ASSIGNMENT - 1

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(1)

Imagination

- It is the ability to form ideas, create texts and images.
- It allows us to percieve world in new ways and come up with solutions to the problems.

Eg- One example is simulation, which imagines how future will play out as a means of practice, like a public speaker who imagines the audience's reaction to their speech (like a stand up comedian).
Or an artist using his imagination to create paintings that challenge people's perception of reality.

Intuition

- It is not logical. It is the ability to know/predict something without concious reasoning.
- It is also known as a sixth sense or the gut feeling.

Eg- It is like reading non-verbal communication cues to understand what people are saying between the lines and not at face value.
Scientists also use their intuition to come up with theories. OR like getting a good idea about how to solve a problem out of no where.

Will

- It is the ability to control one's own thoughts and actions. ability to resists short term temptations to achieve those long term goals.
- It is essential to overcome ~~over~~ bad habits.
- It is also described as grit or determination.

Eg- David Goggins used his will power and determination to loose more than a 100 pounds in less than 3 months to join the navy. This shows his will and hardwork, and now he is known as the toughest man on planet.

Perception

- It is the ability to see, hear, smell, taste and touch ~~the~~ our surroundings. It is essential to interact with our surroundings.
- It can be changed and influenced by our past experiences.

  Eg- If there is an image ~~in~~ which contains the sun and the sea, for one person it may seem that the sun is rising but for another person it may seem that the sun is setting.
- Perception can vary from person to person.

Memory

- It is the ability that helps us to remember things that happened to us in the past.
- Memory for humans is like a storage device or a database for a machine based on which perception & intuition depends and effects our present decisions.

Eg- A student may remember the concepts he learned and write it in a test. Similarly a machine can remember its past output and can use it to compute the result for another problem.

Reasoning

- It is the ability to make logical decisions, and to make proper judgements based on a series of logical and reasoning statements.
- Reasoning for different people may change based on their past experiences and emotions and also their level of knowledge.

Eg- If a person buys a big house, one's reason may be that the person has a big family due to which he bought a big house for his family members but for another person big house may be a symbol of richness in the society even though he doesnot particularly need a big house.

(2)

PEAS means performance, environment, actuators and sensors.

Eg 1 – Autonomous driver Agent

(1) Performance – it is measured by how the vehicle travels from one place to another based on the performance such as obeying traffic laws, checking the road conditions are driving appropriately also driving based on the weather conditions and

surroundings. It is also measured by time taken, fuel consumed.

(2) Environment - It includes road network, traffic conditions and also the weather conditions.

(3) Actuators - It includes steering system, break system, horns, lights, etc.

(4) Sensors - The required sensors are distance sensor, sound sensor, GPS, cameras, etc.

Properties of environments are -

① Limited range of sensors are one of the drawback. Since agent depends on the data provided by these sensors it has a limited range which limits its functions.

② Changing environment is also a challenge for the agent like in an area where the children are playing then the agent must proceed with caution cause any child can come in front of the car. The weather conditions may also change, so depending on that we need to change the driving style too.

③ Unpredicted events like accidents may also occur. It may be due to fault in our vehicles or the other person's. It cannot be determined, so the agent should be able to make proper onspot split decisions like any normal would do.

Eg 2 - Virtual Personal Assistant

(1) Performance - Completion of ~~assignment~~ assigned tasks properly. Providing accurate information to the user.

(2) Environment - The internet connection speed, database of the devices, other smart devices, understanding the user's commands.

(3) Actuators - Speakers, microphones, text to speech and speech to text engines

(4) Sensors - Microphones, text recognition.

Properties of environment are -

① Cannot access the whole environment as it can only access other connected devices or the devices which are connected to internet but not any other devices.

② Processing the queries according to the situations as the required output for the same query may be different according to the environment and present conditions.

③ Identifying properly as the text or speech of the user may change sometimes, then the agent need to properly recognize the user. Like if the user has a sore throat and his/her voice changes then the agent need to recognise that.

(3) Autonomous driver agent

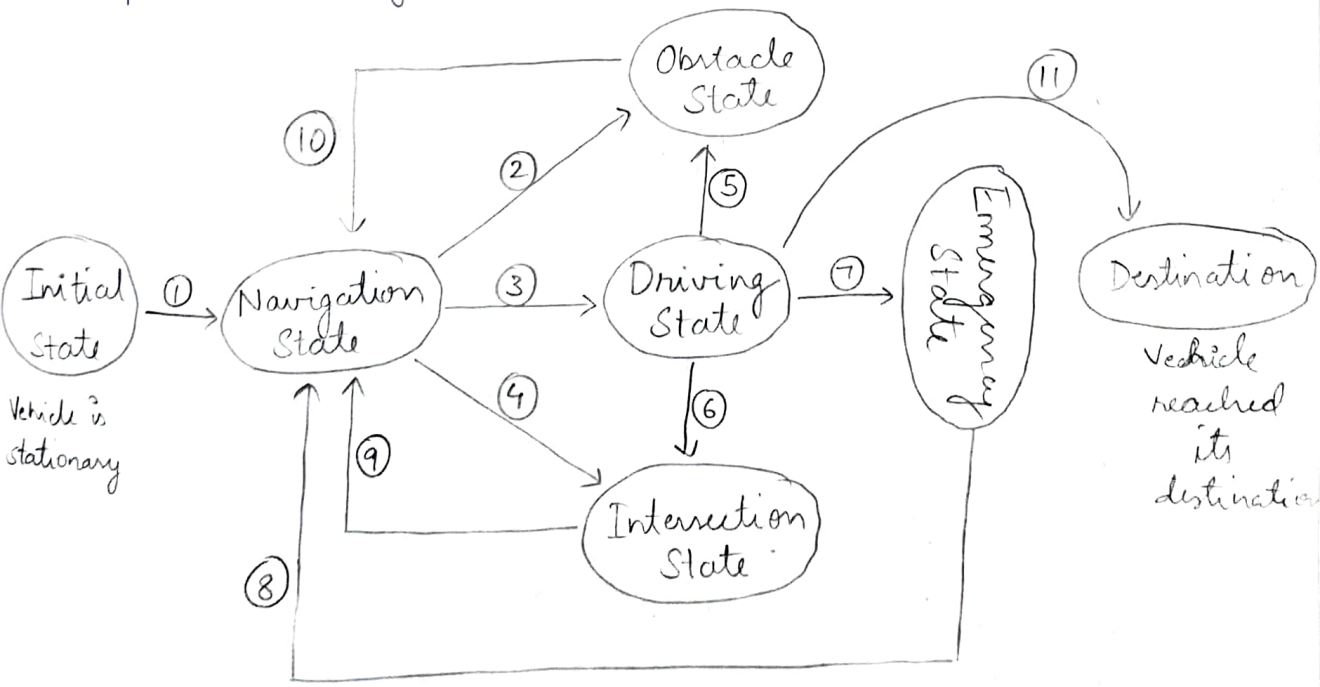
(1) Performance - Its performance is often measured by time taken to cover a particular distance from point A to B. It also depends on how much fuel it consumed during the journey. We also determine by how it obeyed the traffic laws, checking the road conditions and the surrounding environment while driving. It also needs to drive without facing any accidents.

(2) Environment - The environment include road network, checking the road conditions, checking the traffic condition and also the weather conditions.

(3) Actuators - It includes storing system, break system, horns, lights, etc.

(4) Sensors - They are the main component to perceive the environment. So the mainly they rely on cameras, LiDAR, GPS, inertial sensors, microphones, etc.

Space State Diagram may be drawn like this.



① Sensors starts
GPS starts
Engine starts
AI agents starts evaluating the environment (surroundings)

② If there is any obstacle then it goes to obstacle state.

③ If there is no obstacle then it goes to driving state

④ If there are traffic signals ~~then it is~~ or it encounters a road junction then it goes to intersection state.

⑤ While driving if any obstacle is faced

⑥ While driving if junction arrives or traffic lights change

⑦ Unexpected emergencies may come such as accidents or sudden change in weather conditions or any other difficulties in the vehicle.

⑧ After solving the above problems it again goes to navigation state.

⑨ At intersection after clearing checking conditions it goes to navigation state

⑩ After percieving the obstacle either changing course or modifying it goes to navigation state.

⑪ Destination is reached.

④

Agents are entities that percieve their environment and take actions to achieve specific goals. Here are some common types of agents —

(i) Simple Reflex Agents — these agents operate based on a set of if-then rules, mapping states to actions. They don't maintain internal state

(ii) Model based Reflex Agents - These agents have a model of the world and can consider the history of actions and observations.

(iii) Goal-based agents - They have predefined goals and use planning or search algorithms to find sequences of actions that lead to goal achievement.

(iv) Utility based agents - They made decisions by evaluating the utility or durability of different outcomes. They consider not only whether a state achieves the goal but also how well it achieves it.

(v) Learning Agents - They can adapt and improve their behavior overtime through various machine learning techniques and algorithms. They learn from their interactions with the environment and may develop strategies or policies.

Properties of the Agent of TIC-TAC-TOE

Type - It is a Goal based agent.

Goal - Win / Draw

Environment - Game board

Sensors - Vision sensors

Agents decision making process -

(1) Perception - The agent uses its sensors to analyze the current state of TIC-TAC-TOE board to determine where the person has placed X or O.

(II) Goal formulation - The agents goal is to win the game or achieve a draw.

(III) Planning - The agent explores possible moves and encounters moves using algorithms to analyze future game states.

(IV) Action selection - Based on search results, the agents selects the best move and places X or O on the board accordingly.

(V) Execution - The agent executes the chosen move on the board.

(VI) Learning - As the time passes by, the agent can learn from past games to improve its decision making.

The choice of agent type depends on the complexity of the AIs strategy, the level of challenge for the human and the available computational resources. For a game like TIC-TAC-TOE, a goal based agent with a well defined search algorithm is often considered as a suitable choice.

```
#include <iostream>
using namespace std;
void display (char board [3][3]){
   for (int i=0 ; i<3 ;i++){
      for (int j=0; j<3 ; j++){
         cout << board [i][j];
         if (j<2) cout << " | ";
   }
```

```
    cout<<endl;
    if (i<2) cout<<"_____"<<endl;
  }
  cout<<endl;

}
bool isBFull(char board[3][3]){
    for(int i=0; i<3;i++){
       for(int j=0; j<3; j++){
         if (board[i][j]=='') return false;
       }
    }
    return true;
}
bool isGameOver(char board[3][3], char p){
  for (int i=0;i<3; i++) {
     if (board[i][0]==p && board[i][1]==p && board[i][2]==p) return true;
     if (board[0][i]==p && board[2][i]==p && board[2][i]==p) return true;
  }
  if(board[0][0]==p && board[1][1]==p && board[2][2]==p) return true;
  if (board[0][2]==p && board[2][2]==p && board[2][0]==p) return true;
  return isBFull(board);

}
int selectMove(char board[3][3]){
  for (int i=0; i<3; i++){
     for (int j=0; j<3; j++) {
       if (board[i][j]==' '){
         board[i][i]='x';
         if (isGameOver(board,'x')) return i*3+j;
         board[i][j]=' ';
       }
     }
  }
  for (int i=0; i<3; i++){
    for (int j=0; j<3; j++){
       if (board[i][i]==' '){
         board[i][j]='0';
         if (isGameOver(board,'0')) return i*3+j;
         board[i][j]=' ';
       }
    }
  }
```

```
    int move;
    do{
      move = rand() % 9;
    } while (board[move/3][move%3] != ' ');
    return move;
}
int main(){
  char board[3][3] = {{' ',' ',' '},{' ',' ',' '},{' ',' ',' '}};
  displayBoard(board);
  while(true){
    int am = agentSelectMove(board);
    board[am/3][am%3] = 'X';
    cout << "Agent's move:\n";
    displayboard(board);
    if (isGameOver(board, 'X')){
      if (isBFull(board)) cout<<"Draw";
      else cout << "Agent wins";
      break;
    }
    int hm;
    cout << "Enter move index (0-8)";
    cin >> hm;
    if (hm<0 || hm>=9 || board[hm/3][hm%3] != ' '){
      cout << "Invalid";
      continue;
    }
    board[hm/3][hm%3] = 'O';
    cout << "Human's move";
    displayBoard(board);
    if (isGameOver(board, 'O')){
      if (isBoardFull(board)) cout << "Draw" << endl;
      else cout << "Human wins";
      break;
    }
  }
  return 0;
}
```