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Adaptive A* Based Gnome Segmentation Of Précised Navigation Images For Optimum Route Decision Of An Autonomous Robot Using Rfid Networks

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Abstract— **Radio Frequency Identification (RFID) has attracted considerable attentions in recent years for Its broad applications in ubiquitous computing and promises new field of work that is eagerly awaited for many different types of applications. Many of the new generation robot systems use RFID tag system for navigation because of its simplicity reliability, accuracy and ease of implementation. Still, one of the major strategies related to the field of RFID navigation is to identification of optimum route plan and navigation using normal processing circuit which is more complex and time consuming. The basic processing circuit need large and complex algorithms for positioning, navigation n and route planning. The proposed system introduces a Précised image based navigation obtained from predefined data of tag distribution and acquired information from RFID tag-transreceiver system. Adaptive A* Search algorithm is implemented for optimum route planning based on adaptive weight iteration that changes its nature with respect to user needs and environment. . Genome percolation algorithm applied on précised images in order to extract the feature of designed route and establish a better user interfered route planning within minimum time and less complexity. The image based methods put forth a major advantage of exact positioning; route planning and easy design over control of Robot servo system in XY co-ordinate due to accurately measured dimensions and angles using image velocitometry and novel video co-relation systems.**

Keywords— **GNOME Segmentation, RFID Navigation, Adaptive A* Algorithm, Robots.**

I. INTRODUCTION

The task of robotic self-localization, in which a robot estimates its position in a given map of the environment, has been studied extensively over the past decade. Numerous robot navigation methods have been suggested over the past few years. The ubiquity, portability, good connectivity, the trend towards increased performance and inclusion of new sensors make RFID navigation an ideal target device. These systems generally fall under one of the following categories: dead-reckoning-based, landmark based, vision-based, and behavior-based techniques. Landmark based navigation is intended to greatly improve robot position estimation over dead reckoning by tracking visual features in the environment and using them as landmarks. There proved many advantages in Land marked methods where the tracking is done based on a localized search for the maximum correlation between a RFID transreceiver outputs and the image, in the neighborhood of the expected location of the feature in the image template.

Abstract-Path planning is an essential task for the navigation and motion control of autonomous robot manipulators. This NP-complete problem is difficult to solve, especially in a dynamic environment where the optimal path needs to be rerouted in real-time when a new obstacle appears. The A* algorithm is an optimization technique based on swarm intelligence. This paper investigates the application of A* to robot path planning in a dynamic environment. Two different pheromone re-initialization schemes are compared and computer simulation results are presented.

In order to obtain a Cartesian co ordinate mapping, robot position detection mapping and rooting, segmentation and feature extraction of image has been done. The most obvious solution is the use of standard intelligent image processing methods or combinations of it. Gnome sort proposed by Hamid Sarbazi-Azad in 2000 then later on described by Dick Grune and named "Gnome sort", is a sorting algorithm where moving an element to its proper place is accomplished by a series of swaps.

II. RFID NAVIGATION SYSTEMS

RFID is an automatic identification method that relies on storing and remotely retrieving data using data-carrying devices called RFID tags or transponders.

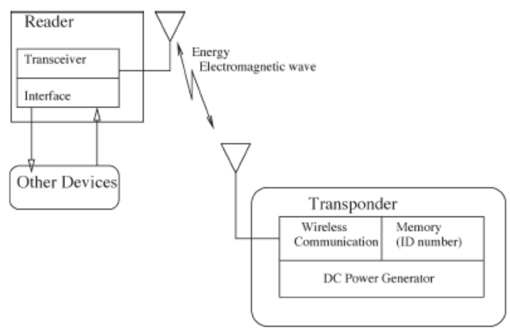

Fig 1.. Simplified RFID system's architecture.

The aim of the RFID navigation system is to make the robot navigate along the virtual lines on the ground, linking the orthogonal projection points of the tags on the ground. The power required to operate the data-carrying device is transferred using a contactless technology from a data-capturing device called an RFID reader. The basic communication between the reader and the transponder of an RFID system is based on radio frequency (RF) .

The communication antenna is usually built within the tag, whereas the reader is typically equipped with one or two antennas. The RF transceiver on the reader illuminates a short pulse of electromagnetic waves. The transponder receives the RF transmission, rectifies the received signal to obtain the dc power supply for the IC memory, reads the ID stored in the memory, and backscatters it in response to the interrogation. The signal generated by the transponder is then received by the reader to extract the tag's ID number. The processing circuit reads and analyses these datas to get a better navigation and control.

The proposed configuration for landmark based navigation consists of a RFID TR System as shown in Fig 1 on board a dual-Pentium PC mounted on Nomad, as well as wheel encoders and steering encoders on Guiding axis. The Processor will be used to log images directly from the framegrabber, and to perform operation online. This online processing has several advantages over processing on-the-move, including:

III. SYSTEM STRATEGIES

Skilled navigation in mobile robotics usually requires solving two problems pertaining to the knowledge of the position of the robot, and to a motion control strategy. These tasks ought to be solved in conjunction due to their interdependency. Usually there arises the problem of uncertainty of location due to the nature of the antenna and tags so that an error is always present which is relative to the rout planning using uncertain transreceivers. Many researches have used external sensors in order to reduce the location errors which increase the size and complexity.

A normal sixteen bit processor takes more time to receive the transreceiver signals, analyze the them , determine robot's present position and a route planning for motion. Thus many of the RFID based autonomous robots are more slow compared to GPS based systems. The area of time consumption is more to locate the present position of robot just using the transreceiver signals as the range of tags are small and it is too complex to determine exact position using limited number of tags. . The proposed method that uses précised image of maximum route layout along with RFID transreceiver which is able to estimate the robot's location and orientation more precisely by using image processing algorithms and Cartesian coordinates in a regular grid like pattern and optimized outplaying using Adaptive A* Saerch optimization,. The proposed method effectively estimates both the location and the route of a mobile robot during navigation using A* in GNOME segmented précised image layouts augmented with directional information.

IV. ADAPTIVE A* OPTIMIZATION

In computational complexity theory, path planning is classified as an NP (nondeterministic polynomial time) complete problem. A* is widely used in path finding and graph traversal, the process of plotting an efficiently traversable path between points, called nodes. Ina typical A* algorithm, firstly search area is divided into a square grid.. This particular method reduces search area to a simple two dimensional array. Each item in the array represents one of the squares on the grid, and its status is recorded as dynamic or static.

As A* traverses the graph as shown in Fig 2, it follows a path of the lowest known cost, keeping a sorted priority queue of alternate path segments along the way. If, at any point, a segment of the path being traversed has a higher cost than another encountered path segment, it abandons the higher-cost path segment and traverses the lower-cost path segment instead. This process continues until the goal is reached.

The path is found by figuring out which squares we should take to get from A to B. Once the path is found, pointer person moves from the center of one square to the center of the next until the target is reached.

Then characterize a class of admissible heuristic search strategies, using the evaluation function:

f(n) = g(n) + h(n

g(n) represents the actual distance at which the state n has been found in the graph, and h(n) is the heuristic estimate of the distance from n to a goal state. So f(n) represents an estimate of the total cost of the path from the start, through n to the goal.

Define the evaluation function f*:

f*(n) = g*(n) + h*(n)

Where g*(n) is the cost of the shortest path from the start to n and h*(n) returns the actual cost of the shortest path from n to the goal. So f* is the actual cost of the optimal path from the start to the goal through n. f* or an oracle is an ideal evaluation function that can see the shortest path from the start to the goal. Of course, oracles of this type don't exist for most search problems

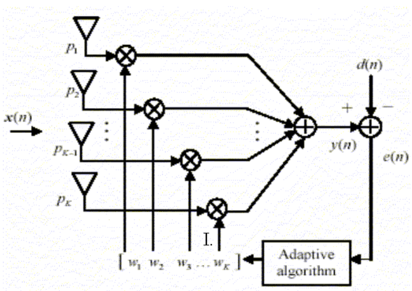

Fig 2 : Adaptive A* System

Thus A*: is algorithm A in which h(n) <= h*(n) for all states n. In other words, if an algorithm uses an evaluation function that underestimates the cost to the goal it is an A* algorithm as shown in Fig 3.

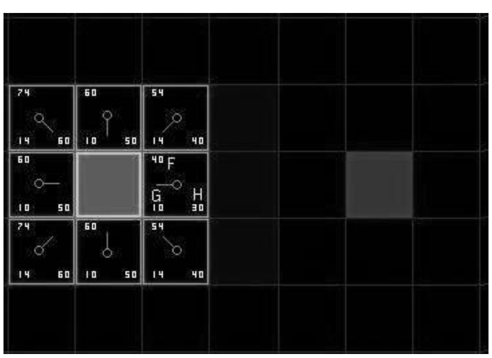

Fig 3 : Adaptive A* System

V. GNOME SORTED PERCOLATION MODEL

Gnome sorted Percolation algorithm is an advanced method suitable for object detection which gives a smoothed image to obtain uniform brightness, followed by removing isolated points to remove noise and morphological operations with fast operation . The percolation algorithm described in works can be used for even complex images which are based on the physical model of liquid permeation, are started from each pixel. Depending on the shape of the percolated region, the pixel is considered as an object pixel or route. Basically the simple percolation process consists of the described syntax:

1. Initialize the Gnome operator i=1 and the latest iterative variable k to 0
2. If the Gnome operator value is less then the maximum gray level value n, following conditions are executed.
3. The starting pixel P_s is added to the set of percolated pixels P
4. The threshold t is set to the value

$$t = \max\left(\int_{p\in Dp}^{\infty} max\ I(p), t\right) + w,$$

Where w is a parameter to accelerate the percolation depends on ray absorption cp-efficient

5. Each pixel p neighboring P is added P to if I(P)≤ t
6. The circularity Fc is defined by

$$Fc = \frac{4 \times |P|}{\pi (diam\ P)^2}$$

7. Gnome operator is redefined by the value of k and k is assigned to zero If the P exceed the preceder, P> P(n-1)
8. Pixel values are interchanged and k redefined by the value of Gnome operator and i is assigned to zero if, P< P (n-1).
9. Gnome operator is increased in each step by one for all values n less than i else decreased by one.
10. Iteration on k is implemented until p reaches boundary of M×M window with centre P if the circularity Fc of P *is* close to 0, p is considered as a crack pixel.

The Improved percolation algorithm described in the previous section can be used immediately for the detection of cracks low resolution images but not for complex images. While steps 1–4 can be directly applied to complex images, the circularity Fc computed in step 5 has no obvious generalization to complex images. An extension of the percolation algorithm to complex images with improved computation time is proposed in this section. Employing the sheet filter as conventional system introduces more complexity. Implying Laplace smoothing can improve the performance of system increasing.

Sum of smoothing signals consisting of equidistant points is the moving average . An array of raw (noisy) data [y1, y2, …, yN] can be converted to a new array of smoothed data. The "smoothed point" (yk)s is the average of an odd number of consecutive 2n+1 (n=1, 2, 3, ..) points of the raw data yk-n, yk-n+1, …, yk-1, yk, yk+1, …, yk+n-1, yk+n, as shown in Fig 4.

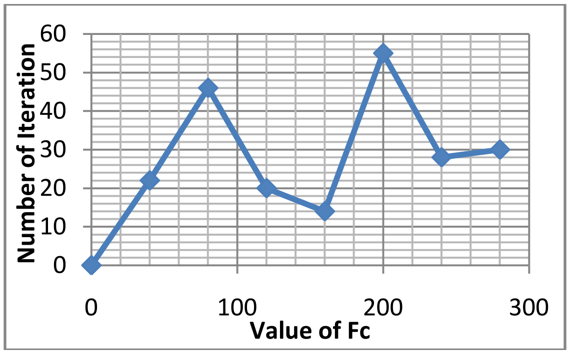

Fig 3 : GNOME Percolation iterative values of H_C

VI. ADAPTIVE A* IMAGE BASED NAVIGATION

The advent of advanced computer architectures for parallel and symbolic processing has been devolved for the development of better of prototype autonomous robots as shown in Fig 5. Control of such devices will require communication between knowledge based subsystems in charge of the route planning, and conflict resolution aspects necessary to make autonomous vehicles functional. RFID system exchanges data between two entities namely a reader/ writer and a tag. This communication allows information about the tag or the element carrying the tag to be determined and in this way it enables processes to be managed more easily.

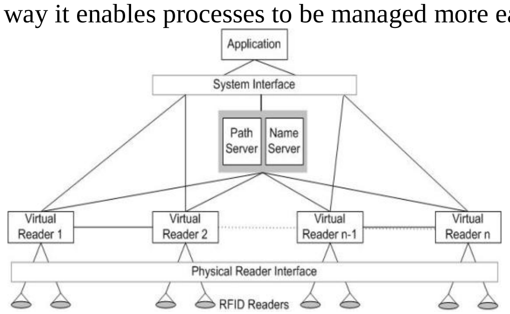

Fig 5 : Basic Adaptive A* GNOME Percolation System

The reader write is used to communicate with the tags that may pass within range, normally be located in a fixed position and to interrogate an RFID tag. The RFID tag contains data that is relayed to the reader, and in some systems it may also be possible to update the data within the tag to indicate that the tag and hence the item has undergone a specific stage in a process, etc. RFID application software runs the overall system with many systems there will be a number of different reader / writers and the data to and from these needs to be coordinated and analyzed. Using the dataset acquired from the RFID tags, the system processor marks the robot relative position, obstacle status and measures in précised image template stored as shown in Fig 6,which shows maximum probability of travelling paths and static obstacles that may present. Thus the précised images helps to get the exact information about static obstacles from image layouts and dynamic obstacles and current location measures from RFID transreceiver.

Instead of using the tedious process of robot teaching, an on-line path planning algorithm has been developed for industrial robots to improve their accuracy and efficiency. Collision avoidance is the primary concept to achieve such goal. By use of the distance maps, the inspection of obstacle collision is completed and transformed to the configuration space in terms of the robot joint angles as shown in Fig 7.

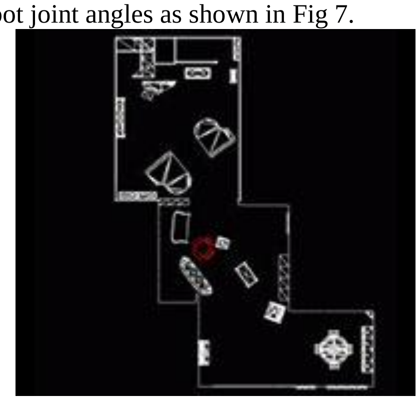

Fig 7 Précised Image Layout

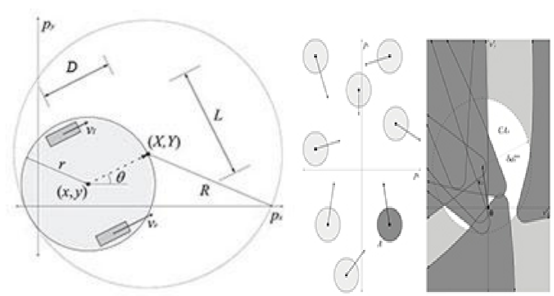

Fig 7 : Adaptive A* Route planning

On this configuration map, the relation between the obstacles and the robot arms is obvious. By checking the interference conditions, the collision points are indicated with marks and collected into the database. The path planning is obtained based on the assigned marked number of the passable region via wave expansion method. A* algorithm was a heuristic state space search method under the known environment originally. The A* Search Algorithm used for the path planning from the one used for the navigation map. The difference is in the way the algorithm to construct neighboring nodes. For a navigation graph, you can only select neighboring nodes defined in the graph. The

Gnome segmentation module is used to identify the position and location of robot using précised image layout and to make Cartesian movement along map layout which helps to perform a fast, reliable and accurate positioning.

VII. RESULTS AND DISCUSSIONS

A substantial amount of work has done both in real-time and in simulation applications to check the reliability and performance characteristics of the system. It was found that even at complex hazardous route, obstacle and optimized path can be monitored by using intelligent system design and that the monitoring can produce useful Information. Testing procedures, developed have been applied to a wide variety of testing samples successfully.

Figure 8-10 shows the optimized path selection using adaptive A* route planning and it can be found that at each iteration effective distance field vector is reduced. Figure 10 shows the optimized route for navigation with less time and energy.

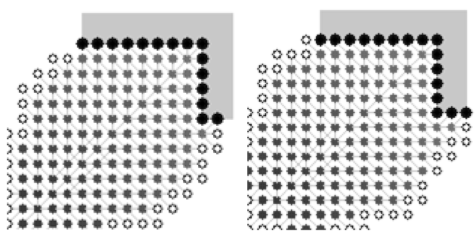

Fig 8 : Adaptive A* Route planning Iterations

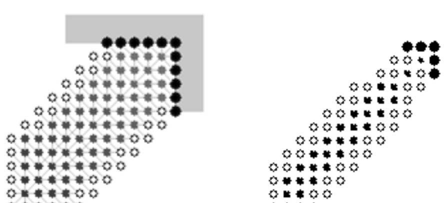

Fig 9 : Adaptive A* Route planning Iterations

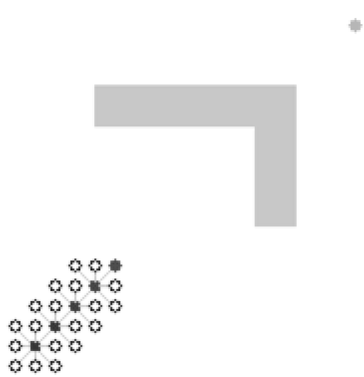

Fig 10 : Adaptive A* Route planning – Navigating Route

Once the route for navigation is found, it is marked for better determination of Cartesian co ordinate. To avoid complexity, expect the rout pixel levels are extracted using GNOME Percolation model as shown in Fig 10 and Fig 11 Show the possibility of Segmented image for RFID Tags and Obstacles.

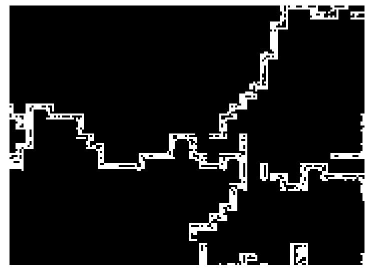

Fig 10 : Adaptive A* Route planning – Navigating Route

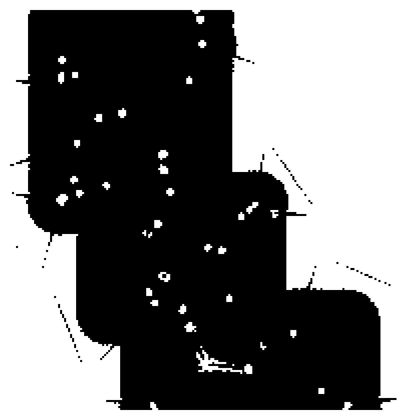

Fig 11 : Segmented RFID Tags- Obstacle Detection

Figure 12 shows the variation of iteration levels for proposed model over conventional system.

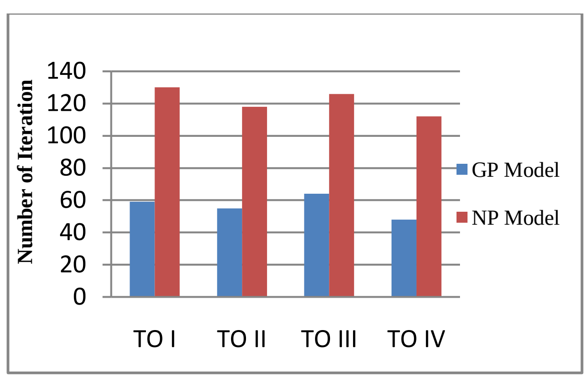

Fig 12 : Sharpening and detection of obstacles

VIII. CONCLUSION

The proposed system presented a novel A* search based robot navigation algorithm using RFID technology with the help of précised layout images using GNOME Sorted Hessian Percolation Model.. The algorithm is demonstrated to be highly effective in guiding the robot to under any RFID tag by a simple intelligent. It is shown through computer simulations that neither the initial position nor the initial direction of the robot affects the algorithm's convergence performance as long as it is within an accessible range from the tag's transponder. In addition, the proposed algorithm is also shown to be quite promising in tracking the rectilinear-desired trajectories of various complexities defined by several RFID tags mounted at unknown locations in 3-D space. It is worth mentioning that although these results are based on computer simulations, the RFID model used in the simulations is built from real-world data sampled from a real RFID system. The developed methodology with specialized algorithm has shown higher reliability, accuracy and optimized number of iteration for operation. Moreover distributed selection of staring pixel instead of random selection using Gnome percolation model makes the system to execute the recognition process within no time. The image preprocessing systems for image enhancement has improved the process by better image representation and easy processing for defect detection and classification. Rather, it might be regarded as an alternative navigation solution for many robotic applications where vision might not be absolutely necessary.

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