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Effective Automatic Robot Control System for Education Social Cause-Library System

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Abstract- This paper presents a guidance method using a laser pointer attached to a librarian robot and gestures consist of body movements. Our librarian robot that is fixed in an experimental environment is able to say greeting properly based on estimation results of human behavior using a laser range finder and search books depending on a user's request. When the robot explains where a requested book is in the library, it points out a target position using a laser spot while the body and head are also turned around to the direction of the target. However, the robot cannot always point out a target position directly using the laser pointer. So we design three types of guidance using the laser pointer and the gestures depending on the library environment. Some experimental results reveal the validity and effectiveness of our proposed guidance method using the laser pointer and some gestures for our librarian robot.

Keywords- Social Robot, Human Robot Interaction, Autonomy Design, Stemming Algorithm, WOZ

I. Introduction

In today's Era, Robotics Technology has reached very far in every field. A social robot is an autonomous robot [1] that interacts and communicates with humans or other autonomous physical agents by following social behaviors and rules attached to its role. This definition suggests that a social robot must have a physical embodiment (screen characters would be excluded). Recently some robots have been developed that use a screen to display the robot's head. Such a machine is on the borderline of being a robot. If the body only functions as a holder for the screen then such a system cannot be considered a robot but if the robot has some physical motor and sensor abilities then such a system could be considered a robot. The definition states that a social robot should communicate and interact with humans and embodied agents. These are likely to be cooperative, but the definition is not limited to this situation. Moreover, uncooperative behavior can be considered social in certain situations. The robot could, for example, exhibit competitive behavior within the framework of a game. The robot could also interact with a minimum or no communication. It could, for example, hand tools to an astronaut working on a space station. However, it is likely that some communication will be necessary at some point. Two suggested ultimate requirements for social robots are the Turing Test to determine the robot's communication skills and Isaac Asimov's Three Laws of Robotics [2] for its behavior (The usefulness to apply these requirements in a real-world application, especially in the case of Asimov's laws, still is disputed and maybe not possible at all). However, a consequence of this viewpoint is that a robot that only interacts and communicates with other robots would not be considered to be a social robot: Being social is bound to humans and their society which defines necessary social values, norms and standards. This results in a cultural dependency of social robots since social values, norms and standards differ between cultures. This brings us directly to the last part of the definition. A social robot must interact within the social rules attached to its role. The role and its rules are defined through society. For example a robotic butler for humans would have to comply with established rules of good service. It should be anticipating, reliable and most of all discreet. A social robot must be aware of this and comply with it. However, social robots that interact with other autonomous robots would also behave and interact according to non-human conventions. Field trials of social robots placed in real-world environments such as museums, schools, and train stations have shown great success and provided valuable insights into real-world social phenomena which cannot be observed in the laboratory. For Example, in the future, a communication robot at train station might provide about departures platform, transfers and nearby shops by effectively using both verbal and non verbal expressions , since the target audience of a communication robot is the general public (people without specialized computing and engineering knowledge), a conversational interface that uses both verbal and non-verbal expressions is important. Another example we will see A field trial we recently conducted at a Japanese shopping mall [3] illustrates an example of a social robot application. We placed a humanoid robot in a central public space in the shopping mall for several hours a day, where it chatted with visitors and provided information and route guidance to locations within the mall. Customers were excited by the engaging interactions, and people crowded around the robot every day, waiting for a chance to talk with it. A human operator is often used to simulate the missing components of a system under development and to observe peoples reaction. This is known as the

"Wizard of Oz" [4] method, in human computer interfaces. Some studies have used WOZ Techniques for human-robot interactions, although these prototypes demonstrated little autonomy. For example, Woods el at. Used a tele-operated robot that approached people to observe their reactions. Green el at. Used a tele-operated robot in a living room setting to determine what services people needed.

A. Human-Robot Interaction

Human–robot interaction is the study of interactions between humans and robots. It is often referred as HRI by researchers. Human–robot interaction is a multidisciplinary field with contributions from human–computer interaction, artificial intelligence, robotics, natural language understanding, design, and social sciences.

B. Autonomy Design

The importance of autonomy can be summed up in the following slogan: No meaning without intention; no intention without function; no function without autonomy. This paper develops the role of autonomy to show how learning new tasks is facilitated by autonomy, and further by representational capacities that are functional for autonomy. Many past works focused on a robot that acts in everyday environment frequented by ordinary people. For instance, Burgardel at. Developed a tour guide with robust navigation skills that behaved as a museum tool. Siegwaert el at. developed a robot that guided people in large scale environments. Bauer el at. realized a robot navigating robot under an unknown urban environment using GPS data, cameras, laser range finders, and interaction with people. Some researchers develop robot to support people in daily environment such as shops. These cases indicate that autonomous robots are already feasible for delivering pre-defined messages associated with locations, particularly at many places with many people who have a special interest in robots, such as museums and world expos However the input for these robots are limited; although buttons and tactile sensors were robustly used, these robots did not exploit natural language, which largely limited their capabilities.

II. Existing System

In many existing systems some mobile robots equipped with hands can handle books on a bookshelf. The autonomous mobile robot LUCAS has a graphical interface displaying a human-like animated character, and acts as a guide for a library user in a library. Some mobile robots with upper half of the body for guidance, is able to show a direction with their hand motions. However, it is not suitable for hands to point out a particular spot with accuracy.

A. Disadvantages

- Complicated configuration
- No accuracy spot search
- Commanding is difficult

III. Proposed System

In this system we propose a new guidance method by that a library user can understand easily where a book of search results is in a library. A laser pointer is attached to the library robot's head with six degrees of freedom. When the robot explains where a requested book is in the library, it points out a target position using the laser spot while its body and head are also turned around to the direction of the target.

3.1 Advantages

- The robot has simpler configuration, and is rather close to the reception robot.
- The system will automatically fetch the exact location of the searched book and also it sends the commands to the robot.
- Although our robot cannot move, it is one of important tasks for it to guide a library user with clear explanations.
- A laser pointer is used effectively to point out a particular spot for guidance or explanation about a remote target or object.

B. Modification

We propose is, once the user provides the voice input, the system will verify all the available books, and finds out the best book by comparing Input term frequency with total number of keywords extracted using Stemming Algorithm. So that resultant book shelf is identified by the Robot.

IV. Implementation

A. Algorithm Evaluation

The algorithm that we are using here to finds out the best book by comparing Input term frequency with total number of keywords extracted using Stemming Algorithm.

Many natural languages (Indo-European, Uralic and Semitic) are inflected. In such languages several words sharing the same morphological invariant (root) can be related to the same topic. The ability of an Information Retrieval (IR) system to conflate words allows reducing index and enhancing recall sometimes even without significant deterioration of precision [5]. Conflation also conforms to users intuition because users don't need to worry about the "proper" morphological form of words in a query. The problem of automated conflation implementation is known as "stemming" algorithms.

B. Modules

- Robot with Laser Point
- Admin

- Client
- Server

C. Modules Description

1.) Robot with Laser Point

A laser pointer is attached to the library robot's hand with six degrees of freedom. When the system commands the robot where a requested book is available in the library, it points out a target position using the laser spot. However, since the library is large and there are a lot of obstacles for guidance by the robot, such as book stacks and columns, the robot cannot always point out a target position directly using the laser pointer. So we design three types of guidance using the laser pointer depending on the library environment.

2.) Admin

Admin module is the important module in this system. Since he only has the rights to design the commands and actions for the robot. Whenever the client gives his request that request is processed by the server system with the help of the admin guidelines.

He has the responsibility to arrange the books in a specific order and also update the accurate information in the database based on dynamic process. Likewise if any new books are racks included in the system, he must update these details also in the database.

3.) Client

The client system is the system which wants to get service or response from a server by forwarding request to the server. Clients can any person who needs the best book and the current location of that book among the several locations. He can directly send the request to the specified server or he can send the request to the main server.

4.) Server

Whenever the client gives his input to the server to search the exact position of the best book in the library, the system receives the inputs and processes them. It will go through all books in the particular system based on request. Then it will find out the current location of the specified books from several racks and immediately forwards the location command to the robot via RF. This system also displays the user friendly messages to the client about the exact position of the book and the direction.

V. Experimental Result

Experiments on the robot manipulators were conducted to show that library robot is able to search books depending on a user's request and show them to the user using a laser pointer. The experiment set-up is described below.

First, every book present in the library will be given a book label. Mike will be attached to the Pc. When the voice input will be given through the mike it is received by dot net software and based on voice input it will transmit the command to microcontroller through serial communication. The microcontroller generates a signal and transfers RF transmitter for every record command from PC. The radio frequency (RF) using here is 433.92 MHZ. In the receiver section, RF will receive the data that will be given back to microcontroller. Based on received signal microcontroller will control the operation of root motor. The motor will be will rotate on getting request from server and show the book to the user using a laser pointer situated in his head. The robot manipulator started at its initial position and begins to show the books to user after getting request from server. The robot manipulator executed the book pointing process.\The algorithm used here is Stemming Algorithm to find the best book requested by the user.

Fig. 1. The Library Robot

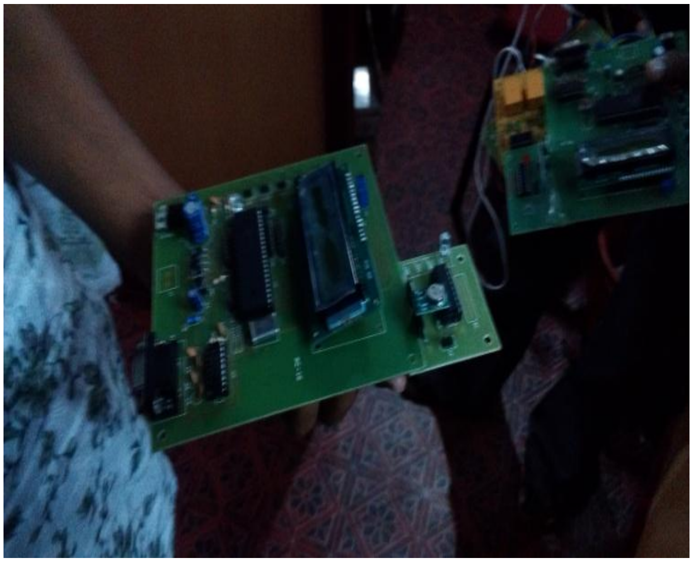

Fig. 2. Transmitter used in library robot

VI. Conclusion

We proposed a new guidance method by that a library user can understand easily where a book of search results is in a library. Since the librarian robot points out a target or a direction to the target using the laser pointer attached to the robot's head, a library user is able to understand the guidance easily and intuitively. The validity and effectiveness of our proposed method were confirmed with the experimental results with two subjects. However, the number of the subjects is still few; we will have to perform further experiments to evaluate the validity and effectiveness of our proposed method with a quantitative. We are now planning to set up the librarian robot in one of the university libraries with library staffs. Since a library is usually a silent place, we are also concerned whether the guidance method with voice interaction is acceptable or not.

VII. Future Enhancement

A librarian said that since the number of library users was decreasing because of development of the internet, library services might have to be changed, and this talking robot might be acceptable. We are going to evaluate the librarian robot, including this point. Moreover, in future work, since our library has the second floor, we will try to develop a new more suitable guidance method.

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