KNOWLEDGE BASED SYSTEMS
PROJECT TITLE :

ANIMAL IDENTIFICATION EXPERT SYSTEMS

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INTRODUCTION

An animal identification expert system is an intensive effort of modern technology to be able to classify, differentiate and identify animals with a good accuracy level. This expert system is a type of program that will be able to handle a limited domain which is this case involves a series of animal characteristics and features at an expert level and using expert knowledge and reasoning process.

The inspiration behind this system is the fact that many animals have been affected by the intense climate changes and have been migrating away from their birth places which makes it hard for studies to be conducted regarding their species so a very crucial role of such a system is to easily identify the type of animal using a bunch of "if-then" rules and animal characteristics.

This system will emulate a scientist or a researcher to classify animals accurately.

PROBLEM BACKGROUND

There are many kinds of animal species existing and each of them are unique to its own characteristics. However so, manually identifying animals for the purpose of classification and research is a load of work as there is a large number of them and can be pretty taxing and inconvenient. Despite the inconvenience, identification of animals is indeed an important task to be carried out as to father research and study on these animals developments. In this project, we have developed a user friendly expert system that intelligently helps researchers to easily identify animals. The identification process is mostly done by studying its unique characteristics.

OBJECTIVES

- To build an expert system that can identify and organize animals.
- To ensure the system can handle its domain well and can accept facts well as produce an output.
- To reduce workload of researchers.

DATA COLLECTION & FACTS

The study of animals and data collection mostly comes from the internet, such as Wikipedia, blogs and website that list animal and its info. First, the general characteristics of animal is identified – such as vertebrate, live on land, has shell, has hooves, breastfeed its offspring, etc. These characteristics are important as it help when classifying animals. Next, after the facts have been obtained, a graph tree is constructed, and the rules are defined.

After a list of animals for our system is obtained, a bit information and description of animals are obtained from the internet. These details include name, scientific name, lifespan, and brief description. This info is displayed during showing the match of the user's query.

METHODOLOGY

(i) Choosing a tool for the project

We have chosen to use CLIPS because of its easy and user friendly interface.

(ii) Identification of problem

We discussed regarding a topic and realized the problems associated with it. In this case we have chosen the Animal Identification Expert System and the problems associated with it are researchers find it a hard time to classify animals accordingly and accurately.

(iii) Design the system

We created the decision tree as well as production rules associated with Animal Identification as part of the system design.

(iv) Building the system

We used CLIPS to build the code associated with our facts and knowledge. The work is separated into the user interface, the animal knowledge interface and also the inference engine. In the user interface the user (researcher) can feed the data to the system. In the animal knowledge interface, here is where all the characteristics are stored to be able to identify the animals. And finally the

inference engine is the part that does all the processing work to infere an accurate final result.

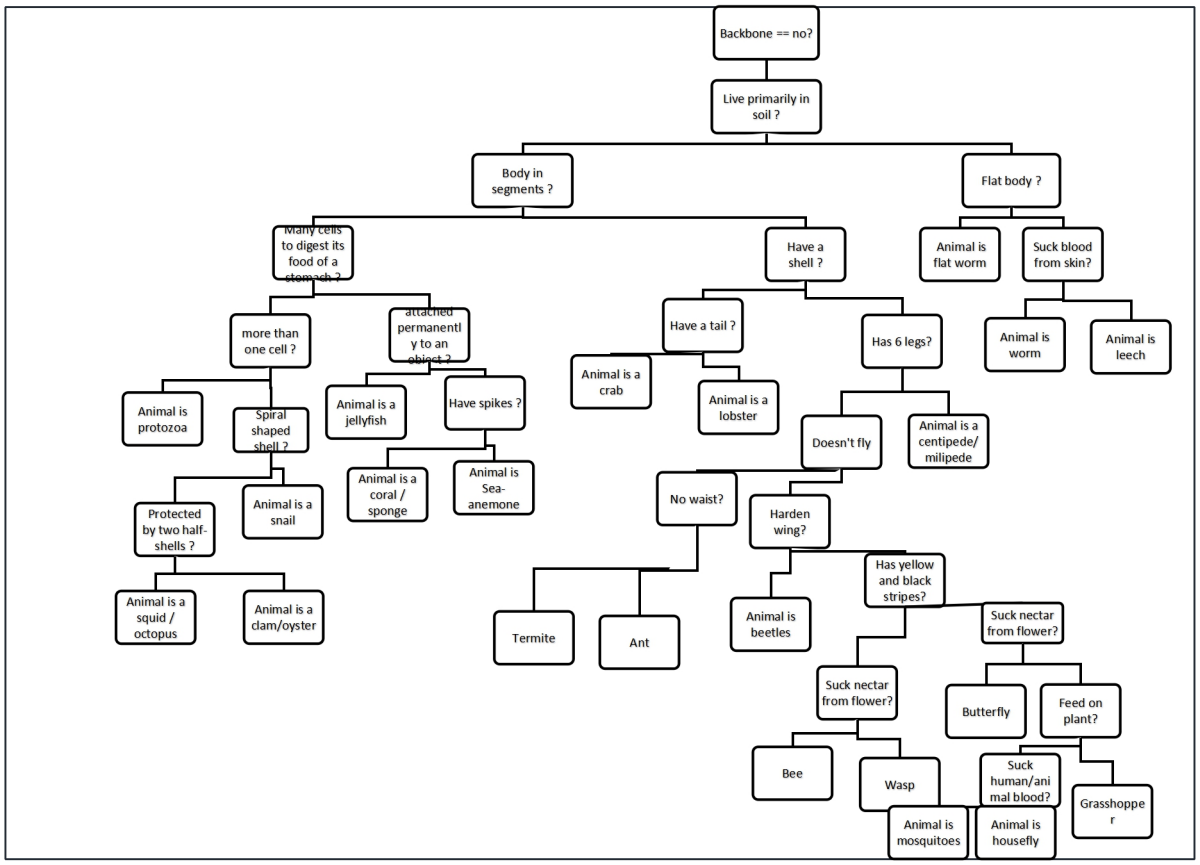
(v) Test Run

We tested the system and worked on improving the system to make it more user friendly.

(vi) Finalise

After system maintainance and updates, we have a finalised system ready to function.

TREE GRAPH



RULES

In total, there are 54 rules identified and used in this knowledge based system. Due to page limit, the rules is attached with this submission in Rules.docx file. Below is examples of some rules used in this system.

Rules:

1. If the animal is a vertebrate
   And it is warm blooded
   And it breastfeed its offspring
   And it eats meat/insects
   And it can fly
   Then the animal is bat.
2. If the animal is a vertebrate
   And it is warm blooded
   And it breastfeed its offspring
   And it eats meat/insects
   And it cannot fly
   And it has opposing thumb
   And it has prehensile tail
   Then the animal is monkey

27. If the animal is a vertebrate
    And it is not warm blooded
    And it does not live in water
    And it has scale skin
    And it cannot jump
    And it has limbs
    Then the animal is an eel
28. If the animal is a vertebrate
    And it is not warm blooded
    And it does not live in water
    And it has scale skin
    And it cannot jump
    And it has no limbs
    Then the animal is a salamander.

53. If the animal is not a vertebrate
    And it does not live in soil
    And its body is not in several segments
    And it has no multiple cells for digesting food
    And it is not multicellular
    And its shell is not spiral shaped
    And its shell is protected by two half shells
    Then animal is clam
54. If the animal is not a vertebrate
    And it does not live in soil
    And its body is not in several segments
    And it has no multiple cells for digesting food
    And it is not multicellular
    And its shell is not spiral shaped
    And its shell is not protected by two half shells
    Then animal is squid

Figure: Example of rules used in the system

CODING

Due to the code (CLP) file exceeds 1000 lines, the file attached in a separate file alongside this submission. Below is the snapshot of some code for a few sections:

a. Interface menu

```
(deffunction mainMenu()
        (printout t "Animal Identification Expert System" crlf)
        (printout t "==================================" crlf)
        (printout t "" crlf)
        (printout t "Welcome to Animal Identification Expert System" crlf)
        (printout t "You can use this expert system to idenfify an animal by" crlf)
        (printout t "simply answering the question below" crlf)
        (printout t "" crlf)
        (printout t "==================================" crlf)
        (printout t "" crlf)
        (printout t "Does the animal is a vertebrate? [yes/no]" crlf)
        (assert(vertebrate(read))) ;read user's value
        (run)
)
```

b. Rules (using defrule)

```
(defrule vertebrate
        (vertebrate yes)
      =>
        (printout t "Is the animal live mostly in soil?")
        (assert(live-in-soil(read))) ;read if it live in soil
)
```

```
;rule animal lives in soil
(defrule live-in-soil-yes
        (live-in-soil yes)
    =>
        (printout t "Is the animal has a flat body?")
        (assert(body-flat(read))) ;read if it has a flat body
)

;rule animal doesn't live in soil
(defrule live-in-soil-no
        (live-in-soil no)
    =>
        (printout t "Is the animal's body consist of a few segments?")
        (assert(body-segments(read))) ;read if its body consist of several segments
)
```

c. Defining the template of the animal (deftemplate)

```
(deftemplate animal
        (slot name)
        (slot lifespan)
        (slot scientific-name)
        (slot length)
        (slot diet)
        (slot description) ;a brief desc of that animal, if any
)
```

d. Asserting the facts of the animal (asserting into deftemplate when the results is found)

```
(defrule no-scale-limb-no
        (no-scale-limb no)
        =>
        (assert(animal (name "Eel")
                (lifespan "")
                (scientific-name "")
                (length "")
                (diet "")
                (description "")
          ))
)
```

e. Displaying the output

```
(defrule print_animal
        (animal (name ?name)
                (lifespan ?lifespan)
                (scientific-name ?sn)
                (length ?length)
                (diet ?diet)
                (description ?desc))
        =>
          (printout t "Animal: "
                    ?name crlf
                    "Lifespan: " ?lifespan crlf
                    "Scientific name: " ?sn crlf
                    "Diet: " ?diet crlf
                    "Description: " ?desc crlf
```

```
))
```

RESULT

```
CLIPS> (mainMenu)
Animal Identification Expert System
===================================

Welcome to Animal Identification Expert System
You can use this expert system to idenfify an animal by
simply answering the question below

===================================

Does the animal is a vertebrate? [yes/no]
```

Figure: The greeting screen and the first question. User input by typing yes/no

```
CLIPS> (mainMenu)
Animal Identification Expert System
===================================

Welcome to Animal Identification Expert System
You can use this expert system to idenfify an animal by
simply answering the question below

===================================

Does the animal is a vertebrate? [yes/no]
no
Is the animal live mostly in soil?yes
Is the animal has a flat body?yes
Animal: Flatworm
Lifespan: 65-140 days
Scientific name: Platyhelminthes
Diet: Tunicates, small crustaceans, worms, and molluscs
Description: The flatworms, flat worms, Platyhelminthes, or platyhelminths are a phylum of
CLIPS>
```

Figure: Example when user enter an invertebrate that live in soil and has flat body.

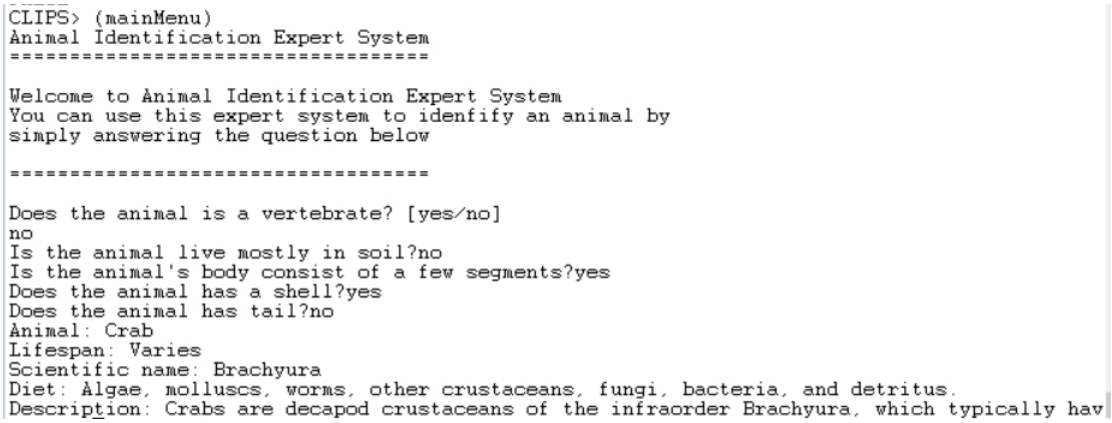


Figure: Example when the user enter an invertebrate that doesn't live in soil, its body has few segments, it has a shell and no tail.

DISCUSSION

In the Animal identification system, user have to input whether yes or no based on the displayed questions by the system.

The system starts off by asking questions regarding the physical features of the animal itself - for example, if the animal has a backbone? if the animals body is in segments? If the animal has a flat body?

Based on the answers input by the user (yes/no) the system will minimise the domain to output an accurate animal.

If the animal has a flat body it automatically reduces the choices to animal is a worm or leach.

However if the user inputs it has body in segments, the system will continue prompting questions based on the animals characteristics such as if the animal has more than one cell, is it permanently attached to an object, is the shell spiral shaped, does the animal have spikes and if the animal is protected by two half shells. The user then must answer a yes or no for the system to be able to identify and output the correct animal.

The results are used to identify an animal accurately. Based on the tree graph, the system would have made a correct identification.

CONCLUSION

From the project conducted, we learned that the acquisition and knowledge representation methods in the field of animal classification can be accepted and executed by the computer system. In a nutshell, the expert system is able to identiy the animals accurately based on the classified characteristics. This system can be effectively used by active researchers and anyone who is interested in thsi domain. As for the improvements, this system can be improved by expanding the characteristics to produce a system with a wider domain range. We can also use a more advanced building tool such as a UI/UX developer tool.

VIDEO

https://youtu.be/H-0OhuUAgSY