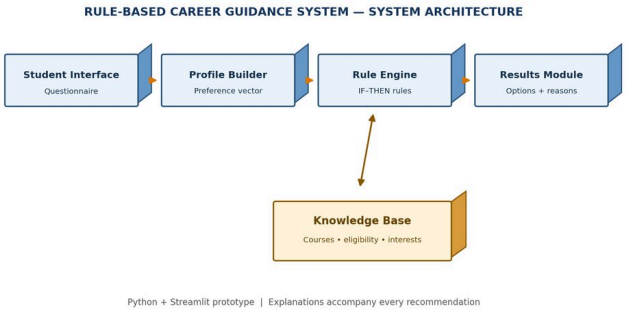


Figure 1. Layered architecture of the proposed rule-based career guidance system.

4. PROPOSED SYSTEM AND ARCHITECTURE

The system is organized into four primary modules: the student interface, profile builder, rule-based recommendation engine, and results module. A separate knowledge base stores pathway descriptions, associated interests, course

prerequisites, and sources for verification. The modules communicate through a Python application implemented with Streamlit.

4.1 MODULE DESCRIPTIONS

TABLE I

Module	Responsibility	Output
Student interface	Collects subject interests, preferred activities, and goals.	Structured responses
Profile builder	Validates answers and converts them into preference indicators.	Student preference profile
Knowledge base	Stores pathways, interests, eligibility notes, and information sources.	Verified pathway records
Rule engine	Applies documented IF–THEN rules to the profile.	Matched pathway candidates
Results module	Shows options, match explanations, caveats, and useful links.	Explainable guidance report

4.2 DATA FLOW

A student completes the questionnaire; the application validates required responses and creates a preference profile. The rule engine checks the profile against the knowledge base. Matching pathways are then displayed with a plain-language explanation that identifies the relevant answers. If no rule matches, the system should say that it cannot make a useful suggestion from the current responses and invite the student to revise the answers or seek guidance.

4.3 SUGGESTED TECHNOLOGY STACK

TABLE II

Technology	Proposed role
Python	Core application logic and rule evaluation
Streamlit	Web-based questionnaire and results interface
Pandas / CSV or JSON	Structured pathway and rule data
Matplotlib	Optional visualisation of evaluation findings
Version-controlled files	Tracking changes to rules and pathway information

5.1 RESEARCH AND DEVELOPMENT PROCESS

The study follows a design-and-evaluation approach. First, pathway categories and information fields are defined. Second, rules are drafted and reviewed for clarity and consistency. Third, a prototype is implemented. Fourth, predefined test cases are run and results recorded. Finally, explanation clarity and usability may be assessed through a small, ethically conducted pilot if approval and appropriate consent are available.

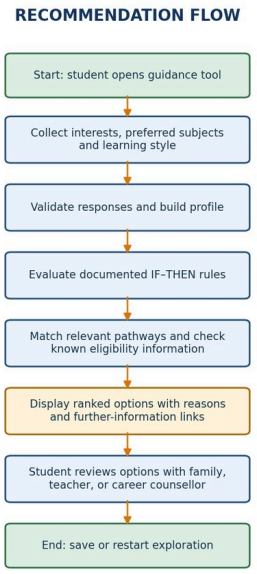


Figure 2. Flowchart from student input to explainable educational pathway suggestions.

5.2 QUESTIONNAIRE INPUTS

TABLE III

Input category	Example response	Use in guidance
Preferred subjects	Mathematics, languages, science, social science	Identifies subject-related interests
Activity preference	Computers, business, creative tasks, practical work	Connects activities to pathway descriptions
Learning preference	Practical, theory-oriented, or mixed	Adds context to recommendations
Areas to explore	Technology, commerce, humanities, skilled trades	Narrows the pathway set
Future study goals	Continue higher study, learn a trade, explore options	Supports relevant information display

6. RULE-BASED RECOMMENDATION ENGINE

The recommendation engine uses explicit IF–THEN rules. Each rule links one or more preference indicators to an educational pathway and includes an explanation. A student can receive several suggestions when multiple rules match. The system should not force a single result when preferences are mixed or incomplete.

6.1 ILLUSTRATIVE RULES

TABLE IV

Rule ID	Condition (IF)	Suggested exploration (THEN)	Explanation shown to student
R1	Interest in computers and practical technical work	Explore relevant technical diploma and higher-secondary options	Your answers indicate interest in computing and hands-on learning.
R2	Interest in business, accounting, or entrepreneurship	Explore Commerce-related pathways	Your stated interests align with business and financial topics.
R3	Interest in language, society, history, or creative expression	Explore Arts/Humanities-related pathways	Your preferences include social, language, or creative subjects.
R4	Interest in practical skills and a specific trade	Explore suitable vocational or skill- based courses	You indicated a preference for applied, hands-on learning.
R5	Several interest groups selected	Display multiple pathway categories	Your interests span more than one area; compare the options.

TABLE V

Field	Description	Example
pathway_id	Unique identifier for a pathway	PATH-TECH-01
pathway_name	Display name of the pathway	Technical diploma option
interest_tags	Interest indicators associated with the pathway	computers; practical work
eligibility_summary	Brief eligibility information from a verified source	Check current programme rules
source_url	Official information source	Official institution or authority page
last_verified	Date the information was reviewed	YYYY-MM-DD
explanation_template	Text explaining a matched recommendation	Suggested because…

6.2 RULE EVALUATION AND RANKING

For a simple implementation, each matching rule can contribute a small score to its associated pathway. The score represents preference overlap, not aptitude or probability of success. Pathways may be sorted by the number or weight of matched indicators, while preserving other valid options for comparison. The interface should explain the basis of ordering and avoid presenting scores as scientifically validated unless a proper evaluation supports that claim.

6.3 HANDLING MISSING OR CONFLICTING INPUTS

If responses are missing, the system should ask the student to complete the relevant question or present a neutral exploration page. If preferences point to several pathways, it should display alternatives rather than suppressing all but one. Eligibility requirements should be displayed separately from interest matching because preference alignment does not imply admission eligibility.

6.4 RULE MAINTENANCE

Rules should have identifiers, descriptions, review dates, and responsible reviewers. Updates should be tested against existing test cases to identify unintended changes. An educator or administrator should be able to correct outdated course information without rewriting the entire interface.

7.1 APPLICATION WORKFLOW

The proposed application can be implemented as a compact Streamlit application. The interface collects responses using radio buttons, checkboxes, or dropdowns. Python code validates the responses, evaluates the rule set, and renders a results page. Pathway records can initially be stored in a CSV or JSON file, which keeps the prototype simple and easy to inspect.

7.2 SUGGESTED DATA STRUCTURE

Field Description Example pathway_id Unique identifier for a pathway PATH-TECH-01 pathway_name Display name of the pathway Technical diploma option interest_tags Interest indicators associated with the pathway computers; practical work eligibility_summary Brief eligibility information from a verified source Check current programme rules source_url Official information source Official institution or authority page last_verified Date the information was reviewed YYYY-MM-DD explanation_template Text explaining a matched recommendation Suggested because… 7.3 Pseudocode 1. Read student preferences. 2. Validate that required answers are present. 3. Load the reviewed pathway knowledge base. 4. For each pathway, evaluate its associated rules. 5. Collect all matches and calculate a transparent preference-overlap score if used. 6. Display matching pathways with reasons, eligibility caveats, and source links. 7. If no suitable match exists, provide neutral exploration choices. 8. Record only the minimum technical information needed for testing.

7.4 ACCESSIBILITY AND USER EXPERIENCE

The questionnaire should use simple language suitable for students, provide clear definitions for unfamiliar course terms, and work on common mobile and desktop screens. Students should be able to go back and change answers. The result page should avoid judgemental labels such as “weak” or “unsuitable” and should encourage comparison and discussion with trusted adults.

7.5 PRIVACY AND SECURITY

The prototype should minimize personal data collection, protect any stored responses, restrict administrative access to rule editing, and avoid publishing identifiable student answers. If minors participate in a pilot, appropriate institutional permissions, parental consent where required, and student assent should be obtained before data collection.

8. EVALUATION FRAMEWORK

TABLE VI

Evaluation measure	Method	Evidence to report
Recommendation consistency	Run identical inputs more than once	Whether the same rules and outputs are returned
Test-case pass rate	Compare actual results with predefined expected behaviour	Passed cases / total cases, with failures described
Rule coverage	Test each rule with matching and non-matching inputs	Rules exercised and edge cases identified
Explanation clarity	Ask pilot users to describe why a pathway appeared	Responses, recurring confusion, and revisions
Usability	Observe task completion and collect structured feedback	Completion issues and user feedback summary
Information freshness	Audit source links and verification dates	Records reviewed, outdated items, corrections made

8.1 TEST SCENARIOS

TABLE VII

Test	Input pattern	Expected behaviour
T1	Computer interest + practical learning	Show relevant technical pathways with matching explanation
T2	Business interest selected	Show Commerce-related options and reasons
T3	Creative/social interests selected	Show relevant Arts/Humanities exploration options
T4	Several interest categories selected	Present multiple alternatives without forcing one answer
T5	Required response missing	Request completion or show a neutral fallback
T6	No rule matches	Explain that the current answers did not yield a clear match
T7	Eligibility information is uncertain	Show a caveat and direct the student to an official source

8.2 ANALYSIS PLAN

For technical testing, the pass rate can be calculated as passed test cases divided by all executed test cases, multiplied by 100. This metric reflects implementation conformance to expected behaviour, not career-prediction accuracy. Pilot feedback can be summarized using response counts and recurring themes. Any small-sample results should be reported with limitations and should not be generalized to all students.

9. EXPECTED OUTCOMES

The expected deliverables are a working web-based prototype, a documented set of rules, a structured pathway knowledge base, test scenarios, and an evaluation report. The project aims to make exploration more organized and recommendations easier to understand. Whether it improves decision confidence or counselling outcomes remains an empirical question for future evaluation.

10. LIMITATIONS AND ETHICAL CONSIDERATIONS

The quality of the system depends on the accuracy of its rules and knowledge base. Interests stated in a short questionnaire cannot capture every student’s abilities, circumstances, financial constraints, accessibility needs, or evolving goals. Educational eligibility and admission procedures can differ by state, institution,

programme, and year, so outdated information could mislead users. The system must not label students or restrict their options based on stereotypes. Recommendations should remain exploratory, include more than one option when appropriate, and clearly distinguish interest matching from eligibility. Course details should be sourced from official or otherwise reliable sources and periodically reviewed. Student data should be minimized and handled in accordance with applicable institutional requirements.

11. FUTURE SCOPE

Future development may include a larger verified course catalogue, multilingual support, accessibility improvements, educator-reviewed rule editing, and links to official admission portals. A broader evaluation could compare the tool with existing guidance resources and assess whether students understand options more clearly after using it. Any expansion should preserve transparency, privacy, and human oversight. 12. Conclusion This paper presents the design of a rule-based career guidance system for students after Class 10. By connecting stated interests and learning preferences to documented educational pathways, the proposed system aims to support structured, explainable exploration. Python and Streamlit provide a practical route to an accessible prototype, while a transparent knowledge base makes rules easier to inspect and update. The system's actual usefulness must be established through technical tests and, where feasible, a properly designed student usability study. It should complement—not replace—guidance from teachers, families, and qualified counsellors.

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