A Practicum Track Using Librarian Robot in Support Program for Contemporary Educational Needs

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Abstract

The target of our proposed educational program "Practicum Program for Content Creating" is to provide a training ground for creating new types of contents for the Internet age, where students of several specialized fields come together. The practicum program consists of lectures, seminars, and practicum tracks for undergraduate and graduate students. The students is able to expand basic knowledge from the lectures, acquire latest information about contents industry from the seminars, and learn skills for creating several types of contents. Students choose a topic from several kinds of the practicum tracks, for example, creating interactive digital photo frames, creating digital archives of historical videos, and so on. This paper presents one of the practicum tracks. The intelligent robot equipped with basic functions as a librarian was used in the track. The robot is able to talk with a library user by a natural language and search a collection of books through the Internet. However, this robot system still has a lot of functions to be added and problems to be solved. In this eight-day track a month, the students investigated the functions and problems, and chose one of them or found a new theme as his/her own theme to tackle. Despite a short period, every student was able to develop a unique function for the robot, and satisfied our unique program.

Keywords: Librarian Robot, Practicum Track, Educational Program, Good Practice

1 Introduction

Our proposed "Bringing Students of Different Backgrounds into a Team for Content Creation," A Practicum Program for Content Creating [1] was adopted as a three-year plan by the Support Program for Contemporary Educational Needs of the Ministry of Education, Culture, Sports, Science and Technology Japan [2] in 2007. The purpose of our proposed practicum program is to educate students of different areas in one course through creating new contents for the Internet age. This program provides some lectures, seminars and practicum tracks for students. In the lectures and seminars, students can learn basic knowledge such as intellectual property rights and professionals' several ways of thinking from several specialists in several fields. In the practicum track, students are able to choose a topic from several kinds of tracks, for example, creating interactive digital photo frames, creating digital archives of historical videos, and so on, and are able to learn practical techniques for creating several kinds of contents.

This paper presents the outline of our practicum program, and gives a detailed description about one of the practicum tracks. The intelligent robot equipped with basic functions as a librarian was used in the track. This librarian robot is able to say greeting properly to library users as a receptionist by a human behavior prediction function using a laser range finder. She is also able to talk with a library user by a natural language, search a collection of books through the Internet and provide bibliographic information depending on a user's request. However, this robot system still has several functions to be added and a lot of problems to be solved. In this eight-day track a month, students investigated related researches technologies, thought about the functions and problems for this developing system, and chose one of them or found a new theme as his/her own theme to tackle. Despite a short period, every student could develop a unique function required as a librarian or create new contents for for the librarian robot while he/she learning. In this paper, we show the functions and contents made by the students in our unique educational program. Besides, we also introduce comments of the students and the evaluation committee about this program.

2 Practicum Program

In this section, we introduce the abstract of our proposed practicum program.

2.1 Features of Program

The practicum program was held from 2007 to 2009. The targets in this practicum program were 2nd, 3rd and 4th grade undergraduate students in the three different fields: contents, information science and art fields. And master's and doctor's course students supported as teaching assistants. The goad of the program is student resource developments for creating attractive contents in the Internet age. Specifically, they are able to learn a tool operation skill, a workflow management skill and a communication skill with persons in the different fields. In short, the purpose of our program is to make student's skill and motivation up. This program consisted of some lectures, seminars and practicum tracks.

2.2 Lectures and Seminars

The lectures consisted of the following three main elements: basic knowledge of intellectual property rights and privacy, relationships of current production situation and the rights and a future vision of contents. The lectures on each topic were given by university faculties and outside lecturers.

Famous artists and professionals were invited to the open seminar series as speakers for this program. The open seminar series were held to provide excellent opportunities for students to learn the real worlds of content creation and businesses from the talks by the guests. The speakers are as given below.

Mr. Akira Tokuda (Executive Announcer, NHK (Japan Broadcasting Corp.)), Mr. Toshiro Uratani (Vice President, TV Man Union Inc.), Mr. Isao Tomita (Composer, Arranger, Synthesizer Player) [3], Prof. Shinjiro Nishida (Kyoto Seika University), Prof. Hiroyuki Moriwaki (Tama Art University), Mr. Seiichi Hayashi (Painter, Illustrator) [4], Prof. Masafumi Kumata (Kyoto Seika University), Prof. Noboru Rokuda (Manga artist, Kyoto Seika University) [5], and Prof. Yvonne Spielmann (University of the West of Scotland, UK)

2.3 Practicum Tracks

The following nine practicum tracks were provided for students, and they could choose one of the tracks and learn several practical skills for creating contents or systems.

(a) Content Production (Audiovisual) Using Archives

(b) Trial Content for Science Communication

(c) Developing Digital Content that leads to Knowledge [6]

(d) Virtual 3-D Design and Realization

(e) Production of Electronic Works and Development of Private Internet Exhibit

(f) Design and Development of an Interactive Digital Photo Frame

(g) Manga Portal / Manga Mall

(h) Interaction Design and Motion Content Creation for Librarian Robot

(i) Producing Media Art Works by Physical Computing

The outlines of these tracks are introduced in this practicum program homepage [1]. In this paper, the details of the track (h) provided by the author is described.

3 Practicum Track: Interaction Design and Motion Content Creation for Librarian Robot

This practicum track was an eight-day a month course in 2008 and 2009. The goal of the track was to provide the students with opportunities to think about human-to-human and human-to-robot communication and interaction through experimental development of a librarian robot. The robot equipped with a stereo camera, a microphone and a laser range finder as external sensors and a natural language conversation system was used in this track. However, this robot system still had several functions to be added and a lot of problems to be solved for practical use. So, at the beginning, students investigated about the functions and problems for this developing system, and chose one of them or found a new theme as his/her own theme to tackle.

In this track, the students are able to learn several skills from programming techniques to processes of product development of a complex system through experiences where they develop a part of functions for the librarian robot. At the same time they are also able to learn the wonders of human intelligence.

3.1 Librarian Robot System

Figure 1 shows a librarian robot system [7] used in this track. This robot had already had basic functions as a librarian. The robot can say greeting properly to a library user as a receptionist by a human behavior prediction function using a laser range finder. She can also talk with a library user by a natural language and search a collection of books through the Internet. You can see the movie by clicking on Fig. 1 (Adobe Acrobat 9 (Reader 9) or higher recommended).

Figure 2 shows a hardware configuration of our library robot system. A manipulator (PA10-7C, Mitsubishi Heavy Industries, Ltd.) was used as a body of the librarian robot. This system has three kinds of external sensors, a laser range finder (LRF), a stereo vision and a microphone. A stereo camera is attached to the arm tip. A microphone is used for talking with a library user. Several information such as book search results is displayed on a LCD monitor.

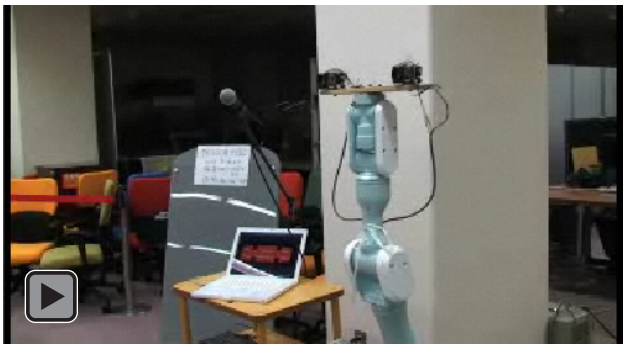

Figure 1: Workflow as library service

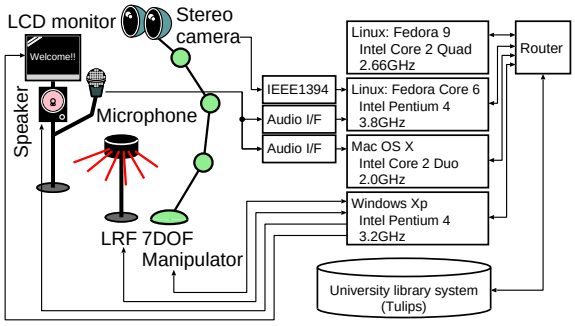

Figure 2: Hardware configuration of librarian robot system

3.2 Results in 2008

Five students joined in this track in 2008. Their chosen themes are described below.

3.2.1 Design of dialogue scenario for librarian tasks

The student who chose this theme was interested in librarian jobs and a conversation between a human and a robot. Since she was in library science field, programming skills were unnecessary for her. Then she learned how to use dialogue scenario generation software, and designed lots of dialogue scenarios for the librarian robot with paper and pencil. Some of scenarios made by her are shown in Fig. 3. She was impressed by the works and complexity of conversation.

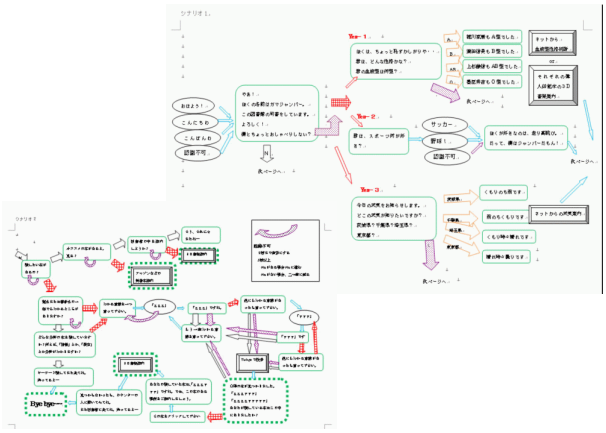

Figure 3: Dialogue scenario for librarian tasks

3.2.2 Weather information collection function from the Internet

This student wanted to learn how to make a client program that could communicate with a web server, and also wanted the robot to talk about a weather topic. Because when we greet each other, many Japanese likes a topic about weather. Then he made an information collecting program of weather in major cities in Japan from a weather information service server. The current librarian robot is able to talk about weather.

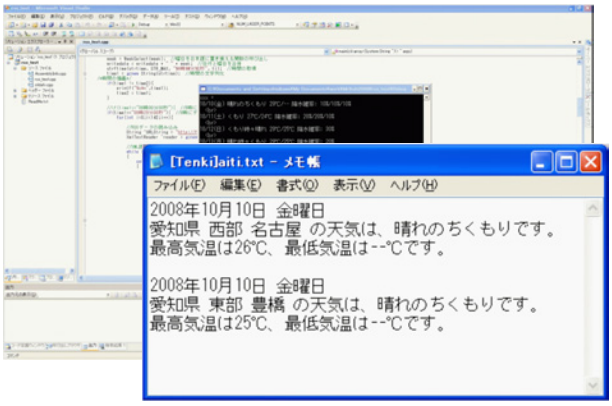

Figure 4: Weather information collection program

3.2.3 Human face extract and tracking function using robot vision

This student wanted to learn image processing, and decided to make a real-time human face extract and tracking program. Since he was in the 2nd grade, it had been supposed that it was too difficult for him. In the early stage, although he tried to use a skin color of our yellow race, it was difficult to extract only human's skin parts as shown in Fig. 5. However he took only a few simple advices, he could make a good performance

human face tracking program as shown in Fig. 6. It was amazing.

Figure 5: Skin and ceiling have same color

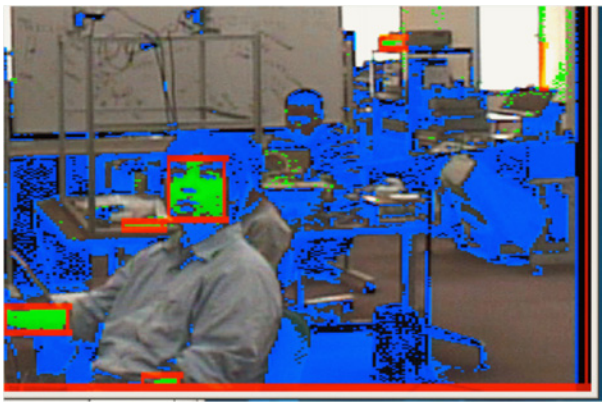

Figure 6: Extracted face part (rectangle in red)

3.2.4 Construction of data base (DB) for book search

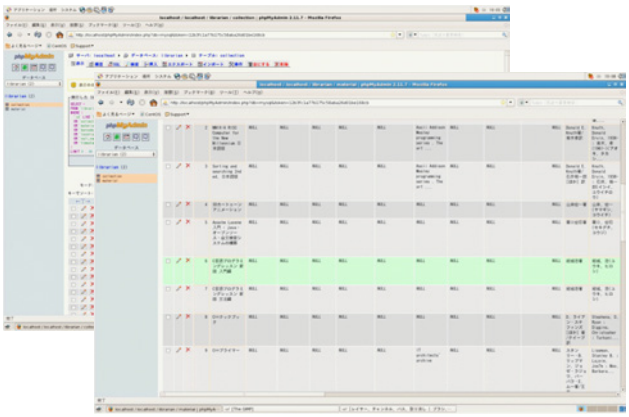

Figure 7: Database using MySQL for book search

Since this student knew about a data base well, he wanted to utilize his knowledge to the robot system. He rebuilt a database using MySQL [8], as shown in Fig. 7, from the official university library database [9] for improving a book search performance.

3.2.5 3D library structure model and guidance animation

The current university library system is able to show 2D map for a library user on a computer display. But it is difficult for an unfamiliar user to understand it for a short time. Then this student decided to improve a library guidance function. He made a detailed 3D computer graphics model of the library as shown in Fig. 8 and a lot of walk through animations for showing a way to a requested book. You can see one of the movies by clicking on Fig. 9.

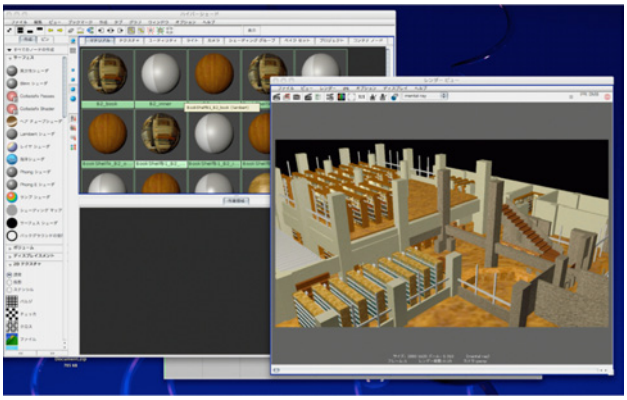

Figure 8: 3D computer graphics model of library

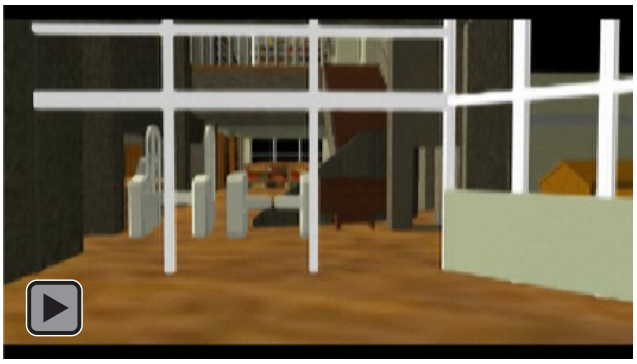

Figure 9: Movie for showing way to requested book

3.3 Results in 2009

Three students joined in this track in 2009. Their chosen themes are described below.

3.3.1 Improvement of dialogue scenario

This student was interested in a conversation between human and robot, and wanted to learn a finite state

machine that controlled robot's reactions during conversation. The idea notes of the state transition diagrams designed by her are shown in Fig. 10. And she improved the dialogue program implemented in the librarian robot system.

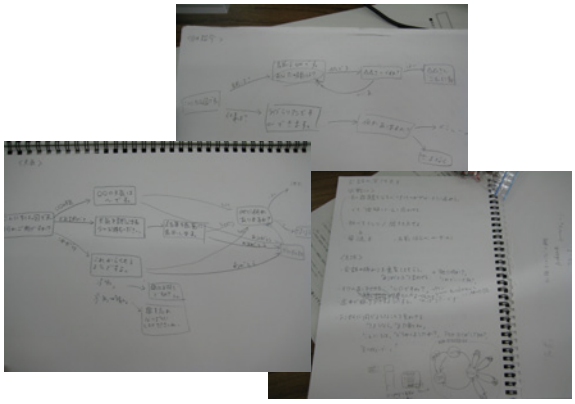

Figure 10: State transition diagrams for librarian robot

3.3.2 Robot motion creation based on teaching-playback method (Teaching system)

This student in information science made a program for controlling and teaching (recording) robot's head motion using a video game controller Wii Remote.

Figure 11: Motion control using Wii Remote

3.3.3 Robot motion creation based on teaching-playback method (Playback system and motion contents)

This student in library science created some friendly and emotional motions of the robot's head, and made

Figure 12: Motion teaching using Wii Remote

a program for replaying the recorded motions. She designed ten kinds of motions for representing emotions and taught (recorded) the motions as motion contents for the librarian robot. Figure 14 shows a scene where the robot bows her head to a library user politely. It is very polite motion to bow his/her head in Japan.

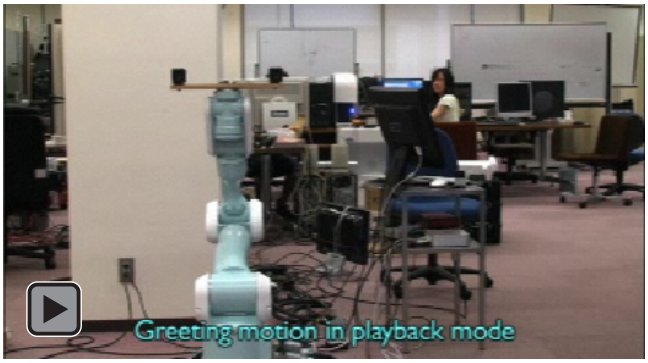

Figure 13: Greeting motion of when robot say hello to library user politely

Figure 14: Joyful motion of when robot can find requested books

4 Comments From Students and Evaluation Committee

The questionnaire results said that more than 98 [%] of the students who joined the practicum tracks received satisfaction with the practicum tracks. The comments obtained from the students who joined this practicum track using the librarian robot and the evaluation committees are described below.

4.1 Comments From Students

- I would like to continue this track. I hope that another opportunity will come, I suppose that it is impossible...
- I could understand what is interesting about developing something little by little, and difficulty about trying to solve problems that does not have unique answer.
- I was very glad that I could have a valuable experience of inputting signals from a sensor and controlling a robot by using a computer and programming. Because there is no lecture or practical training like this track.

4.2 Comments From Evaluation Committee

- I was surprised the idea that robot motions were treated as contents in 2008, and enjoyed the improved functions of the robot system in 2009.
- The student in library science, who focused attention on emotions for the robot, could made the motions of the robot more smooth. This was just the moment when the real purpose of this practicum program "collaboration by students of different specialities" was hypostatized.
- I most expected this practicum track from the point of view of "collaboration by students of different specialities." Because when students tried to improve functions for the robot, they had to consider about mysterious parts of human.

5 Conclusion

Every student was satisfied very much in the track. The students in information science filed enjoyed the latest, rare and expensive equipments, and could learn several techniques. The students in library science field had believed they were not good at engineered approach. But they could find their specialties in an engineering field, and enjoyed it. Of course, their knowledge was very useful for improving the library robot system. Despite a short period, every student could develop a unique function for the librarian robot while he/she learning, and they all were satisfied our unique program. Moreover, we could obtained good comments from the evaluation committee.

Unfortunately, there was no student in art field in this track. I will try to get students in art field next year, and I would like them to design a robot appearance and more human-like motions.

Since the style of this manuscript is different from the style of the author guide, I am going to modify the final manuscript.

Acknowledgments

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We would like to express our gratitude to Research Professor Reid Simmons, the Robotics Institute, Carnegie Mellon University, USA, who offered the IPC library [10] and the people tracking software using a LRF, that are used in the Roboceptionist system [11].

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