ANTS CREATIVITY AND DIFFERENT APPROACHES TO ACHIEVE BETTER PATHING CONSTRUCT

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Abstract:

This paper is primarily based on the fact that single Ant has no global knowledge about any task, it is performing. Yet, as an insect with limited memory can achieve single action its intelligent performance (emergent intelligence) is found to be the result of the self organized of indirect communication between all Ants. It is thought that Ant's colony which is a complex collective Ant'sperformance providing artificial intelligent solution to our problem. In this paper, we consider the problem as a practical example involving the behavior of Ant's colony to reach for an acceptable result to how Ants find a proper bath between two different colonies ranging between Mosul city and Tal-Afar town as two different road sources. This study is bases on the close observation of Ants with their ability to create Ant's paths as we discover new routing algorithm. Ant's efficient routing algorithm is the case of well implemented Ant's techniques to achieve better path construction.

1-Introduction:

In general ,Ants are very small insects living on earth for million years in a very well organized colonies characterized by the modeling of splendidly road bath techniques of different successful app-roaches. Ants had had bi-directional lines of a noticeable single path ways using remarkable land scopes navigation to reach their destination in a considerable short time. This kind of creative technique helped the Ants to adapt the last routing system which is counted in these days as the more optimal path ever found on earth. Recently, many of these who are interested in the existing performance of the Ants ,(Bonabeauand Theraulaz,2000,Jmaba; Zorz:2002, Luca :2003,Lenaerts:2008and Seherger: 2009)in the efficiency of colony road construction have discovered new Ants routing algorithms (Ants colony approach)

2-The Aim of Research:-

This paper aims at revealing Ant's efficiency in their behavior to build up single bath ways as they did use their best effort to distinguish the shortest path mechanism. It is quite clear that many scientists (ibid) have adopted the bi-directional Ant's lanes in relevance of the creative issue of implemented technique. Insect optimal performance in contrast between well-known top-performing routing algorithms used(Ant's colony approach ,using the above realistic multifunctional educational approach using web-based processes and simulations. This Ant's innovational activity is hoped to enforce our approach to-wards an artificial insects intelligence to build up un-seen real economic paths and roads for Ants travelling from Mosul city to reach Tal-Afar town using resource exploration in real search for food.

3-Requirements:

we believe that we are still very far away from the required detailed and quantitative data to make in-formed decisions and to pass very accurate judgment for ant's advanced conception to build colony paths and roads .We hope that we will be very close to discuss the technical requirements for such a research paper especially the role and effect of the project exploration by very small bodies to fulfill the results of the aims in contrast. We present a variety of technical aspects about Ants system including the architectural possibilities instrumentation ,and the demands for geographical knowledge that could help Ants to achieve the research aims.

4-Discussion:

The use of pheromone: Different Ants groups utilize the use of pheromone trail situation. This scent tunnel, that helps ants to search for food and build up better roads is a chemical realized by one insect to affect the behavior of another of the same colony group. Ants interact with each other to more obstacles in their way, to add more pheromones for moving food to a new place, visualizing a new trail which is already established for any old trail Recently, the intelligent solutions to human problems naturally emerge from the self organization like ants and indirect communication of many individual in ruled in a system, which needs special techniques there can be found in development and distribution of Ants artificial intelligent systems.

4-1-Ant's abilities:

Ants predefined social hierarchy in this study will include a ruler's class of Ant and a 'worker's class of Ants. A ruler's class of Ants may consist of one queen Ant or some members of the total colony. The workers class Ant may consist of one or more types of particular socially structured swarms to achieve some special set of science and work requirement of :i-distributed intelligence, ii- communications (swarm messenger) .

4-2 Ant's Capability for Teaching/Learning Simulation:

Ants are discovered to obtain and demonstrate pheromones to communicate and rule up difficulties of teaching /learning. Ant's students are able to interact with two opposing sides. i- Theold virtual Ants and ii- The surrounding environment. The primary aim is how to change their environment to the better, Students Ants' activity is based on how to speed up, slow down,and even stop short teaching time, so that Ants can more closely develop pheromones to study and to communicate. This type of insect social behavior allows a clear visualization of the pheromone tunnels (CODE), roads, and bi-directional paths. A real huge constructional world which is actually invisible by all other beings but not the Ant's students themselves. This type of teaching/ learning simulation provides numerous student evidences within an immersive learning environment that is completely directed towards capturing and holding the ants students' attention-i.e., no effort lose. A kind of full control over the teaching/learning real time. A multi-directional educational activities where student ants can interact with the actual environment and the ants artificial intelligent to obtain and real a suitable path roads for the Ants colonies.

4-3--Ants Technology Architecture System:

For the assigned Ants mission to survey thousands of places of the main belt position Mosul city to search and achieve better housing of food and new colonies built within new holistic integration of shared knowledge among an a remarkable architectural eminence system is highly needed. This Ants system is possible divided into several Ants' technical sub-systems. To mention some:

a- An overall task system for Ants.

b-A task design for Ants workers.

c-An evolutionary plan for Ant's constellation.

d-A plan for Ant's utility of the artificial intelligence.

e-A highly homogeneous integration of success and failure resulting from the dramatic departure in order to fulfill Ant's objectives.

1-The best qualified scientist Ants to pass judgments and to make local determinations of what is good to keep or use and what to seek for as Ants colony requirements.

2- Navigator or sailor like to account for changes and risks caused by travelling events like rain, highwend, and storms. This Ant navigator is responsible of the success and advanced events throughout the task. A trustful sailor for all Ants' mission occasions.

3-Ants ruler: is one Ant or many consist of several types of a fraction within the total colony responsible of the overall task objectives including worker Ants assignment.

4-Ants workers are almost all the Ants working within the swam colony. They are responsible of all the requirements of the colony a among which the optimal data collection. The task2: short road –Ants paths of bi-direction lanes the start the change of existing Ants colony in a heavy populated city of Mosul causing human annoyance to the swarms-every day loses and weather discomfort causing a shortage of food. The target optimal objective is the town of Tal-Afar some 95km the shortest paths over a clay land to 150km.The task development is highly characterized by rules that allow Ants to use the locally available, intermediate or partial knowledge that allows Ants for efficiently search their sets of actions to the task.

4-4- Ant Colony Approach:-

In fact,the intelligent performance of the Ants is natural resulting from the self organized and indirect communication between Ants (emergent-intelligence). We consider an Ant colony as a complex collective performance providing intelligent solution to our problem of the best way to travel from Mosul(S) to Tal-Afar (G).We consider the problem as a practical example involving the behaviors of ants colony to reach for a suitable result for the problem of finding a proper path between Mosul(S) to Tal-Afar (G) using the following steps:

We consider IRAQ map as a graph of several marked nodes among which Mosul as (S) node and Tal-Afar as (G) node. The utility of two important characteristic of Ants colony will be useful to: a- The ability of the ants to find the shortest path between S node and G node based on the graph representing IRAQ map. b-The simplicity of each individual Ant to help us to model the Ants colony as a Multi-Agent System. We consider the graph search and the different nodes as variety places where Ants can stop during the travel which are equal to different cities on the map. The edges of the graph will represent the path connecting the cities. This proposed environment will be populated by traveling agents represent-ted by individual Ants. The individual Agent could be considered as an autonomous entity that has a guiding role within the environment. Actions (finding the best path to go from Mosul (S) to Tal-Afar (G)).

4-5-Agent Behavior:

Simply, the agents will need to walk on a graph from one city to another. The agents must be able to put their pheromones on the different paths. This kind of behaviors will help the Agents to decide which path will be the next to follow, based on the sensation of the pheromone intensity on the available paths. These are the basic actions made by agents(ANTS) performed adequately on its current state as shown within algorithm:

4-6-The Ant Colony Algorithm:

The following data will describe the positive or negative kind of action can possibly perform on each state (node). An agent performance will depend on a step forward at each node or a step backward stop or return

performance on each node next. Once the agent gets a new node, the performance will be repeated from the beginning node (S) till the end node (G). Consequently, they has made a number of contributions to human understanding of complex problem solving, giving us a possible model of actual processes mechanism underling some physical embodiment of problem solving. It is a demonstration of simple local adaptation to shape a complex system in response to actually available data.

This study is designed to solve the problem of finding the best path to go from Mosul (S) to Tal-Afar (G) . The result(s) is hoped to be used as the basic components for a feasible comparative study with the result found for the same problem utilize the Ants' Colony approach ,then the results are compared in terms of :

a-Solution found the best path to travel from Mosul (S) to Tal-Afar (G).

b-Path cost in term of km count.

Accordingly, it is understood that Ants colony approaches, will provide to travel fairly good solutions in this particular problem of finding the best path from Mosul (S) to Tal-Afar (G) using the well defined cities as actual nodes in a graph. Similarly, the presentation of the accurate route measurement of the problem as follows:

1- Firstly, in this circumstance, we need to reduce the number of the nodes that needed to be visited before a proper solution is found.

2-We need to regard that Ants colony approaches is better than depth first searching, since there are many false peaks as seen in the reduced nodes.

The following artificial graph of the possible Ants tasks to change their colony from Mosul city to Tal-Afar town in order to improve their way of life and obtain enough food for Ants. We guess that a reformed detailed analysis for the modeling information transfer and control strategies to achieve progress of the task, we simplify the complexity of the travel scenario into positive and negative markers within and all along the discovery of ants roads and paths. The type and thickness of the pheromone used by Ants will determine the status of each road or path used by even one Ant. The accurate readings of the detailed travel information is judged and correctly mark by the ruler. Ants individual which is executed by all colony Ants exactly without any interference with each other. Within such task scheme, Ants could study and examine the asteroid range, speed and learning

information in order to signal the new paths and roads. The following map and the depicted diagram of the Ant's activity throughout the discovery mission between Mosul cities (start) to Tal-Afar town (goal).

5-Finding(graph)

It looks quite clear that Ant's architecture on land is inspired by the Ant's success of their social colonies. A huge success based on the natural division of enormous labor within the Ant's colony in two key divisions. First, within their specialties, individual specialists-generally outperform Ants. Second, with efficient Ant's social interaction and coordination. The group of Ant's specialists governs and directs all the massive group of out performing Ants. Ants have the ability to Lear about their world (colonist outside needs) and thus Ants often face problems in this real world-problem solving. Low-level dynamical control or reactive approaches are quickly developed for particular tasks inside the Ant's colony or out-side environment problems. To bridge this division between lower and high group functions is thought to create bi-level intelligence that helps to control and direct autonomous ants behavior .it is believe that these two systems interact within a third system (An Evoluable Neural Interface) that allows the Ant's architecture on the colonies and outside as one unique system situated in a real world situations. Future research: we believe that it is interesting news to witness after millions of years of insect's evolution in the direction of developing increased solutions for ranges of life problems; it is quite evident that some relevant ideas can be developed by talking advantage of this paper.It is believe that these rules and the methods of artificial intelligence will together determine the planning and the execution of the layers for the issue. The results of these Ants'activities will include benefits for reduction of mission complexity; cost and improving performance which will improve ants survive-ability. Here, a possibility, any exist to use configurable processing electronic chip to set the performance and req-uirements for Ant's ruler and workers. Almost of ants co-mmand and data handling control will be contained within heuristic systems of ants which can be addressed also in the communication data processing. It is thought that ant's asteroid belt may prepare and determine all what is need-ed for the prospecting mission. This will include the social structure of ants, workers division into groups and the number of asteroids to investigate the start.Rulers, workers, and messengers react and act on the value of the information obtained.

5-1- Ant Colony Program:-

The City is the simplest entity (X, Y) position in the environment. To calculate the distance between two cities.

Program in C++ :-

```
Class route
{ private:
Float length;        -----(1)
Int pheromone;       -----(2)
City firstcity;      -----(3)
Public:
Void evaporatepheromone();}----(4)
```

Explain for each step(chech full source code for detials)
length of road.
Pheromone intensity over the road
Cities connected by this road.
Simulate the evaporate of the pheromone
A good variability of the behavior of the agents can be expressed as a sinusoidal function with at least three coefficients:

$T(pl)=\alpha * \sin (\beta * pl+\gamma)$

The input PL is the pheromone level over a route. Alfa, Beta and Gamma will be proper- ties of the Ant class initialized as random float numbers within the interval [-n,n]. These properties will make possible to have different individuals in the population.

Program:-

```
Class ant
{
Private;
Float alfa;
            (1)
Float beta;
Float gamma;
Bool have food;                                  (2)


Public;
Float gettendency(int pherolevel);          (3)
Void pickfood();                                 (4)
Void leavefood();                              (5)
Void putpheromone();                             (6)
Void walk();
            (7)
};
```

Number exaplanation:-
(1)sensibility
(2) if ant is carrying food.
(3) chosing route.
(4)pick food in food source.
(5)leave food in nest.
(6)increase pheromone level.

The Route needs two pointers to City, it is connecting, the longer the route, the more turns an agent will need to cross it, pheromone intensity , the volatile characteristic of the pheromone.
(7)walk one step.

Environment and the simulation process, evolution process.. Two nodes of the graph must be the nest and the food source. a random number of agents are created in the nest, their pheromone level increased and after some time a solution will emerge from the collective behavior of these virtual ants.

Environment program:-

```
Class environment
Private:
City *foodsourcecity;
City*nest;
Tlist*route;
Tlist*cities;
Tlist*ants;
Public:Void nextturn();};
```

USING ANOTHER PROGRAM EXECUTION (completely):-

2.Ant Colony program:-:

```
#include <stdio.h>
#include <time.h>
#include <assert.h>
#include "common.h"
cityType cities[MAX_CITIES];
antType ants[MAX_ANTS];
double distance[MAX_CITIES][MAX_CITIES];
double pheromone[MAX_CITIES][MAX_CITIES];
double best=(double)MAX_TOUR;
int bestIndex;
/* Initialize the cities, their distances and the Ant population. */
void init( void ) {
int from, to, ant;
/* Create the cities and their locations */
for (from = 0 ; from < MAX_CITIES ; from++) {
/* Randomly place cities around the grid */
cities[from].x = getRand( MAX_DISTANCE );
cities[from].y = getRand( MAX_DISTANCE );
for (to = 0 ; to < MAX_CITIES ; to++) {
distance[from][to] = 0.0;
pheromone[from][to] = INIT_PHEROMONE; } }
/* Compute the distances for each of the cities on the map */
for ( from = 0 ; from < MAX_CITIES ; from++) {
for ( to = 0 ; to < MAX_CITIES ; to++) {
if ((to != from) && (distance[from][to] == 0.0)) {
int xd = abs(cities[from].x - cities[to].x);
int yd = abs(cities[from].y - cities[to].y); distance[from][to] =
sqrt( (xd * xd) + (yd * yd) );
distance[to][from] = distance[from][to]; } } }
/* Initialize the ants */
to = 0;
for ( ant = 0 ; ant < MAX_ANTS ; ant++ ) {
```

```
/* Distribute the ants to each of the cities uniformly */
if (to == MAX_CITIES) to = 0;
ants[ant].curCity = to++;
for ( from = 0 ; from < MAX_CITIES ; from++ ) {
ants[ant].tabu[from] = 0;
ants[ant].path[from] = -1;
}
ants[ant].pathIndex = 1;
ants[ant].path[0] = ants[ant].curCity;
ants[ant].nextCity = -1;
ants[ant].tourLength = 0.0;
/* Load the ant's current city into taboo */
ants[ant].tabu[ants[ant].curCity] = 1; } }
/*  restartAnts()
* Reinitialize the ant population to start another tour around the
* graph. */
void restartAnts( void )
{
int ant, i, to=0; for ( ant = 0 ; ant < MAX_ANTS ; ant++ ) {
if (ants[ant].tourLength < best) {
best = ants[ant].tourLength;
bestIndex = ant;
}
ants[ant].nextCity = -1;
ants[ant].tourLength = 0.0;
for (i = 0 ; i < MAX_CITIES ; i++) {
ants[ant].tabu[i] = 0;
ants[ant].path[i] = -1;
}
if (to == MAX_CITIES) to = 0;
ants[ant].curCity = to++;
ants[ant].pathIndex = 1;
ants[ant].path[0] = ants[ant].curCity;
ants[ant].tabu[ants[ant].curCity] = 1;
} }
/*  antProduct()
 Compute the denominator for the path probability equation (concentration
 of pheromone of the current path over the sum of all concentrations
 available paths). */
double antProduct( int from, int to )
{
return (( pow( pheromone[from][to], ALPHA ) *
pow( (1.0 / distance[from][to]), BETA ) ));
}
/* selectNextCity()
* Using the path probability selection algorithm and the current pheromone
* levels of the graph, select the next city the ant will travel to. */
int selectNextCity( int ant )
{
int from, to;
double denom=0.0;
/* Choose the next city to visit */
from = ants[ant].curCity;
/* Compute denom */
for (to = 0 ; to < MAX_CITIES ; to++) {
if (ants[ant].tabu[to] == 0) {
denom += antProduct( from, to ); } }
assert(denom != 0.0);
do {
double p;
to++;
if (to >= MAX_CITIES) to = 0;
if ( ants[ant].tabu[to] == 0 ) {
p = antProduct(from, to)/denom;
if (getSRand() < p ) break; } }
while (1);
return to; }
/*  simulateAnts()
* Simulate a single step for each ant in the population. This
function  will return zero once all ants have completed their
tours. */
int simulateAnts( void ) {
int k;
int moving = 0;
for (k = 0 ; k < MAX_ANTS ; k++) {
/* Ensure this ant still has cities to visit */
if (ants[k].pathIndex < MAX_CITIES) {
ants[k].nextCity = selectNextCity( k );
ants[k].tabu[ants[k].nextCity] = 1;
ants[k].path[ants[k].pathIndex++] = ants[k].nextCity;
ants[k].tourLength +=
distance[ants[k].curCity][ants[k].nextCity];
/* Handle the final case (last city to first) */
if (ants[k].pathIndex == MAX_CITIES) {
ants[k].tourLength +=
distance[ants[k].path[MAX_CITIES-1]][ants[k].path[0]]; }
ants[k].curCity = ants[k].nextCity;
moving++;
} } return moving; }
/*  updateTrails()
* Update the pheromone levels on each arc based upon the number of
ants  that have travelled over it, including evaporation of existing
pheromone. */
void updateTrails( void ) {
int from, to, i, ant; /* Pheromone Evaporation */
for (from = 0 ; from < MAX_CITIES ; from++) {
for (to = 0 ; to < MAX_CITIES ; to++) {
if (from != to) {
pheromone[from][to] *= (1.0 - RHO);
if (pheromone[from][to] < 0.0) pheromone[from][to] =
INIT_PHEROMONE; } } }
/* Add new pheromone to the trails */
/* Look at the tours of each ant */
for (ant = 0 ; ant < MAX_ANTS ; ant++) {
/* Update each leg of the tour given the tour length */
for (i = 0 ; i < MAX_CITIES ; i++) {
if (i < MAX_CITIES-1) {
from = ants[ant].path[i];
to = ants[ant].path[i+1];
} else {
from = ants[ant].path[i];
to = ants[ant].path[0]; }
pheromone[from][to] += (QVAL / ants[ant].tourLength);
pheromone[to][from] = pheromone[from][to]; } }
for (from = 0 ; from < MAX_CITIES ; from++) {
for (to = 0 ; to < MAX_CITIES ; to++) {
pheromone[from][to] *= RHO; } } }
/*  emitDataFile()
 For the ant with the best tour (shortest tour through the graph),
emit  the path in two data files (plotted together). */
void emitDataFile( int ant ) {
int city;
FILE *fp;
fp = fopen("cities.dat", "w");
```

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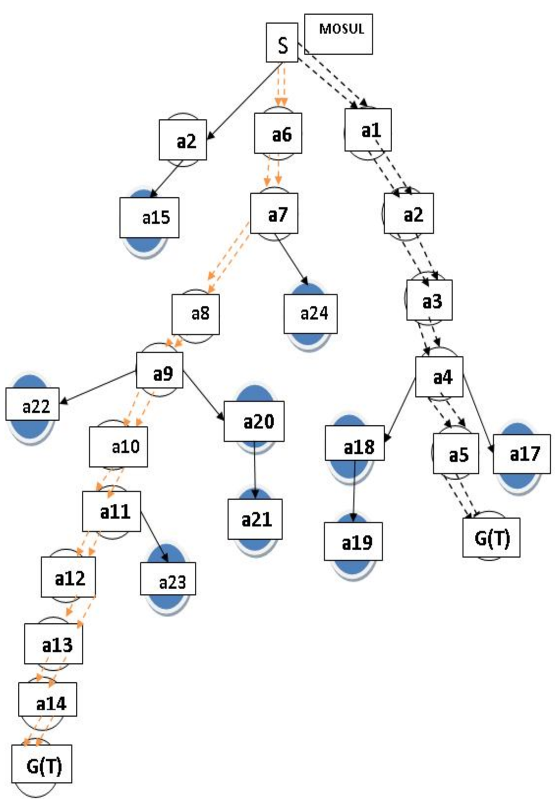
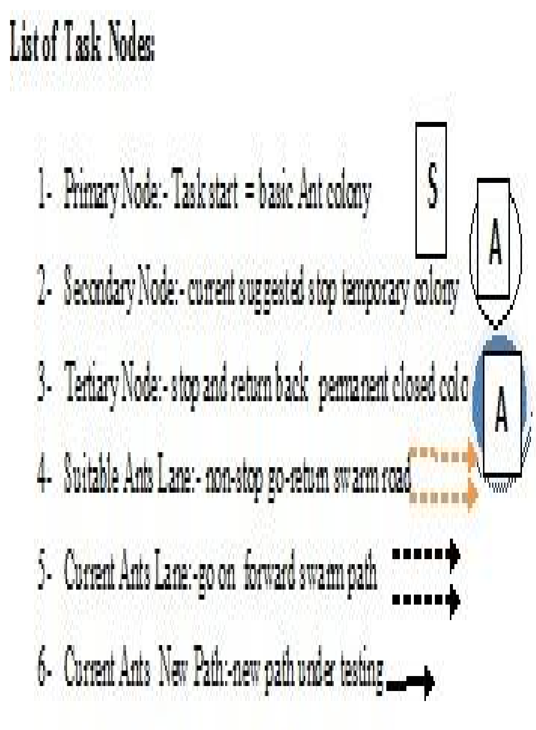
```
for (city = 0 ; city < MAX_CITIES ; city++) {
fprintf(fp, "%d %d\n", cities[city].x, cities[city].y); }
fclose(fp);
fp = fopen("solution.dat", "w"); for (city = 0 ; city < MAX_CITIES ; city++) {
fprintf(fp, "%d %d\n",
cities[ ants[ant].path[city] ].x,
cities[ ants[ant].path[city] ].y ); }
fprintf(fp, "%d %d\n",
cities[ ants[ant].path[0] ].x,
cities[ ants[ant].path[0] ].y );
fclose(fp); }
void emitTable( void ) {
int from, to;
for (from = 0 ; from < MAX_CITIES ; from++) {
for (to = 0 ; to < MAX_CITIES ; to++) {
printf("%5.2g ", pheromone[from][to]); }
printf("\n"); }
printf("\n"); }
```

```
/* Main function for the ant algorithm. Performs the simulation given
the constraints defined in common.h. */
int main() {
int curTime = 0;
srand( time(NULL) );
init();
while (curTime++ < MAX_TIME) {
if ( simulateAnts() == 0 ) {
updateTrails();
if (curTime != MAX_TIME)
restartAnts();
printf("Time is %d (%g)\n", curTime, best); } }
printf("best tour %g\n", best);
printf("\n\n");
emitDataFile( bestIndex );
return 0; }
```

5-2-Ant ColonyTasksGraph:-





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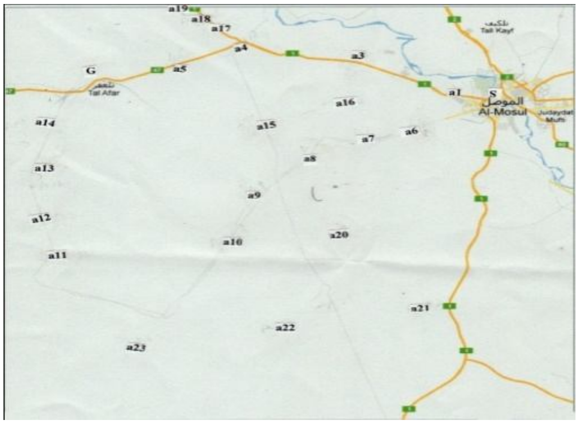

S—MOSUL, a1—DEARMICHAL, a2—HOMIDAT, a3—BADOSH, a4--KISIK-KUPRI, a5—TAL-ABOMARIA, a6—SAHAJI, a7--ADAIA, a8—ALNAZAZA, a9—NAJMIA O JUDALA, a10—TAL SIRWAL, a11—ABDAN,	a12--TAL ABTA, a13—AINKHZAL, a14—ALKHBEARAT, a15—SHAIKH IBRAHIM, a16—ASKI MOSULA, a17—MSHERFAA, a18—WADI ALMUR, a19—OWINAT, a20—JURN, a21—AIN ALBEITHA, a22—AIN ALJAHISH, a23—ALTHRTHAR, **G**—TAL-AFAR.

6- Result and Conclusion:

Artificial intelligent research in network and neuron subsamption of the combination of both are made in comparison between the intelligent needed, which can be shown by Ants in this paper. But I think it still needs a very long time to match it up . Ant Colony is regarded a good method when the path is very deep and the tree branching has an endless depth. The nearest path is chosen to the start node. The value of the research can be improved to the better when there is a possibility to arrange the chain that leads to the early discovery of the goal. The shortest path is implemented to start from Mosul to Tal-Afar, MOSUL(S), DEARMICHAL,HOMIDAT,BADOSH,KISIK-KUPRI,TAL-ABOMARIA,TAL-AFAR(G)which is of 90 Km distance.

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