

A Survey in Consciousness in Robots and Future of Reception Robots

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Abstract- This paper presents a story about consciousness and future of reception robots. A prototype version of reception robot is developed at university of Essex for university open days and Features that are mentioned in this paper are mostly based on it. Another part of story is a discussion about consciousness in robots. In this part, it is aimed to provide a picture of consciousness and answer some questions about ethical problems that may occur in future in facing robots that look like human.

Keywords: consciousness, reception robot, future robots, ethical problems in robotic.

Introduction:

This paper presents a story about future of reception robots and contains a thought provoking about consciousness. The idea of developing reception robot attracted many attentions in business and it is because of potential market which is expected to grow exponentially in future. Background of this paper is a reception robot that is developed and implemented in university of Essex by a group of master students¹. The aim of project was to design and implement a reception robot for university open days to interact with students and visitors. For this purpose, ScitosG5 from Metralab was chosen as platform. ScitosG5 has a mobile base and a Philips iCat android is installed at the top of the robot for facial expressions. Robot can wander environment and detect users. To detect user, face detection by vision techniques and leg detection by using laser scanner were employed. A ring of sonar sensors in combination with laser scanner is used for obstacle avoidance. There is also a graphic interface unit (GUI) which is designed to show some pages on the screen to communicate with user. This robot also provides speech ability. This software plays a key role in interacting with users. A more detailed discussion about features of reception robot and system architecture will be in section 1.

Section 1 of this paper is background which discusses about features of reception robot. Section 2 is story. This story outlines the future development of a reception robot by using current technology. Features of reception robot which are presented in this story are potentially existed and some of them are implemented in the prototype version which is developed. In the prototype version, robot is connected to internet therefore information and services that are mentioned in the story can be provided by using internet. A software can manage the graphic user interface unit and obtain requested service and respond to user by voice or by showing a message on screen. As long as reception robot performs as a **gate** to databases and services, it can have many applications. The prototype version of reception robot was implemented at robot arena in university of Essex fully and tested many times to provide an estimation of performance in practical applications and satisfactory results obtained.

Next part of story is a discussion about consciousness. In this section it is aimed to draw a picture of consciousness and answer this old question that can robots take control of human being in future? Another aspect of story is ethical problems in facing robots which look like human and it is tried to find an appropriate answer. At the end of story there is a discussion about physical and metaphysical characteristic of consciousness.

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1. Background:

The background of this story is a project which was about developing a prototype autonomous mobile robot that can interact with the world through gesture expression, visual display, facial expression and physical motion. It is intended to be used in university open days to interact with students. It can greet these potential students and answer their questions about the courses.

The robot consists of an iCAT android that has a cat face and a mobile base that can move around indoors. The major challenge in this project was face detection and recognition using image processing techniques, specially focused on new algorithmic approach to track people, predict their behavior and react appropriately.

The project will contribute the improvement of the university open day events for students who are able to interact with the robot to obtain necessary degree course information.

The Philips iCat android comes with a “Scitos” mobile base which has two wheels and 24 sonar sensors. It also comes with a linux operated pc with many available ports in which many different hardware can be plugged in. One of these is the Laser scanner which is to be used in the assistance of object avoidance and leg recognition. Another is the touch-screen which is to be used for the GUI.

Webcam is used for vision purpose i.e. it can identify people. Sonar and laser sensors are used to avoid obstacles and allow a safe wandering path. Facial Features is required to greet people with expression. Touch Screen is used to provide interaction to user, for taking input and displaying information.

First, the robot detects the visitors’ faces and selects one that is detected the best, and then the robot moves toward the person. On the way, the robot should avoid all obstacles between it and the person. As the robot reaches the person, if the student shakes his or her hand, the robot will say hello or welcome to the student. Then the student can choose which information he or she needs from the screen (e.g. the information about the course of undergraduate and postgraduate, the research group and the academic group). After the student has finished his or her inquiring, the robot will wander again and begin to search the next target. In addition, if one student consumes much more time on demanding, the robot will remind him or her and go away to find the other students.

The reception robot is completely autonomous mobile robot. It performs many complex information-processing tasks in real time.

The default state of robot is in wandering, which is also the initial state in which robot will look for any face in the nearby area. The face up to 2 and half meters can be detected by sensors. While the robot is wandering in its boundaries, robot checks whether the input data from sensors is obstacle or face. If the input is obstacle then motor control commands are sent to move the robot away from the obstacle. If the input is face then the motor control commands will be issued to move towards the face. The robot will move forward to face until it detects the legs at half a meter distance. When it detects the legs the robot state goes to stop i.e the robot does nothing at this state.

When the robot reached its goal, it first checks for hand gesture. If a hand gesture is there then robot greets the student in front of it. A touch screen application is executed to establish communication between user and robot. Robot is able to give information regarding the university.

Robot can communicate with a single student for 10 minutes .Each time during the communication this time constraint is checked .After 10 minutes robot executes a good-bye application and starts its wandering behavior again.

While the robot is wandering, it checks for boundary conditions .If it exceeds the limit on wandering left side then control commands are given to it to turn right, if it exceeds the limit on right side then it is controlled to turn left. If it approaches corner limits then control commands are issued to turn around.

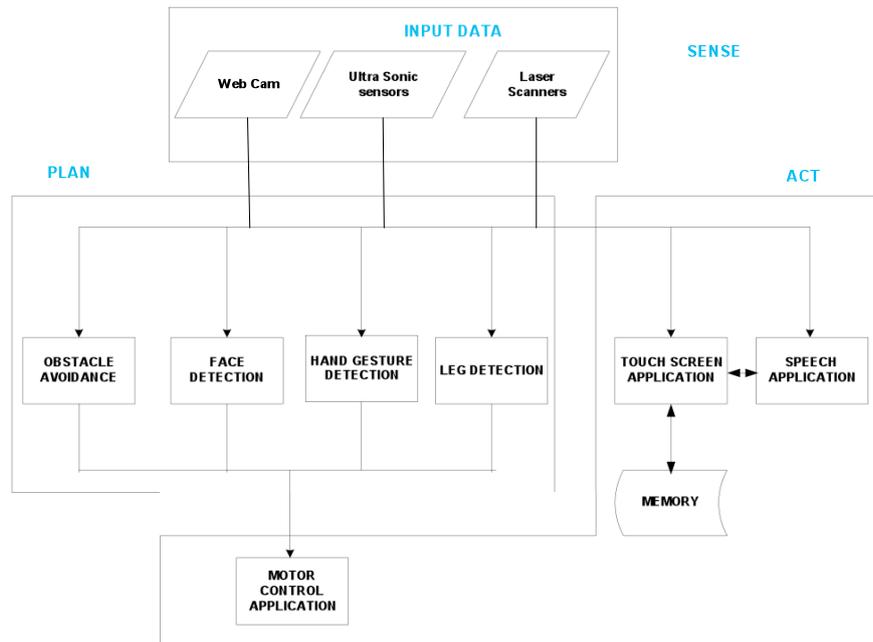


Figure 1 - System Architecture

Above figure shows hierarchical system architecture. Sense task is to acquire the input from 3 types of sensors. These can control the motion of all moving parts and can detect the current difficulties and send information to Planer to react and take appropriate action. In plan section, Planner takes the information from sensors and interprets the information to detect whether it is an obstacle or face or hand or leg. It takes any further decision after interpreting the input data and then sends high-level information to the ACT module. Act involves the actual task related to Robot low-level movement and control; it receives commands from planner and acts accordingly. These commands may include Move Forward, Stop, turn etc. The module is also responsible for interaction with user.

2. Story:

Jacob and Zed enter to an organization's building. When they enter a robot approaches to them.

Jacob: what is this Zed?

Zed: This is a reception robot. Haven't you see some of them around? These days where ever you go you can see some of them.

Jacob: Well I noticed them but to be honest, I always was afraid to start interacting with them.

Zed: Why? These are really useful tools that provide excellent services.

Jacob: What do they do?

Zed: Let's start with this one which is standing In front of us. Hello.

Robot: Hello. What can I do for you sir?

Zed: What are you doing here and what is this organization about?

Robot: Here is university of Essex and I am Rex. I am here to provide any information that you need and also provide some services which you may find interesting.

Zed: Do you know where the income office is?

Robot: Yes, income office is in fourth floor of this building. Would you like I guide you to there?

Zed: No thanks. Do you know if I want to register, where should I go?

Robot: You have two options. You can go to registration office then you must have your ID and related fees in your hand or you can register here and in this case, you must have your electronic ID.

Zed: How can I pay?

Robot: I have embedded ATM. You can pay or withdraw money by credit card.

Zed looked at Jacob and Said: what else do you need to know?

Jacob: It is really impressing. Can it provide some information other than this organization?

Zed: Sure why don't you give it a try?

Jacob looked at robot and said: Do you know when world war two ended?

Robot: World War 2 ended at 1945.

Jacob: where is the nearest restaurant in neighborhood?

Robot: In this map you can see where we are now and red point is nearest restaurant. Below the map is restaurant's menu.

Jacob: Can you call a taxi for me?

Robot: Yes, if you like, I can reserve a table in restaurant.

Jacob: No thanks. What is the result of Japan football league?

Robot: Today is final match and up to minute 63, Yokohama is 2 and Honda is 1.

Jacob: Can all reception robots do same things that you do?

Robot: There are many types of reception robots. Depends on application, we are customized. I am a reception robot for organizations. Based on organization that I am working in it I can have different identities. I also can have different identities at same time. There are some reception robots that you can use at home. As in one, reception robot for home. It is designed for old people not to feel alone. It also can provide some services like hoovering and massage.

Jacob: Massage?

Robot: Yes, actually massage program is the most popular one.

Jacob: What did you mean by identity?

Robot: In post office I can work as post officer and in police station I can perform as police officer. At this organization I play role of information center.

Jacob looked at Zed and said: These robots are not passive. They have same functionality that human have. Maybe in future, they protest for same right to humans. What will happen if I kill a robot? Is it a crime?

Zed: To answer this question we have to know what robot is actually. Do you think what is the difference between you and animals?

Jacob: My behaviors and my thought.

Zed: Let's call this collection of behaviors and thoughts consciousness. So can you give me some examples?

Jacob: Yes, I think. I can plan, decide and etc.

Zed: Well, animals can decide too. What is something that animals cannot do?

Jacob: I think animals cannot imagine or dream. There are also some other behaviors which belong to human like praying or love.

Zed: Do you think praying and love and imagination are something physical?

Jacob: No

Zed: And praying and love are two element of a bigger collection that we called it consciousness?

Jacob: Yes

Zed: So we have some metaphysical elements that are member of consciousness. But, do we have any physical member of consciousness?

Jacob: It is difficult to define because when we wanted to define some metaphysical elements, we used animals as standard but in this case most of physical behaviors between human and animals are same. If we want to import some physical elements to our collection we have to accept that animals have consciousness and this will be in paradox with pervious assumption where we said consciousness makes difference between human and animal.

Zed: Consciousness is collection of specifications. This collection is big enough to cover all human specifications. When a collection is big enough, then it has some sub collections and this does not mean that sub collection is equal to collection.

Jacob: You want to say that these two sub-collections, physical and metaphysical collections, form a bigger collection with the name of consciousness?

Zed: Yes but we can investigate on this question later. So, what is the physical member of consciousness?

Jacob: I think physical movements are member of consciousness. There are also some other members like recognizing physical objects and physical specifications like color, taste, shape and size.

Zed: Excellent, lets back to question that you asked about is it a crime to kill a reception robot. Do you think it is a crime to kill animals?

Jacob: Well, I do not like it but human kill sheep and cows and it is not crime.

Zed: As it is obvious, killing other people is a big crime and main difference between animals and human is consciousness. Do you think this robot have consciousness?

Jacob: Well, according to our collection, this robot has only physical consciousness. For example, this robot can't pray or fell in love. If robots wanted to adore, they would adore God or their inventor?

Zed: That's the key. They do not have metaphysical consciousness to find their way. Even if they be programmed to believe in something, it cannot provide motivation to do extraordinary things like human. I mean it is not just about believing. If robots

could be programmed to fell in love, it would not be same as human that take different affects on different persons and provides different levels of motivations.

Jacob: But many people think these robots have consciousness.

Zed: They have consciousness but only physical consciousness. Can you say that if something has half of specifications in a collection, it has all specifications of that collection?

Jacob: No

Zed: So robots do not have full consciousness. All creatures have a degree of consciousness. Consciousness is a collection with two sub collections and robots can have only physical consciousness. Full set of consciousness belong only to human and this unique collection of all specifications is very valuable. If something has lower degree of consciousness is not as valuable as full consciousness. Do you think it is a crime to destroy a robot?

Jacob: No, but anyway you have to pay fine in return. But hold on, you said that consciousness has two subsets of physical and metaphysical attributes. What if metaphysical attributes are caused by physical attributes? For example in the case of love, we put it in metaphysical attributes, what if love is just because of some chemical reactions that happen in body? What if there is nothing metaphysical about love?

Zed: To answer this question, let me ask you another question, what will happen if I insert a big needle into your foot?

Jacob: It will be very painful for sure.

Zed: If I hit on your foot with a hammer, will you feel same pain? I mean the type of pain will be same or different?

Jacob: These are two different kinds of pain. Hitting with a hammer on foot or inserting needle, both cause pain but types of pain are different.

Zed: Yes. There is no doubt about this fact that inserting needle into your foot and hitting your foot with hammer are physical actions. Can you doubt about existence of pain?

Jacob: definitely not.

Zed: So you are sure about existence of pain, can you express type of your pain? For example can you say when my foot was hit with hammer my pain was in category A and when needle inserted it was in category B or I had blue or green pain?

Jacob: Not me and no one else cannot express pain or classify it in such way.

Zed: Why it is not possible to describe pain? Everybody experiences pain, why no one could not describe pain during centuries?

Jacob: I think Pain is personal experience that human cannot find something similar in nature to describe pain based on it. In describing nature or a phenomenon, there are some physical elements that we can use them to describe that phenomenon. For example to describe an object we can express physical characteristic of object like size and shape and color. In the case of pain we do not have such physical element to describe it.

Zed: So pain does not have physical characteristic. If something does not have any physical characteristic or feature, can we say it is physical?

Jacob: Certainly not. It will be metaphysical.

Zed: So nature of pain is metaphysical. This fact that pain was created by a physical action does not change the metaphysical nature of pain. So in inserting a needle into your foot a physical action caused a metaphysical phenomenon. What is the physical element in this experiment?

Jacob: probably my foot's nerve.

Zed: What if I do this experiment in situation that you cannot see your foot and I tell you that I am inserting needle into your foot but in fact I do not. Will you feel pain in this case?

Jacob: Maybe, some people may feel pain because they believe a needle is in their foot whether it is or not. Even you may tell to someone there is no needle and he does not feel pain but actually there is needle in his foot.

Zed: Nature of pain is a kind of feeling, can we say feeling is metaphysical?

Jacob: Yes I think feeling is metaphysical.

Zed: Well, we have a physical and a metaphysical attribute which are related to each other but occurrence of metaphysical attribute can be independent from physical attribute. Let's go back to the set that we defined for consciousness. The set had two subsets of physical and metaphysical elements. In the case of pain an element in metaphysical subset had a pair in physical subset where nature of pain in principle can be independent from nerve or physical element. Now let's find an answer for the question that you asked about love. In that question you said that if love is created by a chemical reaction in brain therefore love should be physical and there may be no metaphysical thing at all. We assume that love is created by a physical action. Is love a feeling?

Jacob: Yes love is a feeling and we concluded that feeling is metaphysical.

Zed: So here we have pair which is consisted of a physical and a metaphysical element. What can we say about this pair?

Jacob: The elements of this pair have correlation but based on this fact, we cannot judge about causation of one element to other element.

Zed: I think we have the answer now. If a feeling is caused by a physical action it does not mean that feeling is physical and nature of that feeling is independent from physical action.

Jacob: Yes you are right. Anyway, do you remember why we came here?

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