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**Artificial Intelligence**

**Assignment # 1**

**Section A**

**A\* Algorithm:**

* It is the well-known static searching algorithm. There are many other searching algorithm that are based on A\* searching technique. It searches in the fashion of best first search but also takes into account the distance of the point from the goal. It explores the node that seems to be leading to the shortest path to the goal.
* The best path is determined by choosing the option with the lowest cost, where cost is measured by the function: *f (n) = g (n) + h'(n)*.
  + g (n) =the distance travelled from the starting point
  + h'(n) = the estimated cost of the path from current state to the goal
  + It is important to note that h’(n) is the estimated cost and not the actual cost. This cost is determined by the diagonal step count
* This algorithm will always find an optimal path to a goal, If the heuristic function too often under-estimates the costs, then A\* will have to search too many probable paths, and may run out of time before any solution is found. However, if the heuristic function too often over-estimates the costs, a solution can be found very quickly, but will likely be good and sub-optimal.

**LRTA\* Algorithm:**

* LRTA\* algorithm is almost same as A\* and is different by in just the concept that it is the real time version of the A\* algorithm.
* It operates in repeated trials
* A good heuristic function can estimate the cost of moving from the current state to the goal state, as accurately as possible.
* It should be noted, that using the proper heuristic estimation function will speed up finding the optimal solution

**RTA\* Algorithm:**

* Real-Time A\*(RTA\*), is exactly the same as LRTA\*, with only one difference. When the new value of *h (i)* is stored, it is updated with the second minimum value. The only difference between RTA\* and LRTA\* is that RTA\* stores the second least value.
* Using the RTA\* we can make locally-optimal decisions on tree structures. That is, the path toward the goal chosen by RTA\* has the minimum estimated cost based on the already-obtained information. Although this allows RTA\* to overestimate heuristic costs, RTA\* learn more efficiently on a single trial, and will usually arrive at the goal quicker. In the problems having different initial state and the same goal state, LRTA\* will do a good job and eventually converge on the optimal solutions to along all paths.

**Question No 2:**

**Comparison of Different Route Planning Applications**

**Waze:**

Waze is community driven GPS navigation system that provides Navigation Information, Travel Times and Route Details. It collects map data, travel times and traffic information from users and transmits it to the Waze server. It also sends users' speed and location, back to its database to improve the service. Based on the information collected, Waze can provide routing and real-time traffic updates. Waze can also identify the cheapest fuel station near a user or along their route. Waze has the ability to direct users based on [crowdsourced](https://en.wikipedia.org/wiki/Crowdsourcing) information. Waze users are able to report a multitude of traffic-related incidents from accidents to police traps. This data is used by Waze to help other users either by alerting them of the condition ahead or rerouting the user to avoid the area entirely. In addition to user input, Waze relies on information from state agencies for traffic events such as road construction. The idea behind this is that the more people that provide data the more accurate it will be.

Google Maps:

* Keep a list of your favorite places.

## Makes some suggestions for users.

## Gives a complete route details of the tour

## Offers offline maps service

## Stops can be added to the trip

## Gives time of all the best paths of the tour

## Live traffic updates

## Location sharing

## Total number of visits to a place every day

## Complete history of the tour

## Voice navigation

## Nearby things list availability

## Adding favorite places

## Distance measuring between multiple points on the trip

**Map Quest:**

MapQuest uses the TomTom services for its mapping system.MapQuest allows street level detail and navigation for variety of countries. It features POI search and voice guided navigation. It monitors real time traffic and many more features. MapQuest features Gas Prices features with which users can also compare nearby prices but this feature is only available in United States. MapQuest’s POI data helps the services differentiate itself from other wayfinding software guiding users directly to entrances of businesses and destinations, rather than to general street addresses. It also allows location sharing.

* **RAC:**

Unlike other map providing services, RAC is a British automotive services company which provides roadside assistance and general insurance. RAC breakdown assistance centers operate 24 hours every day and deal with approximately four million calls per year. It has been identified as the most satisfying roadside assistance customers for many years after surveys. RAC also provides travel and traffic services by assisting users with friendly maps. RAC includes online route planners. It also enables users to share their location. It provides in car navigation system. It also helps with travel documents.

**Changes for Pakistani environment:**

These services can be modified for our environment and more sophisticated services

* Online food order system should be added to these applications so that you can order from any restaurant in your city any time by merely some delivery charges.
* Blood donation lists should be available like if someone clicks on a blood bank it should display which blood group bottles are available in this blood bank due to which people can become hassle free of going to the banks.
* They should also display all ancient buildings and recreational sites in the city and also near your location.
* Within these maps there should be a separate column by the name of emergency helplines in which contacts of police, fire brigade, ambulance and others should be readily available and they should be modified 24/7 as your location changes.
* Also food menus of restaurants should be available along with customer reviews on them.
* Prices of fuel, gasoline etc. should be available everywhere.
* Weather prediction and speed check should keep users updated for any future disaster etc.
* Inform detailed over view why on map a particular location is showing traffic, may be due to road blockage etc. and the user can do better route planning.

**Question # 3:**

**Smart Agriculture System**

To improve the rural yield with less assets and work endeavors, generous advancements have been made all through mankind's history. By and by, the high populace rate never let the interest and supply coordinate during every one of these occasions. Because of the rising use of nourishment crops for bio-fuel creation, bio-vitality, and other mechanical utilizations, nourishment security is in question. These requests are bringing about a further increment of the weight on effectively rare agrarian assets. For this reason, this Agriculture framework should be upset by the utilization of Internet and Technology to build the harvest creation when there is an absence of labor who can raise crops, which can cling to wares of the individuals. Utilization of Artificial Intelligence in Agriculture to digitize is of essential significance. By actualizing the most recent detecting and IoT innovations in horticulture rehearses, each part of conventional cultivating techniques can be in a general sense changed. Right now, consistent combination of remote sensors and the IoT in brilliant horticulture can raise farming to levels which were beforehand inconceivable. Following measures have been taken to support the agribusiness framework

**Soil testing:**

For soil sampling and mapping, manufacturers are providing a wide range of toolkits and sensors that can assist farmers to track the soil and, based on this data, recommend remedies to degradation. It allows to monitor soil properties like texture, water-holding capacity and absorption rate which will help to reduce erosion, densification, sanitization and pollution.

**Land Mapping**

Irrigation methods, like usage of drones for watering crops, drip irrigation and sprinkler irrigation, are being promoted to tackle the water wastage issues, which were also found in traditional methods like flood irrigation and furrow irrigation. Both the crop quality and quantity are badly affected when facing water shortage, as irregular irrigation, even excess, leads to reduced soil nutrients and provokes different microbial infections. It is not a simple task to accurately estimate the water demand of crops, where factors like crop type, irrigation method, soil type, precipitation, crop needs, and soil moisture retention are involved. Considering this fact, a precise soil and air moisture control system using the wireless sensors not only makes an optimal use of water but also leads to better crop health.

**Timely Fertilizer Use:**

Fertilization under smart agriculture helps to precisely estimate the required dose of nutrients, ultimately minimize their negative effects on the environment. Fertilization requires site-specific soil nutrient level measurements based on various factors, such as crop type, soil type, soil

Absorption capability, product yield, fertility type and utilization rate, weather condition, etc. The reason is that the measurement of soil nutrient level is not only expensive but also time consuming, as, typically, investigations of soil samples at each location are required.

**Desease Prediction & Pesticides Recommendation:**

Recent IoT based intelligent devices, such as wireless sensors, robots and drones are allowing the growers to slash pesticide uses significantly by precisely spotting crop enemies. Compared to traditional calendar or prescription based pest control procedures, modern IoT-based pest

Management provides real-time monitoring, modeling, disease forecasting, hence proving more effective.

**Cost & Profit Analysis:**

A robotized forecast rendition which dissects the enormous data units of antiquated records the utilization of huge information examination. Huge data examination is the method of investigating monstrous measure of realities originates from assortment of assets like sensors realities, climate gauging, and online networking data with kind of codecs to locate the concealed examples, obscure relationships and furthermore valuable data. Monetary models for the most part gauge change in commercial center advancements and circumstances underneath atmosphere variation. The endeavor is intending to find answers for inconveniences, comprising of environmental change-hastened worldwide suppers absence of certainty, to anticipating and relieving the effect of serious climate occasions on overall money. In light of the fact that we've sensors wherever in region which are utilized to show and degree atmosphere, plants, cloud cowl, ice spread, precipitation, ocean bottom temperature, and numerous more noteworthy geophysical parameters. Those wide-extending data assortments give us an expanding number of more profound and more extensive inclusion of climate exchange, both transiently and geospatially.

**Benefits of Smart Agriculture System:**

* It allows farmers to maximize yields using minimum resources such as water, fertilizers, seeds etc.
* Solar powered and mobile operated pumps save cost of electricity.
* Smart agriculture use drones and robots which helps in many ways. These improves data collection process and helps in wireless monitoring and control.
* It is cost effective method.
* It delivers high quality crop production.

**Disadvantages of excessive use of Technology in Agriculture:**

* The cost of maintenance can be very high.
* Environment damage with excessive use of technology
* Most of the farmers are illiterates so they are unable to use the modern machines.
* The robotic machine could not change their culture, we have to set their programme manually
* The smart agriculture needs availability of internet continuously. Rural part of most of the developing countries do not fulfil this requirement. Moreover internet connection is slower.
* The smart farming based equipment’s require farmers to understand and learn the use of technology. This is major challenge in adopting smart agriculture farming at large scale across the countries.