A DESIGNATION OF HARDWARE FOR TOUR GUIDE ROBOT

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Special Dedicate:

To my beloved family for their genuine love, prayers and encouragement. Then to my supervisor who guide and give moral support me and to all my friends for your help and support throughout my journey education.

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ABSTRACT

This paper describes the software architecture of an autonomous tour-guide or tutor robot. This robot was recently deployed used for indoor environment where it guided hundreds of visitors through the building during a six-day deployment period. The robot‟s control software integrates low-level probabilistic reasoning with high-level problem solving embedded in first order logic. A collection of software innovations, described in this paper, enabled the robot to navigate at high speeds through dense crowds, while reliably avoiding collisions with obstacles some of which could not even be perceived. Also described in this paper a user interface tailored towards non-expert users, which was essential for the robot‟s success in the museum. Based on these experiences, this paper argues that time is ripe for the development of AI-based commercial service robots that assist people in everyday life.

ABSTRAK

Perisian seni bina robot automasi untuk diaplikasikan sebagai pemandu pelancong atau pun sebagai robot pengajar akan dibincangkan dalam tesis ini. Sejak kebelakangan ini, dengan era teknologi semakin canggih dan bertambah moden kegunaan robot ini semakin bertambah untuk memandu pelancong atau pun pelawat-pelawat untuk kawasan persekitaran dalaman, contohnya bangunan, muzium dan sebagainya. Kegunaan robot ini juga dapat mengurangkan tenaga manusia dan juga boleh digunakan pada bila-bila masa tidak kira sama ada hari cuti ataupun hari bekerja. Perisian kawalan robot mengintegrasikan kebarangkalian tahap rendah dengan penyelesaian masalah tahap yang tinggi diprogram dalam logik tertib pertama. Satu koleksi inovasi-inovasi perisian, menggambarkan dalam laporan ini, yang membolehkan robot beroperasi pada kelajuan tinggi ketika suasana orang ramai. Sementara itu,robot ini juga berpontensi dapat mengelak perlanggaran-perlanggaran dengan rintangan-rintangan yang menghalang laluannya. Laporan ini juga menerangkan, kegunaan satu antara muka untuk memudahkan pengguna-pengguna yang tidak mahir. Berdasarkan pengalaman yang pernah dilalui, banyak berlaku percanggahan semasa proses membangunkan perkhidmatan robot-robot perdagangan berasaskan *"Artificial Intelegence"* yang membantu orang lain dalam kehidupan seharian.

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CHAPTER I

INTRODUCTION

1.1 Introduction

In recent years, there have been various trials to extend robotics technology to service application in public spaces. Especially many researchers have an interest in the guide robot since it is closely related to two critical issues in current robotic research such as which are interaction with human and navigation in dynamic environment. So, we can see that tour guide is important to our country. For tourist that wants to do their research might visit some company or institute to get information. Because of this, the company faced problem to entertain tourist. To ensure visitors or tourist satisfied with their serve, they have spare time for them. But totally of employee busy with their work. To solve this problem I decide to design a tour guide robot called as ToGouR.

ToGouR is a robot move in automatically system with a several backup system to avoid failure or emergency. ToGouR will be waiting for visitors in a starting point or initial position that have been decided. The visitors or tourist just need to key in their destination that displayed on a GUI (Geographical User Interface) screen that have been installed. ToGouR will guide the visitors to their destinations.

The robot will be installed PIC 16F877A. This PIC work as a brain to give a command for the robot to move. This command will be installed by using MP Lab software. Other than that, the ToGouR will be installed with a wireless camera, to get a view that will be displayed on a monitor. It is also can be controlled by manual in case the robot having a difficulty on the trip. To improve the movement of the robot, it also will be installed with 2 types of sensors. This sensors like Ultrasonic sensor and Infrared sensor (IR Sensor). Meanwhile, this sensor function does not to improve the movement this robot only, but it is used to ensure that ToGouR move in good condition.

1.2 Problem Background

Today, many places such as museum, library or indoor place still using traditional way of service to guide the visitor to their destination. This is a low efficiency method, inconvenient and may contain mistakes. For example, the tourist guide can"t remember all information about this place. Sometimes the tourist guides forgot to tell some information, so the tourist missed some information about this place. By using this ToGouR or this robot, it makes the service more efficiency. It is because this robot had been program and it will install all information about this place. Beside the efficiency service, by using this robot it can gave a better quality service to customer and it will attract more visitor to the place to get this quality or service.

Besides that, the other problem is many of people or visitor typically had no prior exposure to robotic technology and many of them not intend to interact with robot. This is because this technology has not the other place. So the visitor can take time to understand and familiar with this robot. Other than that, the robot often had no interact with crowds of people. To solve this problem, the robot had been installed GUI. It is used to interface the location in the place. So visitor can choose their destination at GUI.

1.3 Objective

The objectives of this project are listed below:

i. To design automatically robot to guide visitor to their location.
ii. To design the robot can able return to charging point.
iii. To control the robot in manually in case the robot not working properly.

1.4 Scope of Work

The scope of this project will focus on the following areas:

i. This robot will be design an application for the tour guide robot or ToGouR using Power line networking to produce networking through line power in the building. This means the robot can move follow the line when the sensor detects line networking.

ii. MP lab is source code will be written in the assembler language and the code can be tested either using MP lab‟s simulator. This software used for the development of embedded application employing Microchip‟s PIC microcontroller.

CHAPTER II

LITERATURE REVIEW

2.1 For Robot Concept and Design

To design a suitable robot that reasonable for our robot application, I make decision from combination of several robots that available nowadays. This is several robot that a guideline to design the ToGour robot.

2.1.1 ASER Indoor Robot Guide

Figure 2.1: ASER Robot

- This robot named as ASER.
- The types of sensor range-finder sensor and ultrasonic sensor.
- This robot application use for indoor guide.
- It has 60cm height.

This robot is a multi-robot system capable of locating and pursuing moving object in indoor environment [1]. This robot is motivated by the popular game "laser tag". The object of laser tag is too determined and tag individuals from an opposing team using an infra-red tagging device. The robotic form of laser tag involves teams of robots instead of people. The game of laser tag provides unique opportunities for multi agent robotics research. Just like robotic soccer, laser tag is inherently real-time. The environment is dynamic, leaving only limited time for information fusion and decision making. A key difference between laser tag and robotic soccer arises from the pervasive presence of occlusion: most of the time neither teammates nor opponents are within a robot‟s sensor field.

This creates a challenging multi-robot data fusion problem. Furthermore, the robots have to coordinate their actions in the face of this uncertainty. The main problem in laser tag is tracking multiple moving objects under pervasive occlusion. This problem, however, has received relatively little attention in the literature. To solve this problem our technique is based on two related insights. First, pervasive occlusion leads directly to an intractable data association problem. Data association is often difficult, but in many cases if the objects being tracked are well separated and frequently observed, approximating data association with a maximum likelihood point estimate is effective. In laser tag and other domains where occlusion is pervasive, this approximation is poor because many association are plausible. The second insight is that the same pervasive occlusion that makes data association hard introduces structure into our posterior. Our sensors‟ inability to see through walls and around corners causes many dimensions of our belief to become practically equivalent.

2.1.1.1 Factoring Sensor

In particular, there are two types of information we can get from our sensors, positive and negative. Positive information tells us where an opponent actor is; result receives positive information by associating a sensor reading *i* to role *j*. Negative information tell us where an opponent is not; result receive negative information when our sensor beams pass through a space without detecting an opponent. Negative information produces complicated posteriors with sharp edges because our visibility region is distorted by occlusion from static obstacles in the map. Incorporating negative information also tends to introduce multiple modes in our posterior because the field of view may cut out the middle of our posterior over an opponent‟s position. In fact, negative information can increase the variance of our belief distribution (although it always reduces entropy). Most position-tracking systems can only incorporate positive information. If the tracked objects are only rarely occluded, positive information is usually sufficient to achieve good tracking.

2.1.1.2 Tracking

The utility of our tracking system in the laser tag domain by implementing two planners for locating and tagging opponents. The first of these planners uses our tracker to model the location of the opponents. The second, will refer to as the baseline planner, is similar to the first except it does not use a tracker.

In both planners point to point navigation is implemented through standard path planning algorithms. For multi-robot coordination, our tracker-based planner uses a heuristic approach where the greedily attempt to maximize information gain. The baseline planner explores randomly, but uses the same technique of having the chose actions one at a time in an attempt to avoid redundancy. In the tracker-based planner, the values of the destination points are a function of several factors including the travel time required to reach them, the number of hypothesized opponent positions that would be observed were the degree to which those hypotheses would be centered in the sensor field, and whether or not other have already chosen nearby destinations. The degree to which each of these factors influences planning is controlled by empirically chosen weights. In the baseline planner the only contributing factors are the travel time and whether or not other teammates have already chosen nearby points. Coordination strategies similar to our tracker-based solution have been found to be highly effective in the context of coordinated multi-robot exploration of static environments.

2.1.2 RHINO Guide Robot

Figure 2.2: RHINO Robot

- This robot named as Rhino.
- It is installed using 24 sonar sensors and 2 colour cameras.
- The height is 50 cm.

It is equipped with 24 sonar proximity sensors, a dual color camera system mounted on a pan/tilt unit, and two onboard i486 computers. Sonar information is obtained at a rate of 1.3 Hertz, and camera images are processed at a rate of 0.7 Hertz. RHINO communicates with external computers (two SUN SPARCstation‟s) by a tether less Ethernet link [2]. Key features of RHINO‟s control software, as exhibited at the competition, are as follows:

- Autonomy.
  RHINO operates completely autonomously. It has been operated repeatedly for durations as long as one hour in populated office environments without human intervention.
- Learning.
  To increase the flexibility of the software, learning mechanisms support the adaptation of the robot to its sensors and the environment. For example, neural network learning is employed to interpret sonar measurements.
- Real-time operation.

To act continuously in real-time, any-time solutions are employed wherever possible. Any-time algorithms are able to make decisions regardless of the time spent for computation. The more time that is available, however the better the results.

- Reactive control and deliberation.

RHINO"s navigation system integrates a fast, reactive on-board obstacle avoidance routine with knowledge- and computation intense map building and planning algorithms. The integration of a dozen different software modules, which all exhibit different timing and response characteristics, requires a flexible scheme for the flow and synchronization of information. The key principles for the design of RHINO"s software are as follows:

- Distributed control and communication.

Each module communicates with several other modules through Ethernet. There is no single control unit, and communication is not centralized.

- Asynchronous communication.

RHINO"s software lacks a central clock. Each of the modules runs independently of the other modules. To resolve conflicts, certain modules (such as the on-board obstacle avoidance module) can take priority over other modules (such as the planner) in determining the robot"s motion direction.

- Software fault tolerance.

RHINO"s software is designed to accommodate sudden failures of most of its software components. Almost all modules can be stopped and restarted at any time. Effective mechanisms ensure that restarted modules will immediately obtain the currently available global information.