THE OPEN UNIVERSITY OF SRI LANKA

BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

Smart Tourist Assistant

Mini Expert System

Final Documentation

By

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COU4201

Knowledge Representation and Logic Programming

DECLARATION

We hereby declare that this project report document is based on our original work and have not been submitted previously for any other degree or diploma in any institution. To the best of our knowledge, it does not contain any material written by another person.

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Date

Submitted to Supervisor:

_____ _____

Signature Date

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01. ABSTRACT

This project final document is giving an explanation about our group mini expert system which is developed using Prolog logic programming language. In this mini project, user can get a recommendation for a best travel destination based on that user entered preferences into the system. This project is mostly appropriate for the users who are searching a best travel destination for travelling around the world. So, this document gives information about what is this project, what are the methodologies used to develop this system, how implemented the system, and the final outcome of the system that we achieved as a group.

02. INTRODUCTION

This project final report document is submitted" to meet the mini expert system development requirements of the mini project of the Knowledge Representation and Logic Programming Course conducted by the Open University of Sri Lanka.

In this document, we are discussing the Introduction, Methodology, Project Implementation, Discussion and conclusion of this project.

This mini expert system is titled "Smart Tourist Assistant". This system is designed for make easier for user to plan and choose a best travel destination based on that user preferences. So, then system can smartly recommend a best matching travel destination through region, user interest, budget level, season like to travel like that to find the best one for users.

Because of the problem that there are less number of mini expert systems for travelling guides, we developed this 'Smart Tourist Assistant' mini expert system that make travelling life easier for users.

03. METHODOLOGY

The Smart Tourist Assistant project was developed using an approach that focused on utilizing Prolog to create a rule-based expert system. The following organized phases were used to carry out the development.

As the development environment, SWI-Prolog was used for testing, and executing the logic-based program, Notepad++ is used as the text editor for creating and editing the source files. Prolog is used as the logical programming language.

A systematic collection of travel destination information was created using the prolog predicate, with each fact containing specifics about a destination, including the area, season, budget constraints, interests, mode of travel, and activities available. This facilitated effective querying and reasoning. The application starts with an engaging interface that requests user to input through the console. Certain details are sought from the user based on their preference.

The recommendation system is built using a set of prolog rules and predicates, which filters destinations by 4 recommended predicates.

Then the matched travel destinations are displayed clearly, including the details such as,

- Destination name, and country
- Duration in days
- Mode of travel
- List of activities

Destinations are grouped and structured by region and budget for ease of maintenance. Adding new destinations or modifying the existing entries can be done by simply appending or editing the destination facts in the source code.

To develop this project, software and hardware tools are essential. The system cannot be developed successfully without these software and hardware requirements. These are details of the software and hardware requirements for this mini expert system.

03.1 SOFTWARE REQUIREMENTS

Software	Description
Operating System: Windows 10 Pro (64-bit)	Manage all the software and hardware on the laptop.
Microsoft Office Professional Plus 2016: Microsoft Word Microsoft PowerPoint	Tool for editing, viewing, and creating documents, and presentations of the project.
Notepad++	To code the knowledge base, logics, rules, and predefined queries for develop system.
SWI-Prolog	For create the prolog environment setup and run the system.
Web Browser: Microsoft Edge	Find online resources for develop knowledge base and develop the system.

Table 03.1: The software used for mini expert system

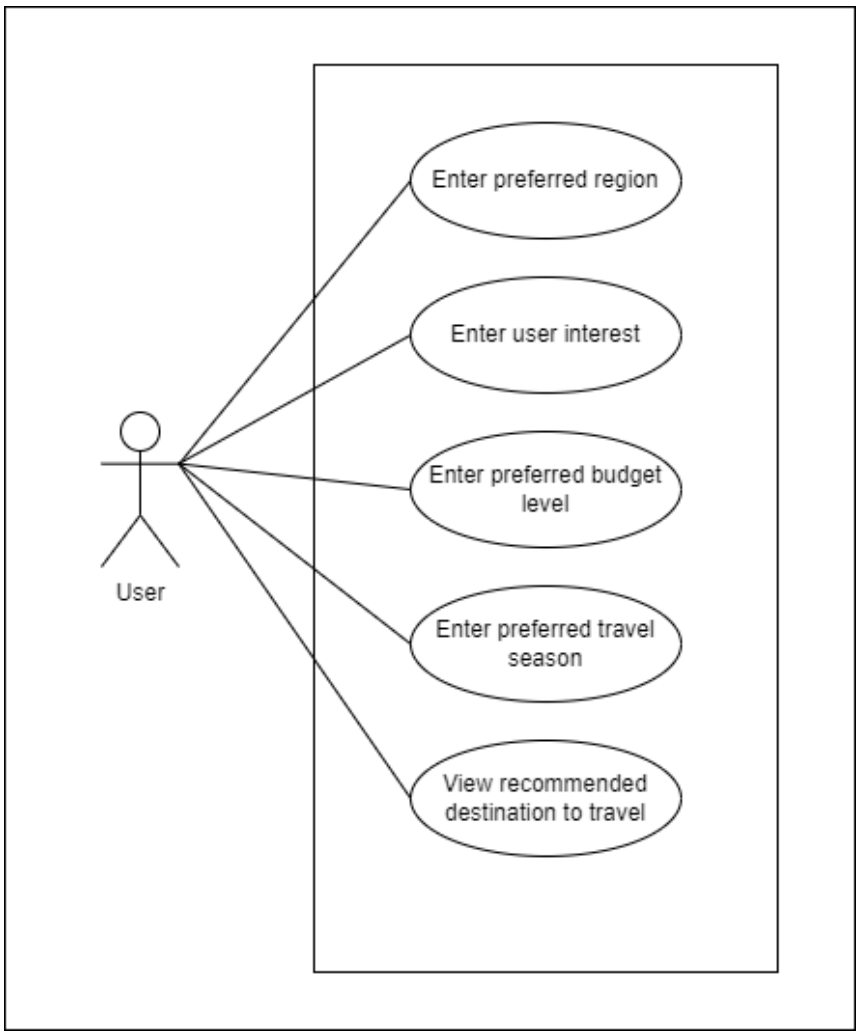
03.2 HARDWARE REQUIREMENTS

Hardware	Description
Laptop: DELL Inspiron 3543 Processor: Intel Core i5 – 5200U CPU@ 2.20GHz RAM – 4GB Storage – 1TB HDD 128GB SSD	To combine team members code snippets and combine them to develop the system, edit, and view documents.
4G/LTE Wireless Router	To access the Internet.

Table 03.2: The hardware used for mini expert system

03.3 FUNCTIONAL REQUIREMENTS – USE CASE DIAGRAM

In the creation and development of this Smart Tourist Assistant mini expert system, there are following functional requirements to perform. In the following is displaying the use case of this project.



03.3. USE CASE Diagram created to develop for the mini expert system

03.4 NON-FUNCTIONAL REQUIREMENT – Usability

Usability is a non-functional requirement for this mini expert system, which is focusing on making the system that include with easy to use, and efficient for users. It involves designing the system in a way that allows users to accomplish their tasks effectively. So, the usability considerations may include, designing a clean user-friendly interface that allows users to work with the system effortlessly.

04. PROJECT IMPLEMENTATION

The initiation of the Smart Tourist Assistant expert system involved choosing and discussing about the project topic. The concept was to develop a rule-based system that could help users select travel destinations aligned with their preferences. This required determining the types of knowledge necessary for such a system, including regions, budget levels, seasons, interests, and activities, as well as comprehending how this data could be logically organized in a prolog-based setting. The topic was selected due to its relevance, potential usefulness, and its suitability for applying expert system principles in a practical way.

After finalizing the topic, the next step is gathering and arranging resources. This involved investigating favored travel spots across various continents, organizing them by budget category, recognizing seasonal trends, and outlining common tourist interests and activities. The gathered resources were subsequently examined and converted into a structured format appropriate for a Prolog knowledge base. Each destination fact was crafted using a consistent predicate structure, enabling logical reasoning and easy data manipulation within the Prolog environment. Also, we used list notation for make list of interests for every destination that we included in knowledge base.

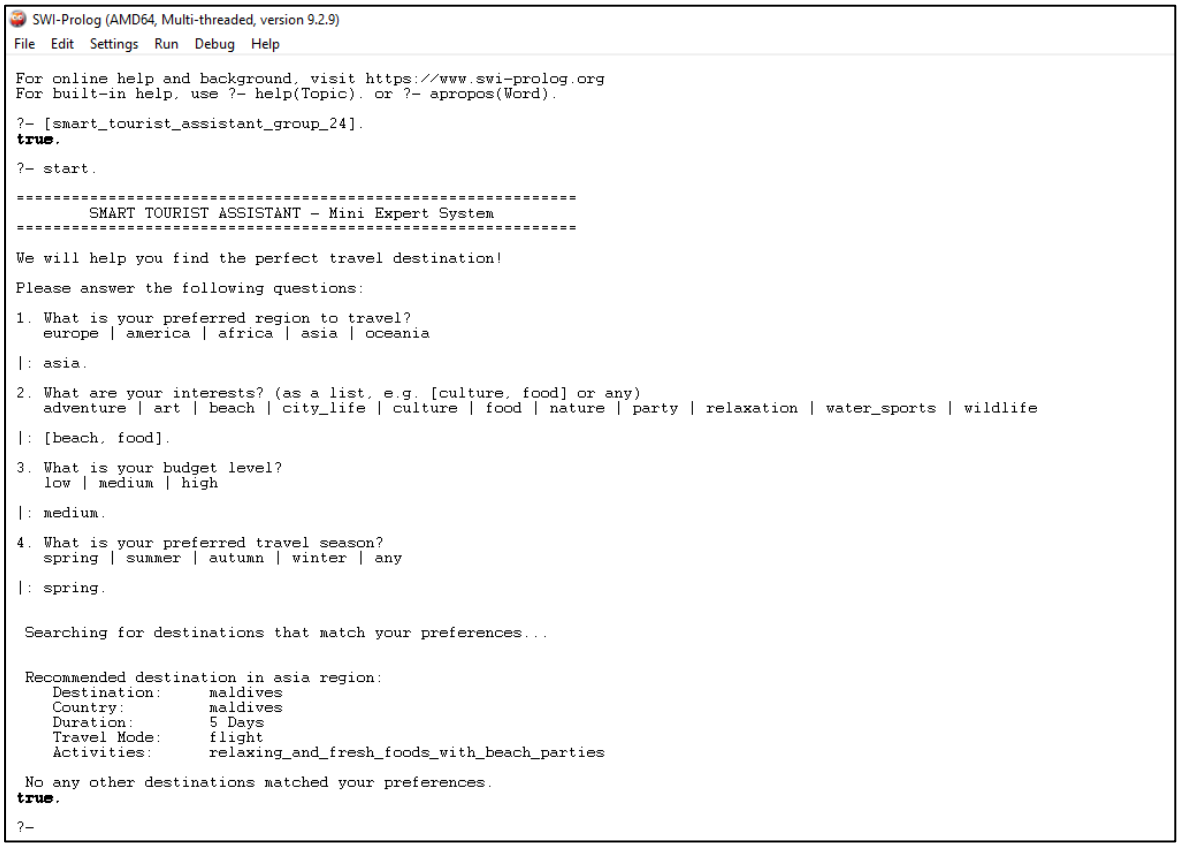
Once the essential knowledge base was established, the phase of implementing the logic began. Utilizing SWI-Prolog, an ideal development environment for this purpose, the core program was created to manage user input and suggest destinations accordingly. The system requests input from the user about their travel destination, interests, budget, and chosen season. It accommodates both particular and general input choices (such as the keyword any) for versatile searching.

The fundamental logic was created using predicates. These guidelines shift through and align user preferences with stored information, identify which budget levels need to be factored in, and present activities in an understandable format. Throughout the development process, the logic was tested gradually. Initial versions were straightforward, with improvements introduced gradually, such as broadening the filtering criteria to permit partial interest matches, adding support features, and refining result presentation.

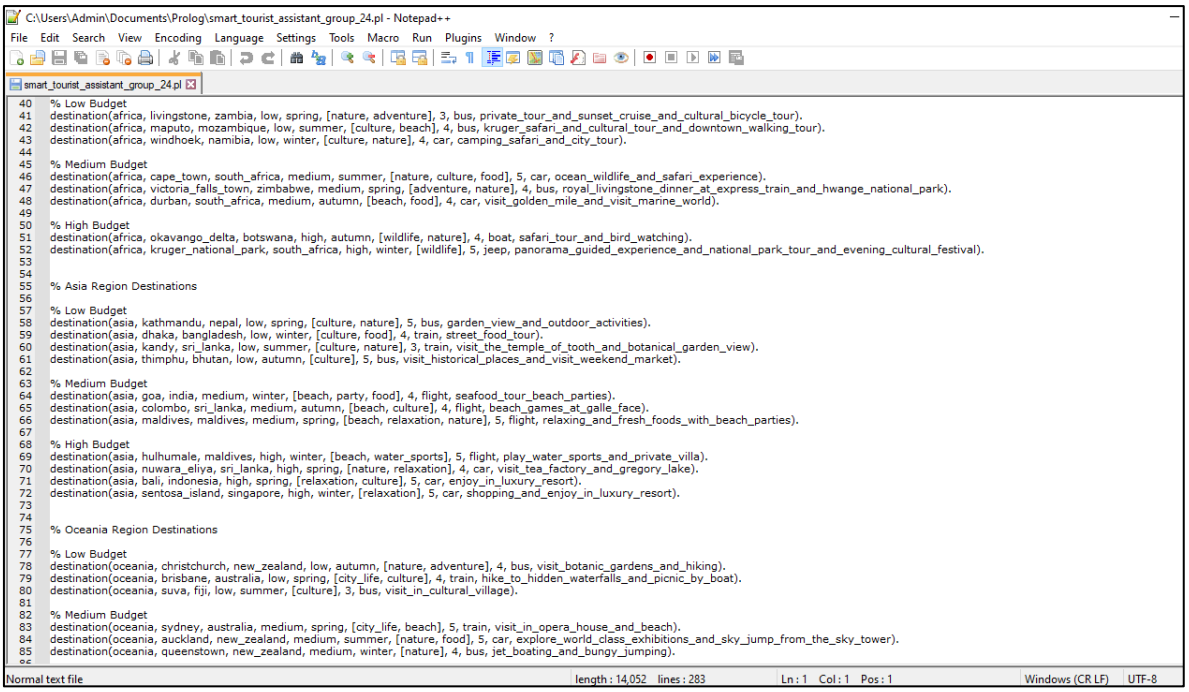
Modifications and enhancements were consistently made during the development process. This involved correcting logical inconsistencies, refreshing the knowledge base, enhancing the performance of the recommendation engine, and ensuring that the program could manage different user inputs without failing. Extra test cases were developed to verify the correctness and reliability of the system's results.

The completed implementation produced an interactive expert system that effectively suggests appropriate level locations. The modular design of the system enables straightforward expansion by simply adding new destination facts or broadening the collection of matching rules. The effectiveness of this implementation highlights how logical reasoning and knowledge representation in prolog can applied to real-world issues.

User interface view

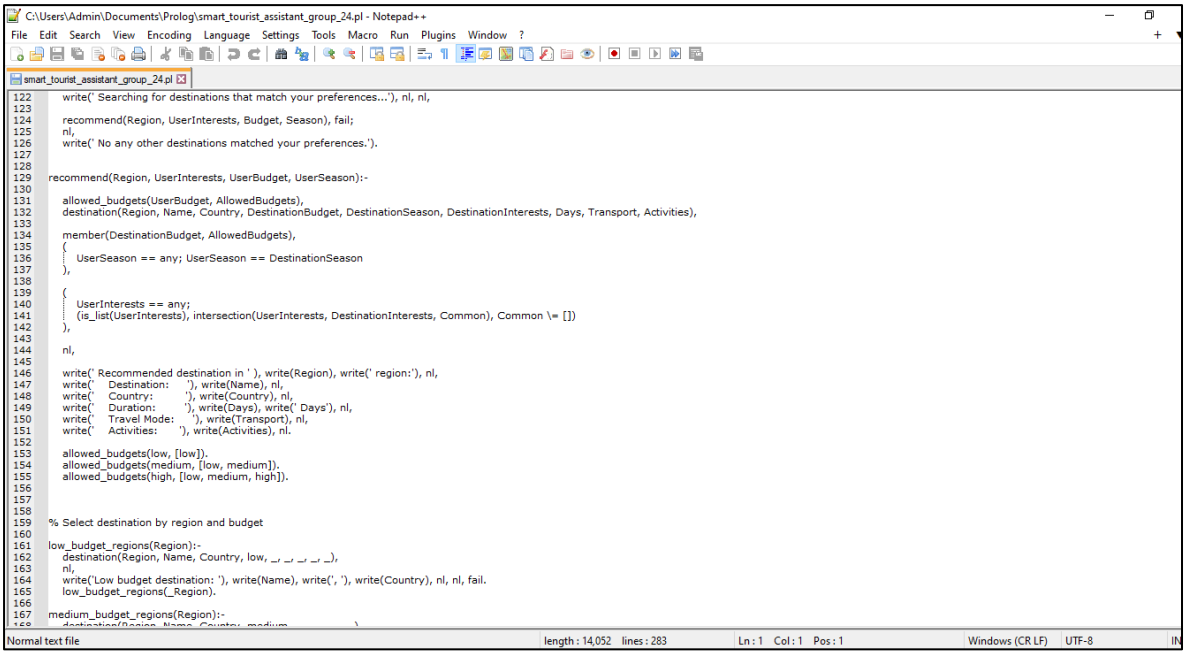


Knowledge base design



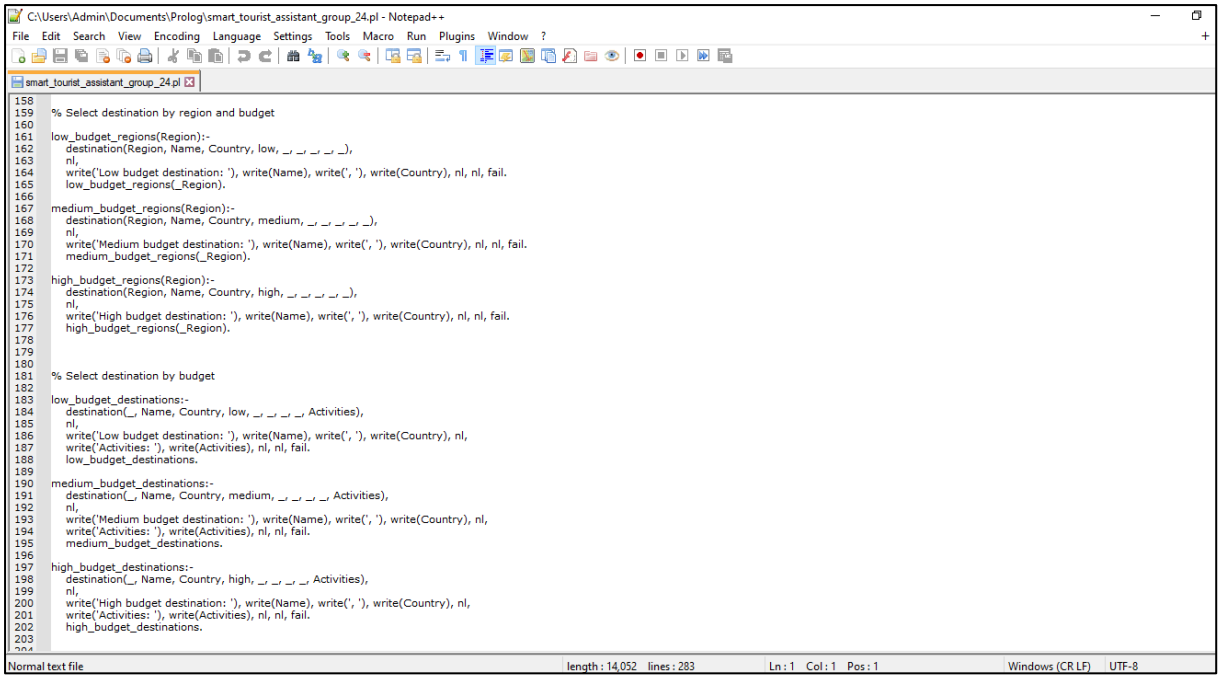
```
% Low Budget
destination(africa, livingstone, zambia, low, spring, [nature, adventure], 3, bus, private_tour_and_sunset_cruise_and_cultural_bicycle_tour).
destination(africa, maputo, mozambique, low, summer, [culture, beach], 4, bus, kruger_safari_and_cultural_tour_and_downtown_walking_tour).
destination(africa, windhoek, namibia, low, winter, [culture, nature], 4, car, camping_safari_and_city_tour).

% Medium Budget
destination(africa, cape_town, south_africa, medium, summer, [nature, culture, food], 5, car, ocean_wildlife_and_safari_experience).
destination(africa, victoria_falls_town, zimbabwe, medium, spring, [adventure, nature], 4, bus, royal_livingstone_dinner_at_express_train_and_hwange_national_park).
destination(africa, durban, south_africa, medium, autumn, [beach, food], 4, car, visit_golden_mile_and_visit_marine_world).

% High Budget
destination(africa, okavango_delta, botswana, high, autumn, [wildlife, nature], 4, boat, safari_tour_and_bird_watching).
destination(africa, kruger_national_park, south_africa, high, winter, [wildlife], 5, jeep, panorama_guided_experience_and_national_park_tour_and_evening_cultural_festival).


% Asia Region Destinations

% Low Budget
destination(asia, kathmandu, nepal, low, spring, [culture, nature], 5, bus, garden_view_and_outdoor_activities).
destination(asia, dhaka, bangladesh, low, winter, [culture, food], 4, train, street_food_tour).
destination(asia, kandy, sri_lanka, low, summer, [culture, nature], 3, train, visit_the_temple_of_tooth_and_botanical_garden_view).
destination(asia, thimphu, bhutan, low, autumn, [culture], 5, bus, visit_historical_places_and_visit_weekend_market).

% Medium Budget
destination(asia, goa, india, medium, winter, [beach, party, food], 4, flight, seafood_tour_beach_parties).
destination(asia, colombo, sri_lanka, medium, autumn, [beach, culture], 4, flight, beach_games_at_galle_face).
destination(asia, maldives, maldives, medium, spring, [beach, relaxation, nature], 5, flight, relaxing_and_fresh_foods_with_beach_parties).

% High Budget
destination(asia, hulhumale, maldives, high, winter, [beach, water_sports], 5, flight, play_water_sports_and_private_villa).
destination(asia, nuwara_eliya, sri_lanka, high, spring, [nature, relaxation], 4, car, visit_tea_factory_and_gregory_lake).
destination(asia, bali, indonesia, high, spring, [relaxation, culture], 5, car, enjoy_in_luxury_resort).
destination(asia, sentosa_island, singapore, high, winter, [relaxation], 5, car, shopping_and_enjoy_in_luxury_resort).


% Oceania Region Destinations

% Low Budget
destination(oceania, christchurch, new_zealand, low, autumn, [nature, adventure], 4, bus, visit_botanic_gardens_and_hiking).
destination(oceania, brisbane, australia, low, spring, [city_life, culture], 4, train, hike_to_hidden_waterfalls_and_picnic_by_boat).
destination(oceania, suva, fiji, low, summer, [culture], 3, bus, visit_in_cultural_village).

% Medium Budget
destination(oceania, sydney, australia, medium, spring, [city_life, beach], 5, train, visit_in_opera_house_and_beach).
destination(oceania, auckland, new_zealand, medium, summer, [nature, food], 5, car, explore_world_class_exhibitions_and_sky_jump_from_the_sky_tower).
destination(oceania, queenstown, new_zealand, medium, winter, [nature], 4, bus, jet_boating_and_bungy_jumping).
```

Rules and logics implemented



```
    write(' Searching for destinations that match your preferences...'), nl, nl,

    recommend(Region, UserInterests, Budget, Season), fail;
    nl,
    write(' No any other destinations matched your preferences.').


recommend(Region, UserInterests, UserBudget, UserSeason):-

    allowed_budgets(UserBudget, AllowedBudgets),
    destination(Region, Name, Country, DestinationBudget, DestinationSeason, DestinationInterests, Days, Transport, Activities),

    member(DestinationBudget, AllowedBudgets),
    (
        UserSeason == any; UserSeason == DestinationSeason
    ),

    (
        UserInterests == any;
        (is_list(UserInterests), intersection(UserInterests, DestinationInterests, Common), Common \= [])
    ),

    nl,

    write(' Recommended destination in ' ), write(Region), write(' region:'), nl,
    write('    Destination:      '), write(Name), nl,
    write('    Country:          '), write(Country), nl,
    write('    Duration:         '), write(Days), write(' Days'), nl,
    write('    Travel Mode:      '), write(Transport), nl,
    write('    Activities:       '), write(Activities), nl.

    allowed_budgets(low, [low]).
    allowed_budgets(medium, [low, medium]).
    allowed_budgets(high, [low, medium, high]).



% Select destination by region and budget

low_budget_regions(Region):-
    destination(Region, Name, Country, low, _, _, _, _, _),
    nl,
    write('Low budget destination: '), write(Name), write(', '), write(Country), nl, nl, fail.
    low_budget_regions(_Region).

medium_budget_regions(Region):-
```

Predefined queries created



05. DISCUSSION

Our group developed a mini expert system that help people find the perfect travel destination which is developed using Prolog, a logic programming language.

In this system, after loading the .pl file into SWI-Prolog, we can input ‘start.’ And then user can give his or her preferred inputs into system which are related to questions that are displaying on system user interface. There a user can give a preferred region to travel, user’s travel interest or interests, user’s budget level for travelling, and also preferred season to travel. Then, the system matches that user preferences with knowledge base and logics implemented within the system and recommend a best travel destination to travel for that user.

Here are a few examples input that we used to see how the input and output is presented to the user. Here’s how it works,

- The user was looking for travel destinations in **europe** with interests in **culture and food**, a **medium** budget, and during the **spring** season.
  Then input will be,

  Preferred region to travel: europe.

  What are your interests?: [culture, food].

  What is your budget level?: medium.

  What is your preferred travel season?: spring.

  Here is the output that user can get.

```
?- start.

============================================================
        SMART TOURIST ASSISTANT - Mini Expert System
============================================================

We will help you find the perfect travel destination!

Please answer the following questions:

1. What is your preferred region to travel?
   europe | america | africa | asia | oceania

|: europe.

2. What are your interests? (as a list, e.g. [culture, food] or any)
   adventure | art | beach | city_life | culture | food | nature | party | relaxation | water_sports | wildlife

|: [culture, food].

3. What is your budget level?
   low | medium | high

|: medium.

4. What is your preferred travel season?
   spring | summer | autumn | winter | any

|: spring.


 Searching for destinations that match your preferences...


 Recommended destination in europe region:
    Destination:      porto
    Country:          portugal
    Duration:         4 Days
    Travel Mode:      train
    Activities:       city_walk_and_river_boat_cruise

 Recommended destination in europe region:
    Destination:      lisbon
    Country:          portugal
    Duration:         5 Days
    Travel Mode:      train
    Activities:       city_center_tour_and_dolphin_watching

 No any other destinations matched your preferences.
true.
```

The system suggests two great European destinations, Porto and Lisbon in Portugal. Porto is a 4-days trip by train, perfect for experiencing city walk and river boat cruise. Lisbon is 5-days trip by train, and can experience there city center tour and dolphin watching.

Also, while developing this mini expert system, we had to face some challenges to achieve our final outcome of this project. Those are, creating a scope for design knowledge base, manage input and output in user interface, and also logic implementation and create predefined queries.

In this project, there we succeeded to complete the project goals that we defined in our project progress document at the beginning of the project. But this mini expert system is not fully completed because there are a few things have to done, which are not accomplished yet.

In the future modifications and improvements, we are planned to do in this system are make user input valid without using square brackets when input the user interest or interests into the system in the beginning of the process. Because currently user has to input square brackets when input interest otherwise the system will not give the correct outcome.

Here are some test cases that we created and tested on our mini expert system.

Test Case 01:

Test Case ID	01	**Tested Date**	02-May-2025
Tester's Name	S.D.T. Rupasinghe	**Test Case Result**	Pass
Test Case Scenario	Test on different budget levels.		

	Test Data
1 (Low Budget)	Region="europe." Interest="[culture]." Budget="low." Season="spring."
2 (High Budget)	Region="africa." Interest="[wildlife]." Budget="high." Season="winter."

Step Details	**Expected Results**	**Actual Results**	**Pass/ Fail**
Enter test data into system after load the .pl file and input 'start'.	Recommended destination in europe region: Destination: porto Country: portugal Duration: 4 Days Travel Mode: train Activities: city_walk_and_river_boat_cruise	As Expected	Pass
	Recommended destination in africa region: Destination: kruger_national_park Country: south_africa Duration: 5 Days Travel Mode: jeep Activities: panorama_guided_experience...	As Expected	Pass

Test Case 02:

Test Case ID	02	**Tested Date**	02-May-2025
Tester's Name	S.D.T. Rupasinghe	**Test Case Result**	Pass
Test Case Scenario	Test any values for interest or season.		

	Test Data
1 (Season is any)	Region="america." Interest="[city_life]." Budget="medium." Season="any."
2 (Interest is any)	Region="asia." Interest="any." Budget="medium." Season="winter."

Step Details	**Expected Results**	**Actual Results**	**Pass/ Fail**
Enter test data into system after load the .pl file and input 'start'.	Recommended destination in america region: Destination: new_orleans Country: usa Duration: 4 Days Travel Mode: bus Activities: explore_bourbon_street_and.. Recommended destination in america region: Destination: austin Country: usa Duration: 4 Days Travel Mode: car Activities: catch_live_music_and_wa…	As Expected	Pass
	Recommended destination in asia region: Destination: dhaka Country: bangladesh Duration: 4 Days Travel Mode: train Activities: street_food_tour Recommended destination in asia region: Destination: goa Country: india Duration: 4 Days Travel Mode: flight Activities: seafood_tour_beach_parties	As Expected	Pass

Test Case 03:

Test Case ID	03	**Tested Date**	03-May-2025
Tester's Name	T.A.B.T. Samadhini	**Test Case Result**	Pass
Test Case Scenario	Test on list matching for two interests.		

	Test Data
1	Region="europe." Interest="[culture, food]." Budget="medium." Season="spring."

Step Details	**Expected Results**	**Actual Results**	**Pass/ Fail**
Enter test data into system after load the .pl file and input 'start'.	Recommended destination in europe region: Destination: porto Country: portugal Duration: 4 Days Travel Mode: train Activities: city_walk_and_river_boat_cr.. Recommended destination in europe region: Destination: lisbon Country: portugal Duration: 5 Days Travel Mode: train Activities: city_center_tour_and_dolp…	As Expected	Pass

Test Case 04:

Test Case ID	04	**Tested Date**	03-May-2025
Tester's Name	T.A.B.T. Samadhini	**Test Case Result**	Pass
Test Case Scenario	Test on giving invalid inputs.		

	Test Data
1 (No destination)	Region="asia." Interest="[wildlife]." Budget="low." Season="winter."
2 (Invalid interest)	Region="europe." Interest="[snowboarding]." Budget="high." Season="summer."

Step Details	**Expected Results**	**Actual Results**	**Pass/ Fail**
Enter test data into system after load the .pl file and input 'start'.	No any other destinations matched your preferences.	As Expected	Pass
	No any other destinations matched your preferences.	As Expected	Pass

06. CONCLUSION

The ‘Smart Tourist Assistant’ mini expert system is undergone a comprehensive evaluation across various of dimensions and potential for future development of this project. While developing this mini expert system, we met challenges that are related to knowledge base design, input and output management, logic implementation like that. In this project, there we succeeded to complete the project goals that we defined in our project progress document. But the mini expert system is not fully completed because there are a few things have to done, which are not accomplished yet.

In the future modifications, improvements are in this system are make user input valid without using square brackets when input the user interest or interests into the system in the beginning of the process. Because currently user has to input square brackets when input interest otherwise the system will not give the correct outcome.

Here is above the conclusion of this ‘Smart Tourist Assistant’ mini expert system.

07. REFERENCES

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