Technological Institute of the Philippines - Quezon City
College of Computer Studies
Bachelor of Science in Computer Science

US Tourist Visa Eligibility Checker using Rule-based, Fuzzy Logic, and Case-based reasoning

In Partial Fulfillment of the Requirement of the Course
CS 404 – Expert Systems

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CS32S2

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US Tourism VISA Eligibility Checker

Introduction

International travel is the process of the crossing of borders from one country to another. It's a process that allows individuals to explore and experience the various different cultures and environments foreign countries have. Upon arrival in a foreign country, travelers are usually questioned by immigration officers. This is to verify the traveler's identity, validate the authenticity of their travel documents, and understand the purpose of their visit. This process is crucial for maintaining national security and ensuring that the traveler's intentions align with their stated purpose of visit.

The eligibility of a traveler to enter a country is evaluated based on various factors. These include the validity of their travel documents, their responses to the immigration officer's questions, and whether their intended activities in the country align with the type of visa they hold. This evaluation is necessary to ensure that only eligible and genuine travelers are granted entry. Once a traveler is deemed eligible, they are granted access to the country and its amenities. This includes public infrastructure, tourist attractions, and other facilities. This access is granted to allow the traveler to carry out their stated purpose of visit, whether it's tourism, business, study, etc.

The process described above is particularly prevalent in tourism. Tourists often have to provide detailed information about their planned activities, accommodations, and return plans. This is to ensure that they are genuine tourists and not intending to stay in the country illegally. Unfortunately some people misuse tourism as a route to immigrate illegally to another country. They may enter the country as tourists and then overstay their visa. This is a concern for many countries as it can lead to unauthorized work, exploitation of the illegal immigrants, and potential security threats. Therefore, the rigorous process of questioning, verification, and validation is necessary to prevent such issues.

Objective of the Study

In enhancing the efficiency and effectiveness of the complex processes that come with international tourism. The researchers proposed the development of an expert system, this system is designed to streamline the process by meticulously reviewing the necessary documents and inquiries from tourists, assessing their eligibility for entry into the United States. The decision to focus on the U.S. stems from its status as a major global tourist destination, attracting a high volume of tourists each year, and the complexity of its visa policies. These factors present a unique challenge and opportunity for the application of an expert system.

Through the implementation of this expert system, the researchers aim to achieve the following objectives:

1. **Simplify the Visa Application Process:** By providing clear, step-by-step guidance, we aim to simplify the visa application process, making it more accessible and less intimidating for applicants.
2. **Accelerate the Visa Application Process:** By automating the review of documents and inquiries, we can expedite the application process, saving applicants valuable time and resources.
3. **Enhance Information Accessibility:** Our system will serve as a reliable source of information, readily available to both new and seasoned travelers, ensuring they are well-informed and prepared for their journey.
4. **Increase Acceptance Probability:** By helping applicants accurately complete their applications and meet all necessary requirements, we aim to increase their chances of being granted a visa.
5. **Design a prototype** that could be expanded for production use in the future
6. **Apply** rule-based, fuzzy logic, and case-based reasoning for designing an expert system.

Methods and Analysis

Problem Definition

In general, the VISA application process can be complex and confusing, especially for first-time applicants. Individuals often struggle to understand the specific requirements for a tourist visa and whether they qualify. This leads to:

- **Wasted Time and Money:** Applicants spend significant time researching eligibility criteria and filling out applications that may ultimately be rejected. Visa application fees are non-refundable, so a rejected application represents wasted money.
- **Frustration and Anxiety:** The uncertainty surrounding eligibility can be stressful for potential visitors. Applicants may be unsure about their chances of approval, leading to frustration and anxiety.
- **Reduces future travel eligibility**: A denied VISA application can negatively impact an applicant's chances of approval for future applications. Consular officers may view a previous rejection as an indicator of increased risk.
- **Inefficiencies for Consulates:** Consulates receive a high volume of applications, many from individuals who may not be eligible. This creates a backlog and slows down processing times for everyone.

Knowledge Engineering

In the process of evaluating visa applications for tourism, the researchers meticulously gathered, verified, and organized essential information. The researchers employed the help of an expert in the field of law in validating the results of the expert system produced and relaying to them the requirements and the question immigration officers would ask of the traveler.

- **Knowledge Acquisition:** The researchers utilized online information to gather explicit, tacit, and implicit information regarding the process of applying for a VISA as a tourist. Furthermore like it was mentioned before, to acquire the knowledge needed to build the knowledge base. The researchers employed the help of Legal Advisor Maria Victoria San Juan-Andretta to verify and

validate the gathered information but also to further add on the information to the knowledge base with further insights on the topic.

- **Knowledge Identification examples**
  The following are sample knowledge that has been acquired:
  - Explicit (easily codified knowledge)
    - Passport must be valid 6 months after the end of the trip.
    - A person that has been banned from getting a US Citizenship is also banned from getting a B-2 VISA.
  - Implicit (knowledge made available by an expert)
    - The variables that are considered for determining one's strength of ties to a country such as family, career, and personal assets.
  - Tacit (from personal experience)
    - Determining the real intent of an applicant for traveling.

- **Knowledge Validation:** The evaluation process is conducted with the help of our legal expert Ms. Victoria San Juan-Andretta, Throughout the creation of the knowledge base she was a part of checking the criteria used by the system to evaluate each traveler eligibility to enter the country and its resulting decision after its evaluation, this includes the information it asks for and the resulting outcome it produces.
- **Knowledge representation**
  - The eligibility criteria are categorized into three groups.

    1. **General Eligibility -** Rule-based systems are well-suited for straightforward, deterministic criteria. In the context of visa eligibility, general rules can be established based on legal requirements, such as minimum income threshold and passport validity. These rules are explicit and can be encoded into a rule-based expert system.

    2. **Proving Strong Ties to Home -** Fuzzy logic is useful when dealing with imprecise or uncertain information. Establishing strong ties to one's home country is often subjective and context-dependent. Fuzzy logic allows for gradual membership in a category (e.g., "strong ties") rather than a binary yes/no decision.

    3. **Travel Itinerary -** Case Based Reasoning leverages past cases (similar situations) to make decisions. For travel itineraries, each case (located in the csv) becomes a valuable precedent. By comparing the current applicant's proposed itinerary with successful past itineraries, the system can recommend or evaluate the feasibility of the travel plan.

Inference Engine Design

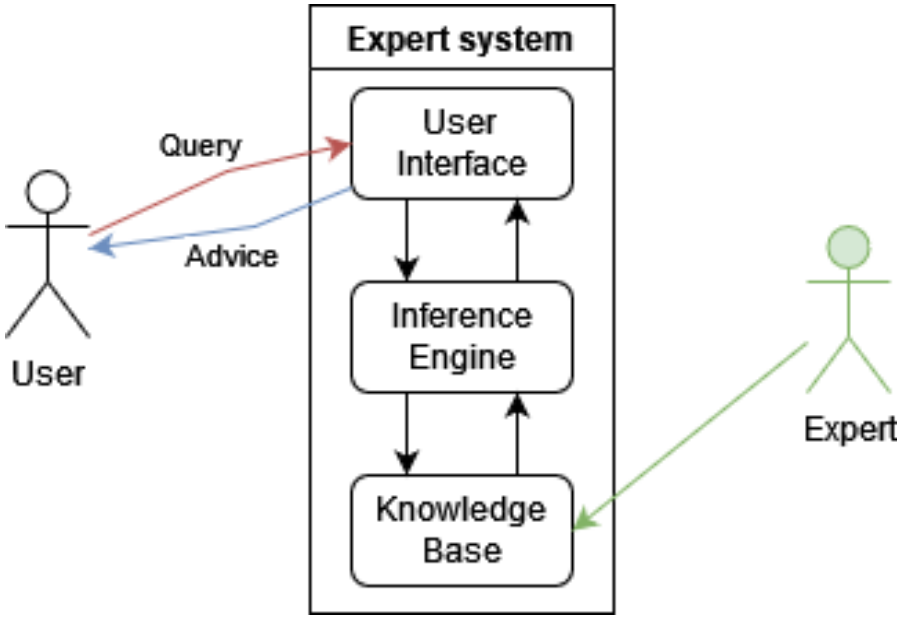

Fig. 1.0: *Inference Engine Design*

Architecture / Expert System Model

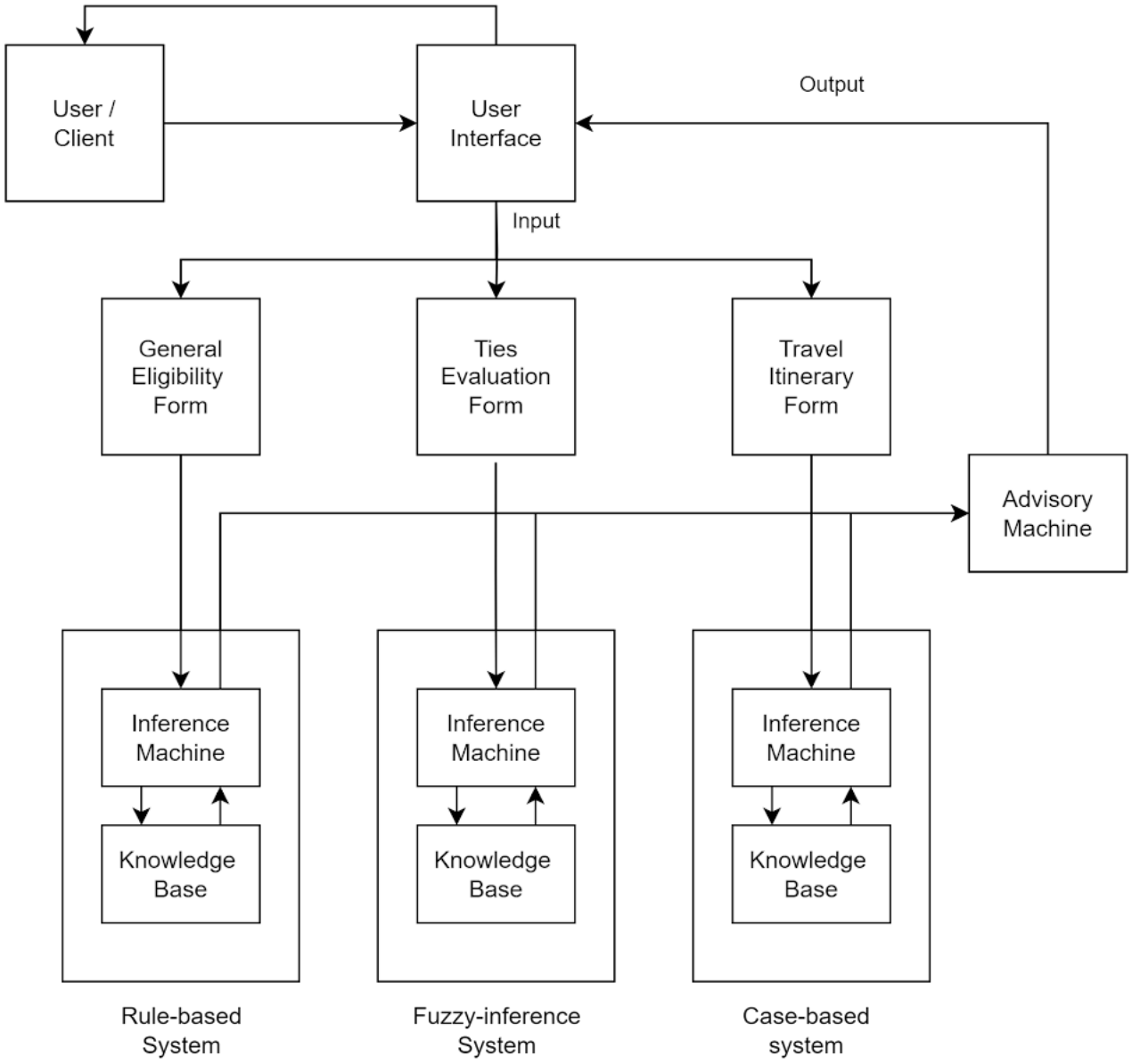

Fig. 2.0: *Architecture/Expert System Model*

Screen Design with Description

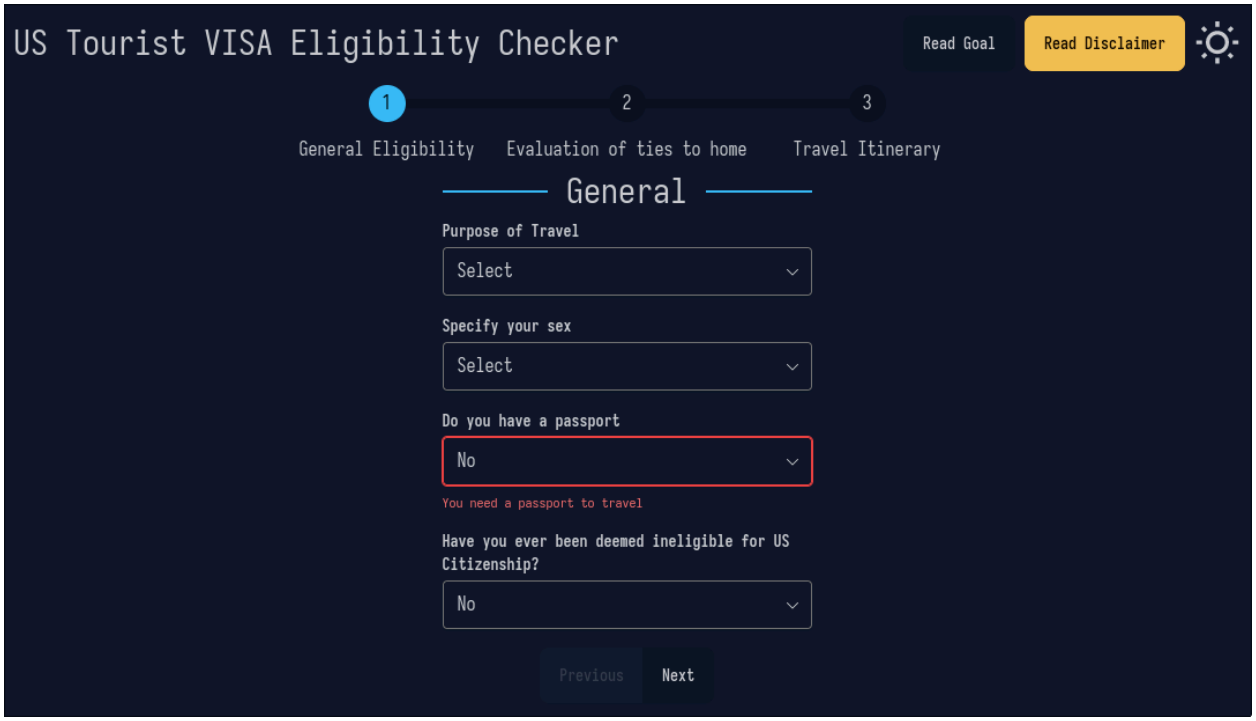

Fig. 3.0: General: Initial Screen

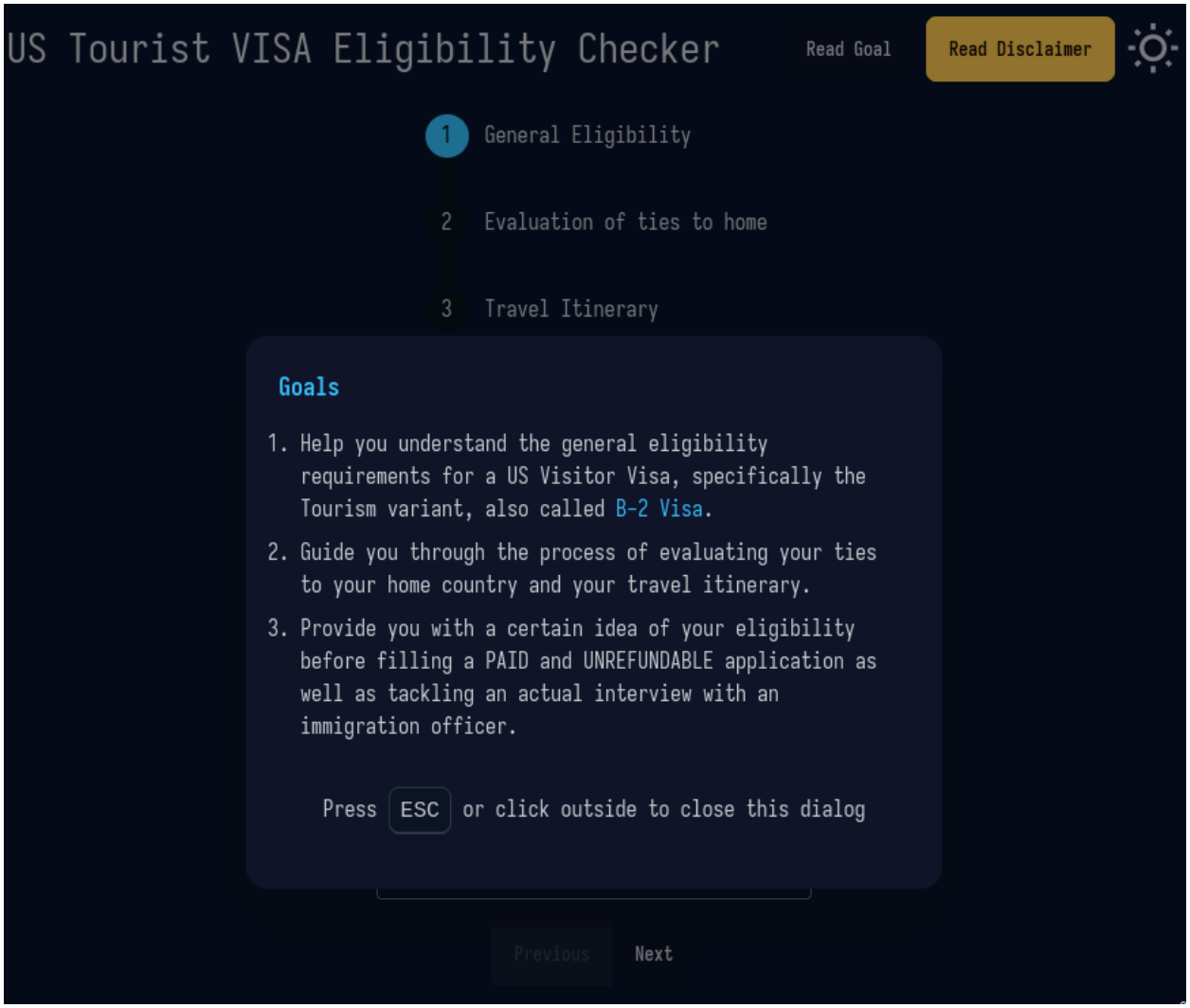

Fig. 4.0: Project Goals

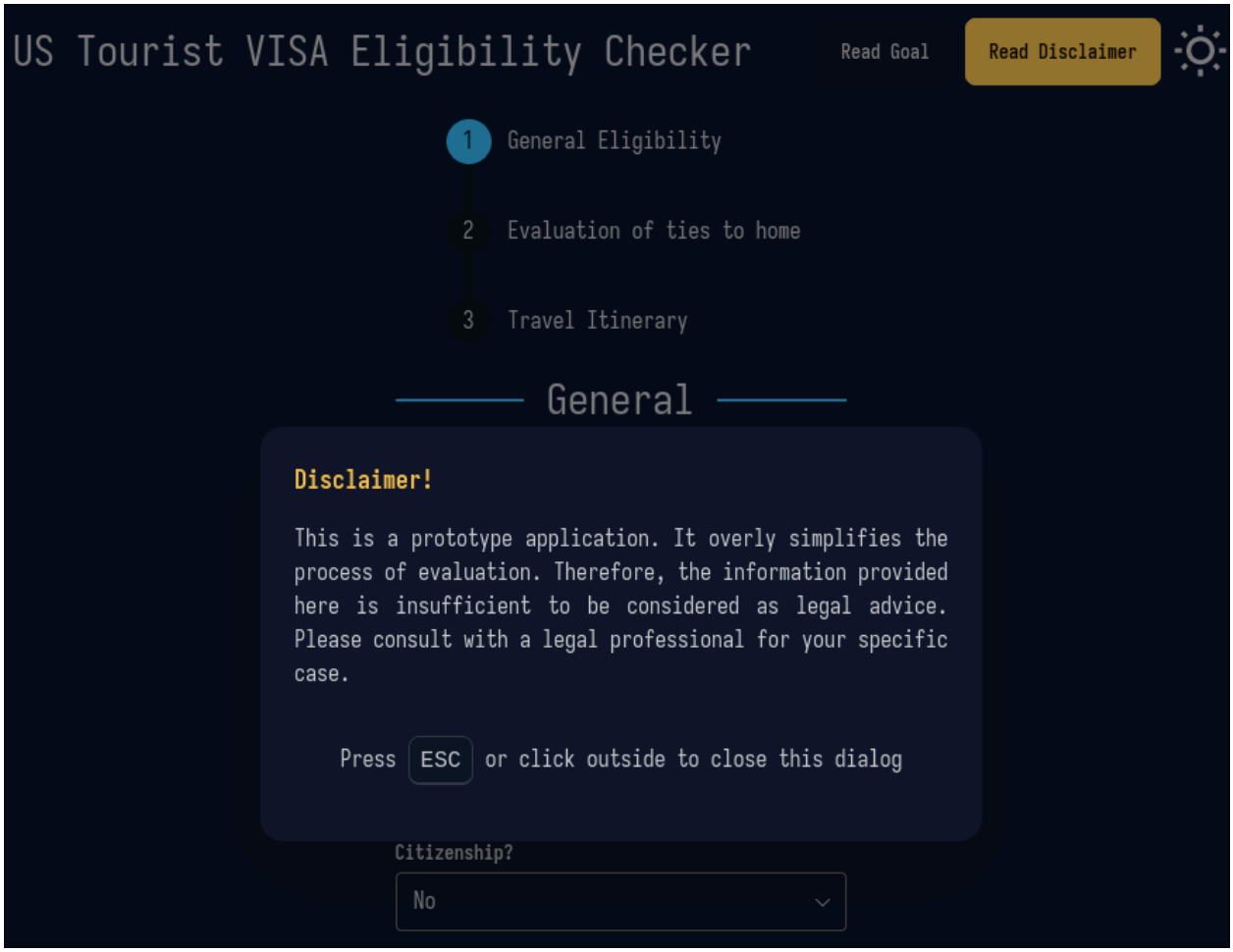

Fig. 5.0: Project prototype disclaimer

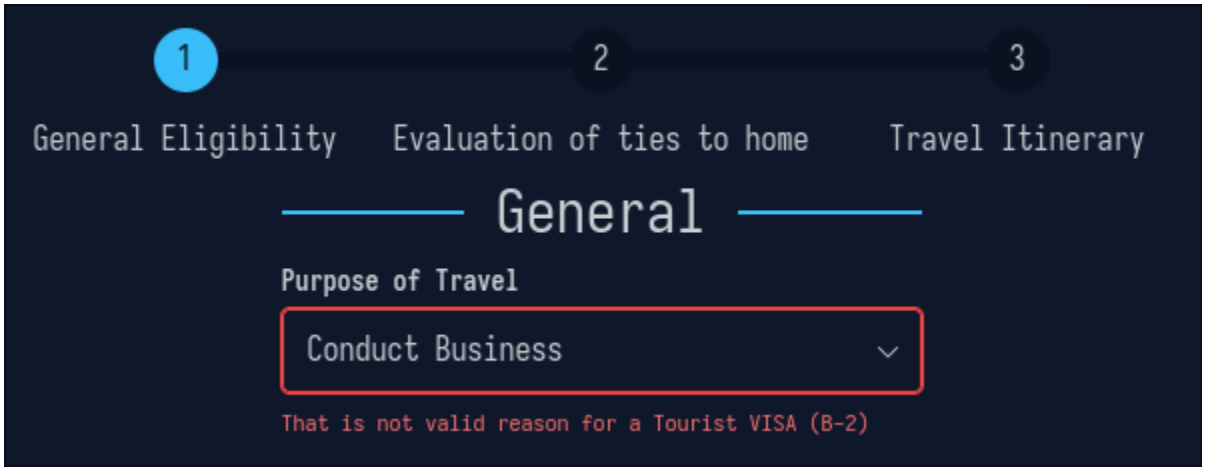

Fig. 6.1: General: Invalid purpose of travel

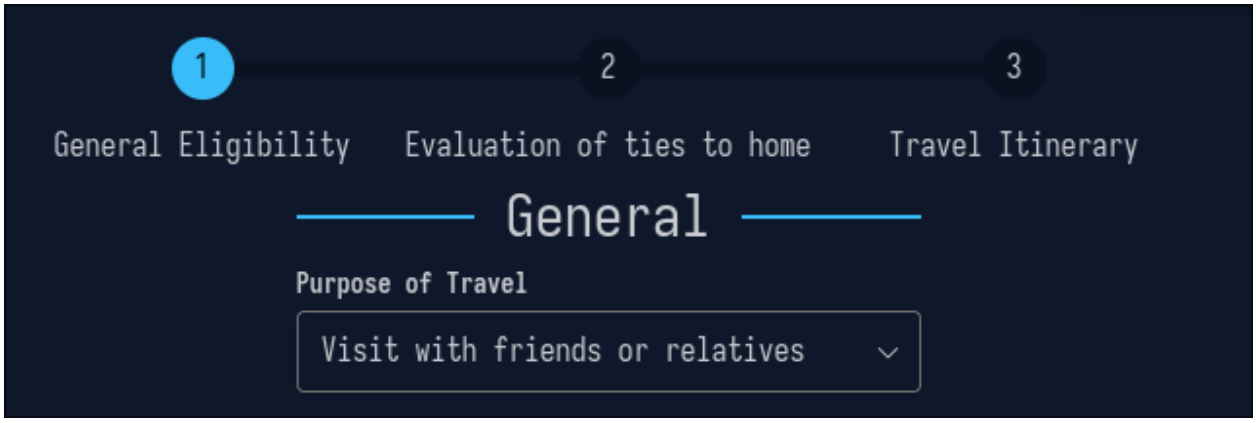

Fig. 6.2: General: Valid reason of travel

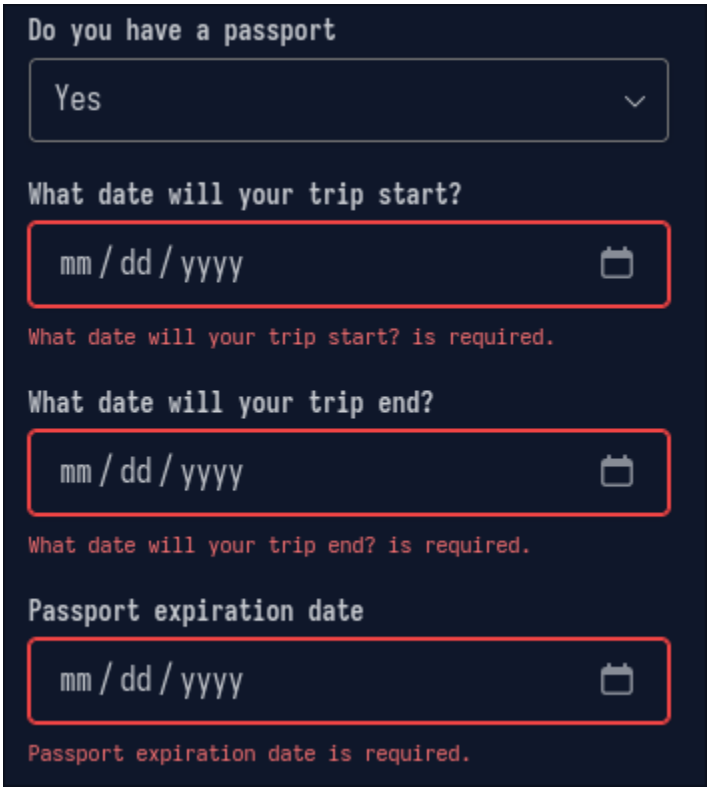

Fig. 6.3: General: Follow up questions regarding a passport

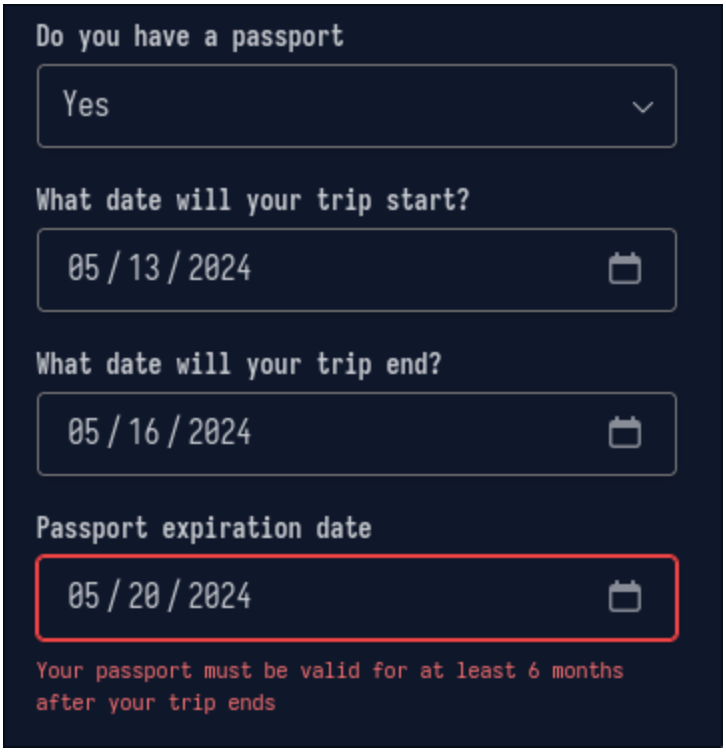

Fig. 6.4: General: Passport expiry

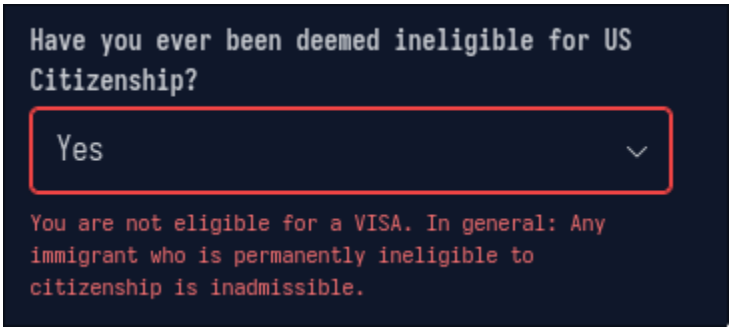

Fig. 6.5: General: Ineligible for US Citizenship

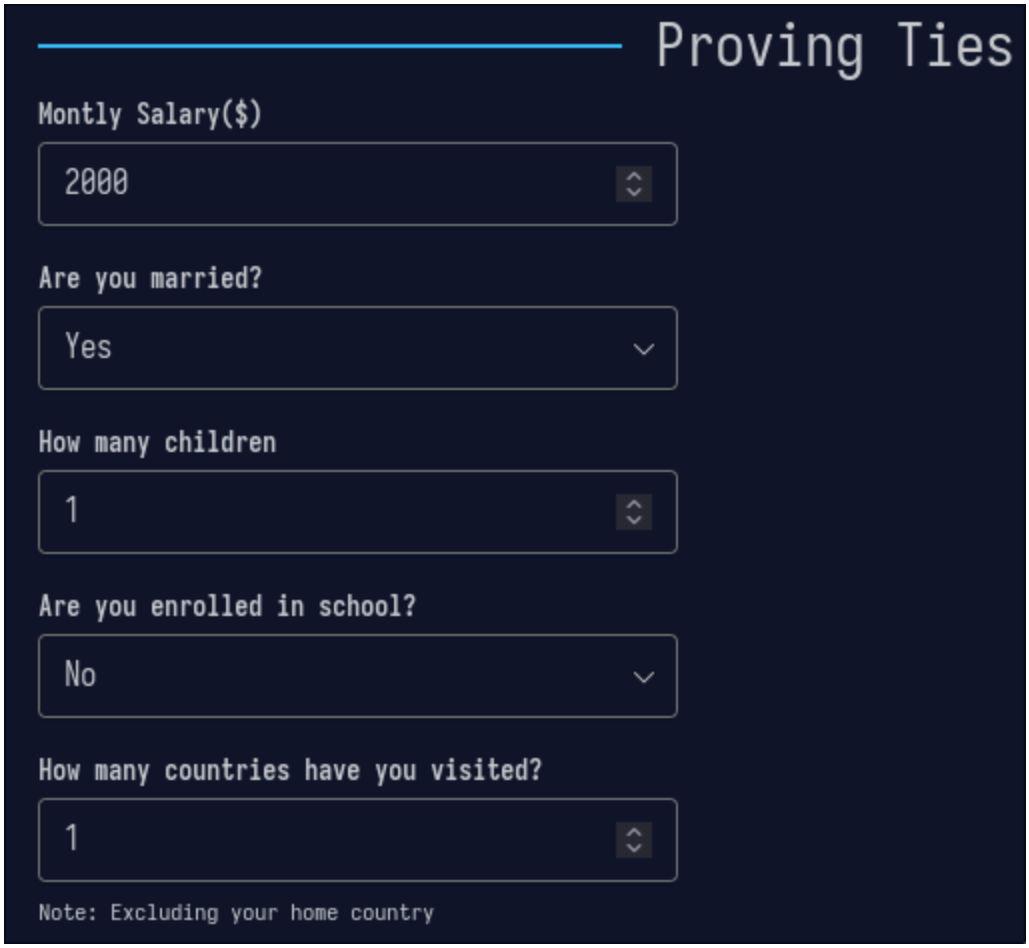

Fig. 7.1: Ties: Inputs for strong evaluation

Fig. 7.2: Ties: Strong evaluation

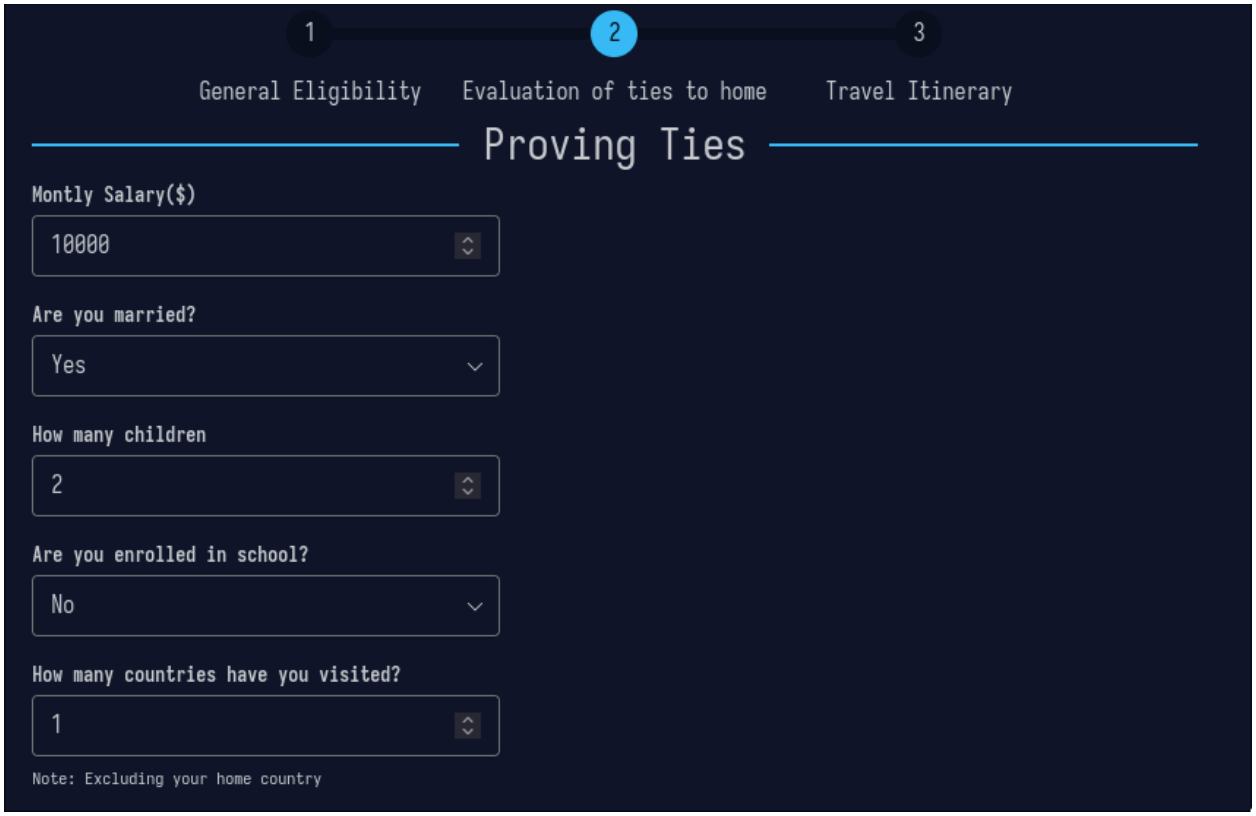

Fig. 7.3: Ties: Inputs for very Strong evaluation

Fig. 7.4: Ties: Very strong evaluation

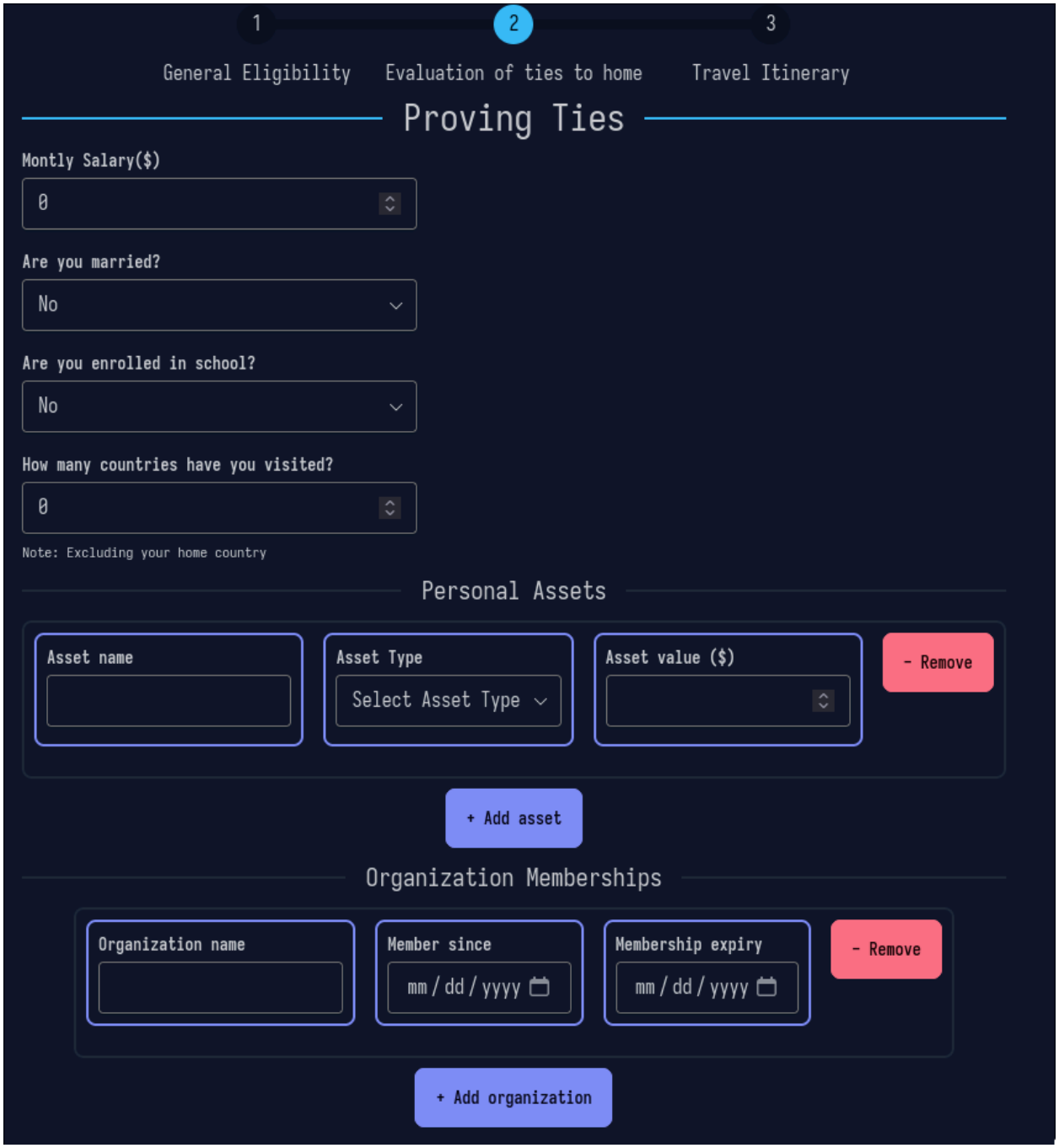

Fig. 7.5: Ties: Initial Screen

Fig. 7.6: Ties: Default evaluation

Fig. 7.7: Ties: Ideal monthly salary

Fig. 7.8: Ties: Evaluation w/ ideal monthly salary

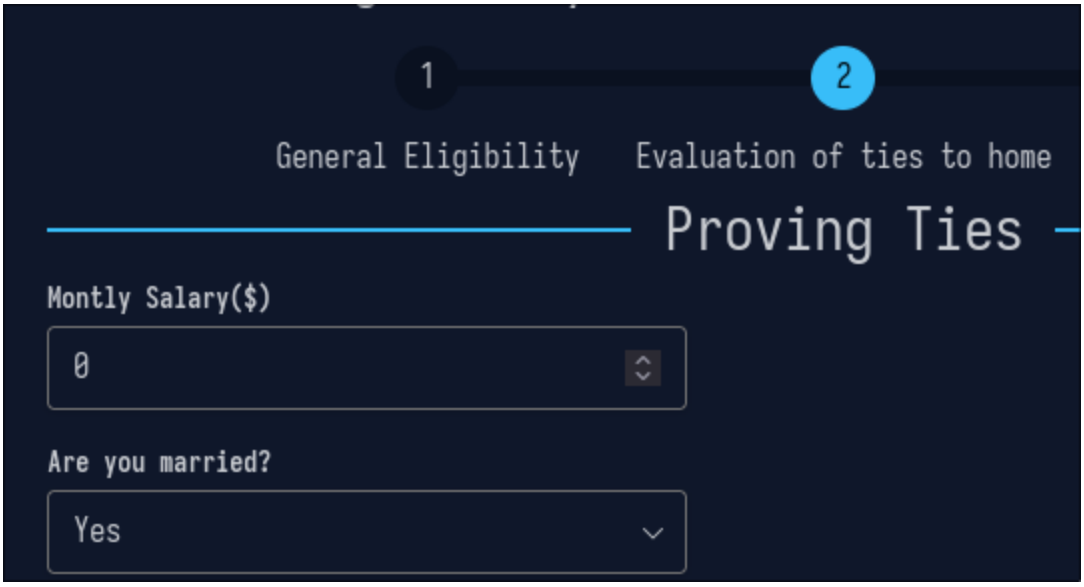

Fig. 7.9: Ties: Being married

Fig. 7.10: Ties: Evaluation of being married only

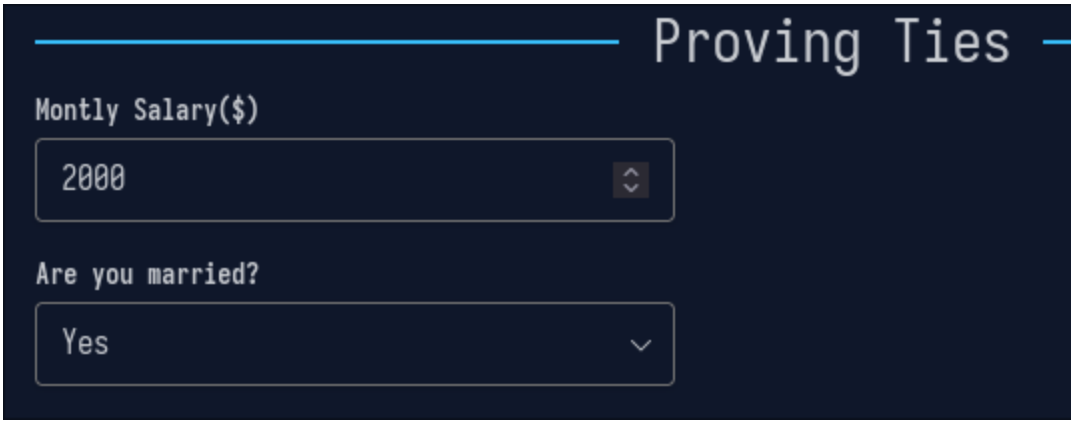

Fig. 7.11: **Ties: Married with ideal salary results in acceptable evaluation**

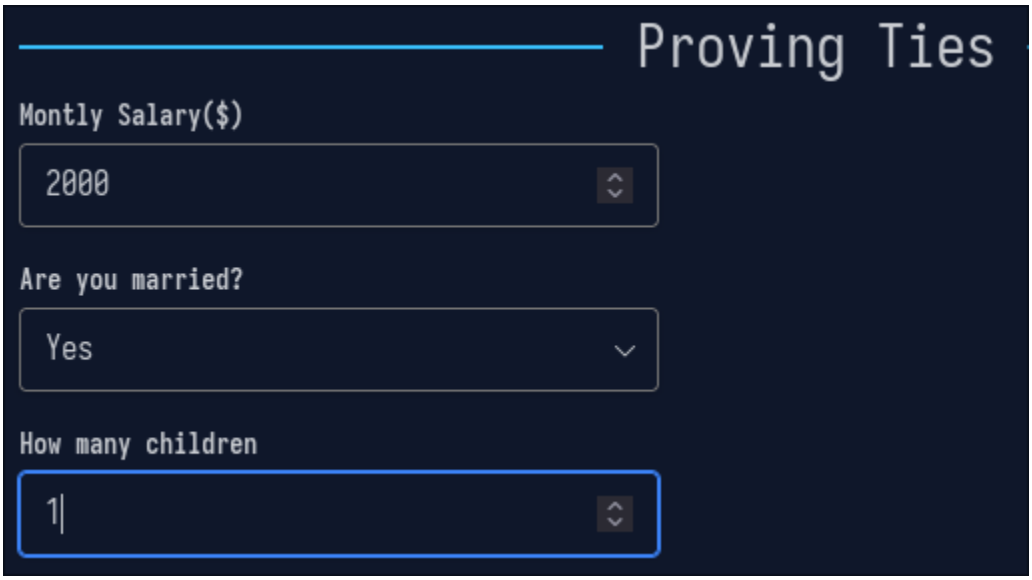

Fig. 7.12: Ties: Married with ideal salary and having a child

Fig. 7.13: Ties: evaluation of the previous figure

Fig. 7.14: **Ties:** Being only a member of an organization

Fig. 8.1: Travel: Initial Screen

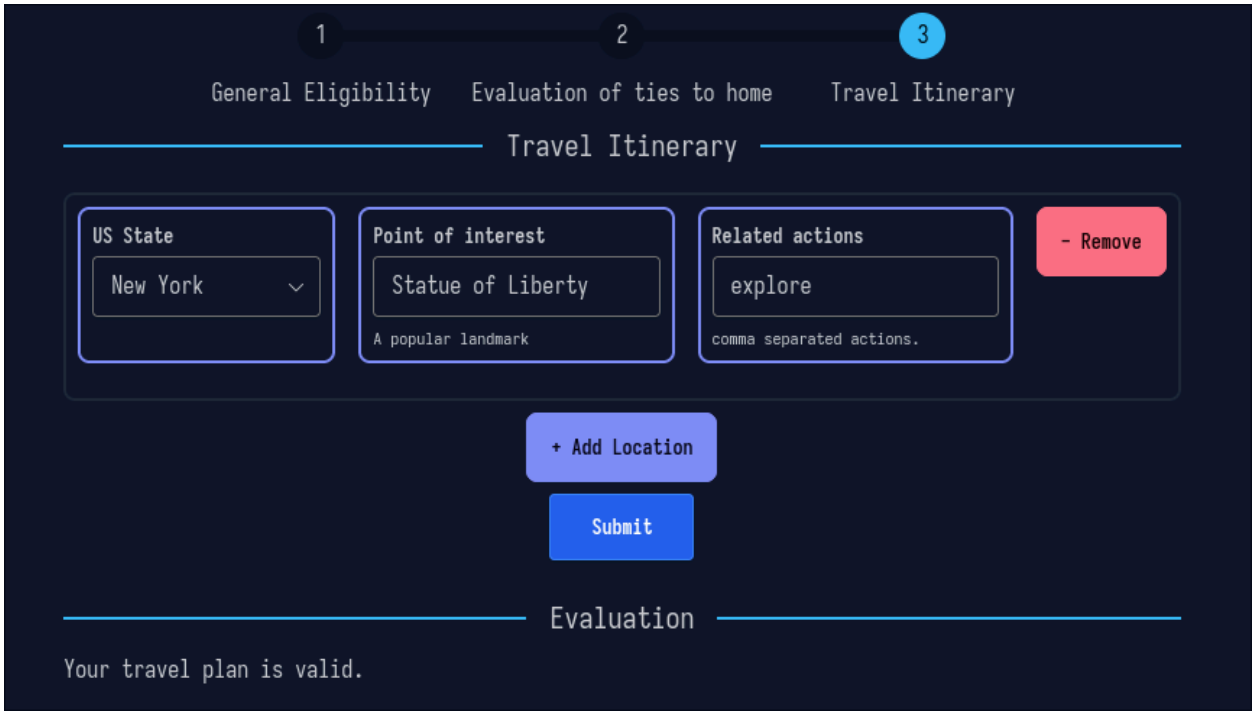

Fig. 8.2: Travel: Valid plan given that user explores statue of Liberty in New York

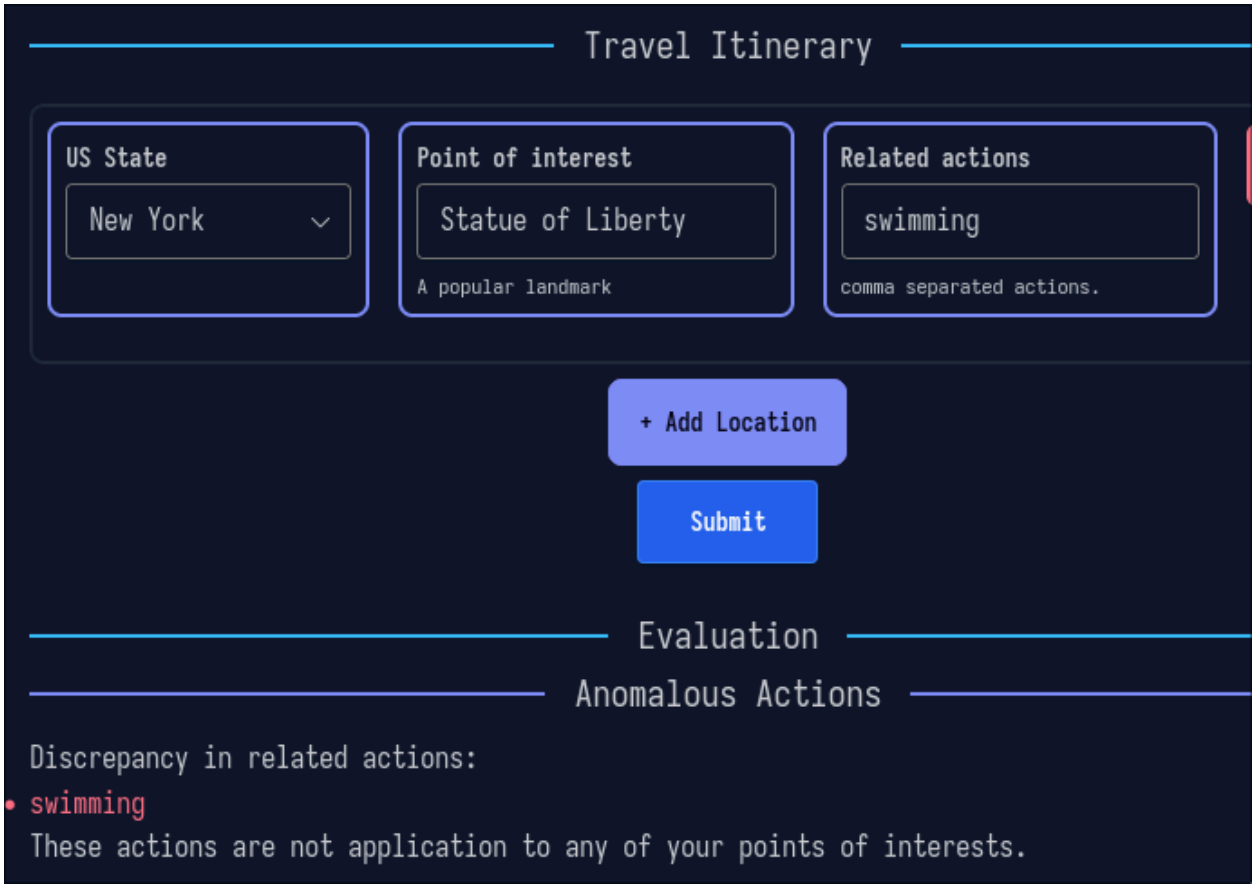

Fig. 8.3: Travel: Invalid action in the given landmark

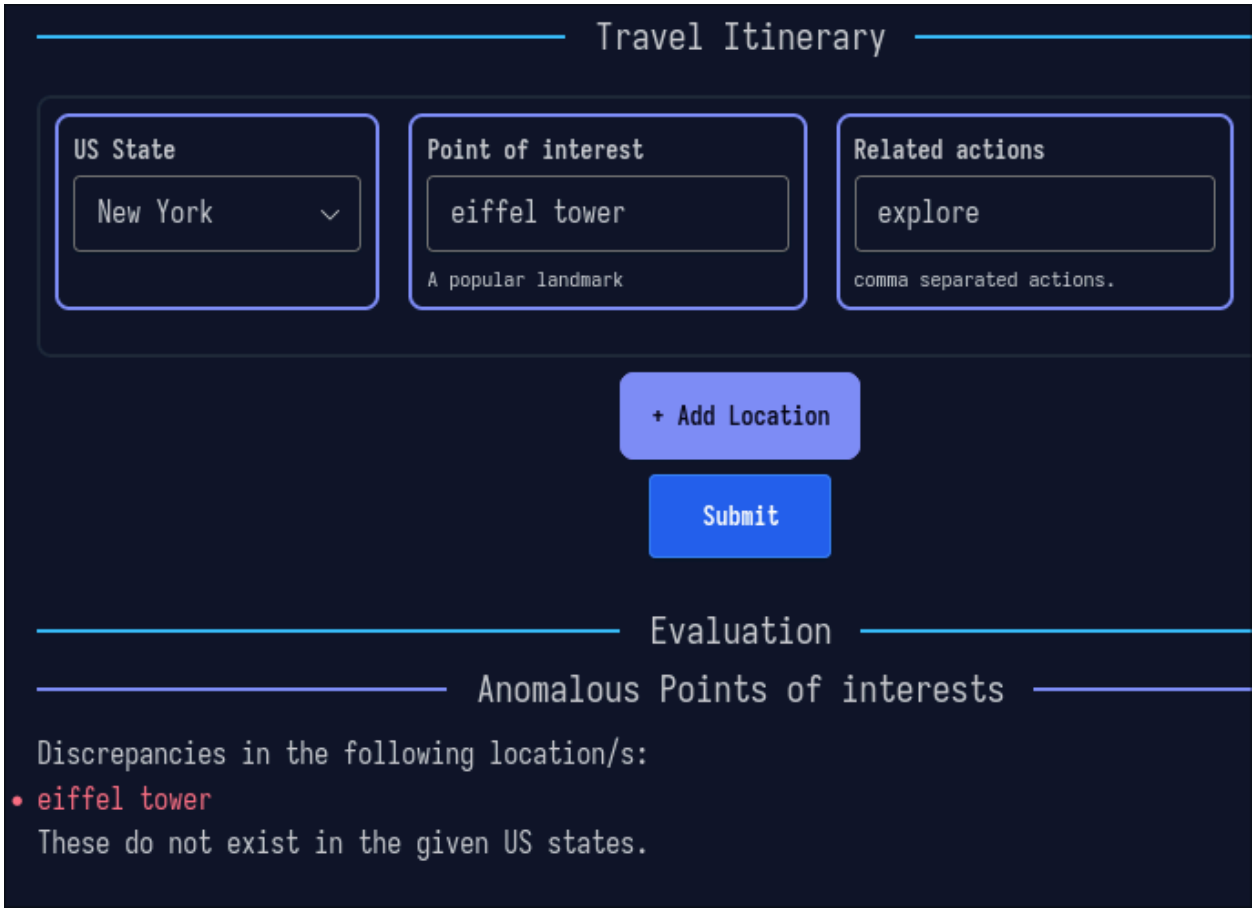

Fig. 8.4: Travel: Invalid plan given that the landmark does not exist in the given place

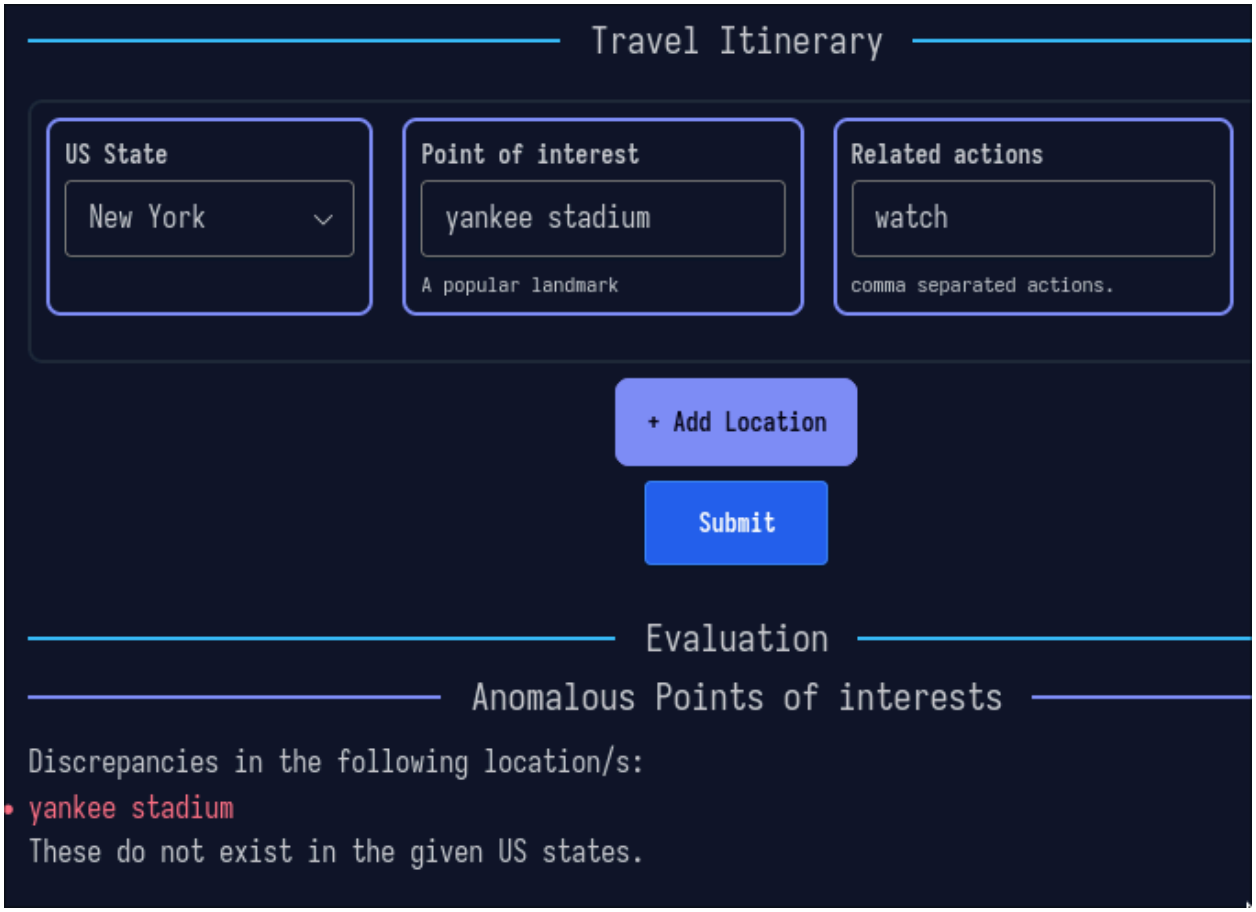

Fig. 8.5: Travel: Landmark is absent from the cases in the knowledge base

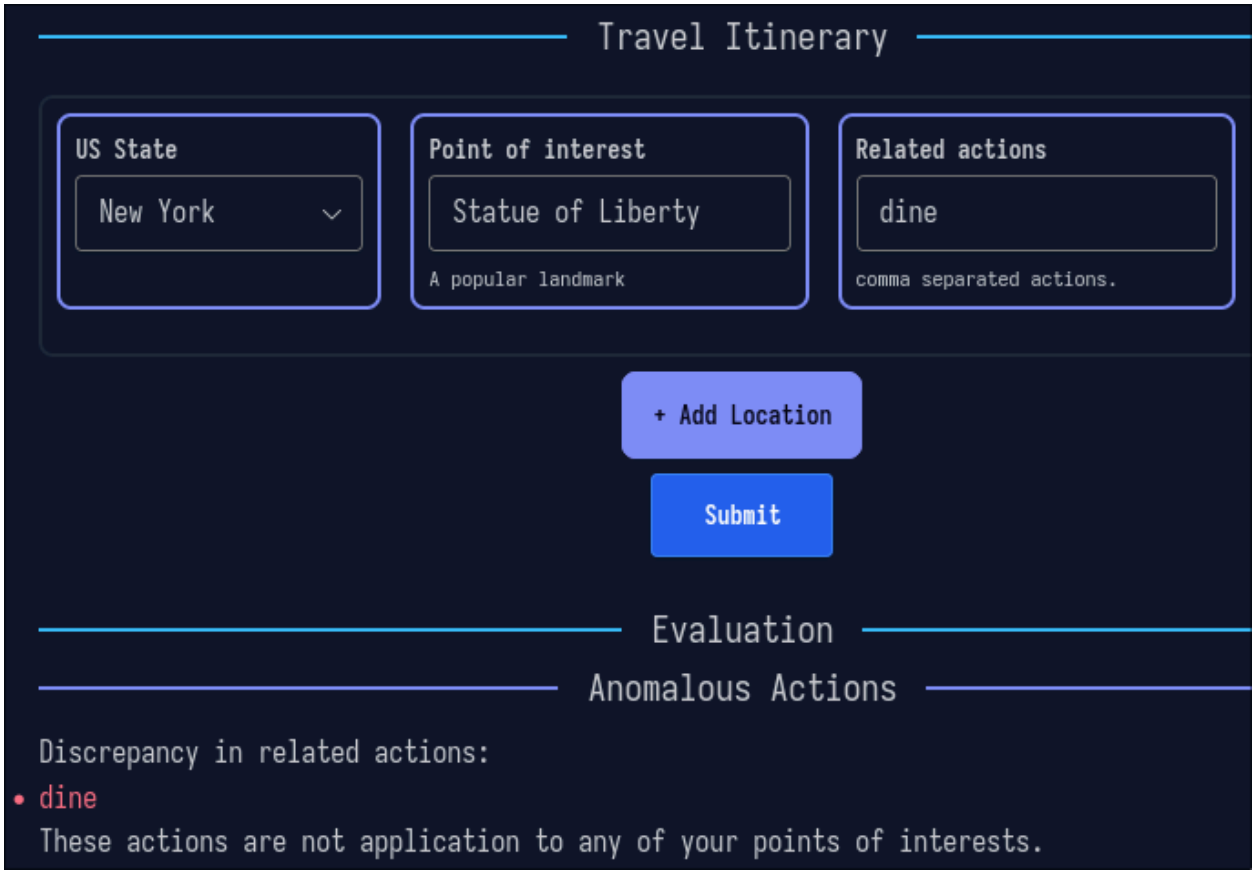

Fig. 8.6: Travel: Action is absent from the cases in the knowledge base.

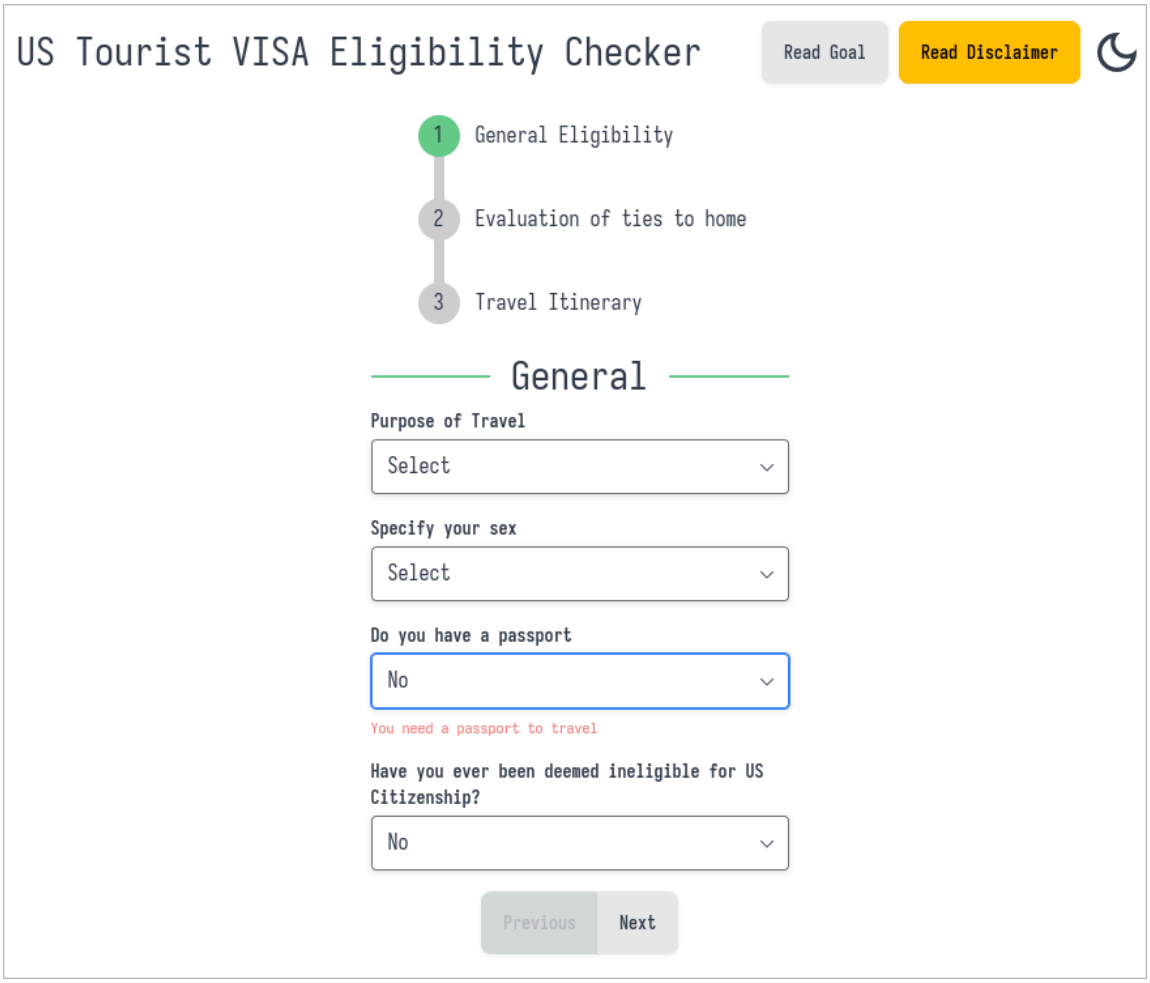

Fig. 9.0: Miscellaneous: Theme

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C E R T I F I C A T I O N

This is to certify that I have evaluated based on my experience that the program of the research titled "**US Tourist Visa Eligibility Checker using Rule-based, Fuzzy Logic, and Case-based reasoning"**

Name of Validator: Maria Victoria San Juan-Andretta
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Institution affiliated: Cheyenne Regional Medical Center and Andretta Innovations LLC

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Signature: *M.San Juan-Andretta*

Date: 05/07/2024 (PHT)

Project Contribution

Name	Contribution	Self-Evaluation 1-6 (6 is highest)
EUSTAQUIO, CYRILL KIERON R.	Research Documentation UI Design	6
FERNANDEZ, AARON JAMES	General Eligibility module Research Documentation	6
ROBIAS, JOHN MAVERICK	Documentation	6
SAN JUAN, JEAN CARLO M.	Main application Strong ties module Research Documentation	6
YAP, ETHAN SANCHO	Travel Itinerary module Research Documentation	6

Medical Diagnosis Expert System
Develop a system that can diagnose common illnesses based on symptoms provided by the user, providing recommendations for treatment or further consultation.

Educational Advising System
Create an expert system to help students choose their courses based on their interests, academic performance, and career goals.

Legal Advisory System
Build a system that provides legal advice or assistance on common legal issues, such as contract drafting, property disputes, or employment law.

Personal Finance Management System
Develop an expert system to help users manage their finances, providing advice on budgeting, saving, investing, and debt management.

Travel Planning Expert System
Create a system that assists users in planning their travel itineraries based on preferences, budget, and available options for transportation, accommodation, and activities.

Nutritional Advisor System
Build an expert system that provides personalized nutritional advice and meal planning based on individual dietary requirements, health goals, and restrictions.

Home Automation System
Develop an expert system that automates various tasks within a smart home environment, such as controlling lighting, temperature, security, and entertainment systems based on user preferences and schedules.

Crop Disease Diagnosis System
Create an expert system to help farmers diagnose and manage diseases affecting their crops, providing recommendations for treatment and prevention strategies.

Career Counseling System
Build a system that assists users in exploring different career paths, providing insights into job prospects, required skills, and educational pathways based on individual strengths and interests.

Language Learning Assistant
Develop an expert system to aid language learners in practicing grammar, vocabulary, and pronunciation, providing personalized feedback and suggestions for improvement based on the user's proficiency level and learning style.