SOFTENG 702 Seminars: Human-Robot Interaction

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ABSTRACT

Robots has been an popular topic for human since 19th centre, area such as science, fiction and novel, movies, education and helth. Robot can have many forms, it can be in shapes of something or animal or even human. Most of robots are built to assist human, to help human perform tasks in some of the area. But do we really want robots in our everyday life and do we really need them? Clearly robot have its advatages and we do believe that robot can be used for something good but when we find it is usefull to us, it also comes with risks and problems. We need to carefully analyse those advatages and disadvatages before we can decide whether to use these robots or not. There are lots of assistive robot designed from the past few years such as Aibo and Paro, a lot of studies have also been done on those robot pets by choosing specific people. It is clearly that there are positive results have been found by using those robots which improved qualities of life for human, but there are also problems witch has not yet been solved.

INTRODUCTION

Studies and researchies has been done in robotic field try to put robots in human's daily life. Up till now, robots are developed for washing, lifting, carrying, mobilishing, companioship and monitoring health. Those robots are great help for human and each of them perform different kind of tasks, some of these task are even impossible for human to be done. Robot can be very usefull to human, it can perform jobs or tasks automatically or by remot control, it can make human life so much easier and it can also be help to improving the quality of life. But there is no one robot that can satisfies everyone or everything. There are many advantages of using robot. Robot can squeeze into spaces too small for people to enter, it can be sent to areas too strcturally unstable or contaminated for safe navigation by human, it can also be send to environment which is not sutable for human or environment that is not possible for human to servive on it. Robots comes with many forms and are used for different perpose. There are robot arms for constrction site, vehicle like robot for searching, pet like robot for entertaining and humanoid robot for educational perpose, public services and also for health care perpose.

A lot of studies has been done which aims to help people, typically with robot pets like Aibo and Paro. Aibo is a dog like robots, it can produce an affectionate high pitched squeal, and it has sensers and camera that can "see", it can run, wag tail and it can also pick up balls just like a real dog. Paro is a baby seal like robot, it can sense a user;s touch, it can recognize a limited amount of speech, it can expresses a small set of vocal utterances and can also move some of its body parts. Those two robot pets are all designed to company children or elderly. They interact with people and also bring people together because it act as a common object and common interist amoung people. Interacting with robot in this way provide some health benifit to those people who was feel lonely before.

Robot can do so much including tasks that is impossible for human. In this paper, we will concentrate more on humanoid robot and robot pets that is designed for children and elderly. We will discusse some of advatages and disadvatages of those robot when interact with human base on

other people's previous studies and works. We will talk about some important features such as characteristic of both robot and human and how those robot can be used for educational perpose and health care.

HUMAN FACTORS

Human factors are the most impoertant things and it need to be considered in the human-robot interaction. Human is the most important element and what we try to accomplish in our goal is making robots more human-like where robots can create a comfortable experience to user and also provide an appropriate feedback. And what is eaiser for human other then human-human interactions? Thus any robot design for human should follow the social rules of human-human interaction and any of the human factors should be first to be consider in the design. When we build humanoid robot, we need to analyse the characteristic of human such as human's body parts, where are joints, the angle of rotation and dimentions. We also need to know the movement of human and reaction of human.

For example, robots has been used to encourage child with autism perform daily human social interactions. Autism is an autistic spectrum disorder with a range of manifestation that can occur to different degrees. Autism is a lifelong developmental disability that affects the way a person communicates and relates to people around them. It is clearly that we need to fully understand the symptoms of people with autism, what kind of behavious and what sort of disabilities they are most likely to have. Thoses human factors plays an important rules when we design our robots.

Other example is using robot for the health care of elderly people. It is a fact that most of elderly people tend to be weaker then normal average young people and adult. they are tend to be weaker in strength and move slower and also more easier to get hurt. It is important that we consider those human factors in our design such as soft surface or slower motion of the action, so the robots we design can be fit to the purpose.

ROBOT FACTORS

Since there is no one robot that can satisfies all the requirement, each robot design will have different characteristics and different abilities to interact with. When we designing a robot, it is important to know the limitation of robot hardware, software, interface and the environment that we will be working on. Robot's appearance might be less important than the fuctionanity that it provide but it is also an important fact to be consider in some of situations.

The most interisting characteristic of robot would be the AI (artificial intelligence). AI can be in many different forms but there is one common feature in all of AIs, that is it provide different options. For example, a chess-play AI, it can perform calculations and choose what to play for next move. Not all of the robot will have AI implament in it since some of the task is very straight forward, for example, lifting. But it is a good idea in some of the cases to have AI in the robot expecially for humainoid robot, which adds more characsitc to the robot and also make the robot more like human.

Sometime the robot characteristic might be dependent on human factors when we consider in humanoid robot or when we try to simulate human performance. Since we trying to make the humanoid robot like a real human, all the human characteristic such as joints, movement, movement angle, size and maybe strength will be considered as the robot characteristic.

The goal is to build a robot that is easy in communication thruogh speech, gesture or facial expression.

ROBOT FOR CHILDS

Logitudinal study for child with autism has been done by Robins B, Dautenhahn K, te Boekhorst R, and Billard A. Child with autism were exposed to a humanoid robot over a period of several months and this particular robot is used as therapeutic and educational toy, trying to encourage children to perform basic social interaction skill.

Some psychological studies have shown people with autism generally feel comfortable in a predictable environment and they are specially

enjoyed interacting with computers since computer response is predictable. In this particular example, it is a good idea to use robot since people with autism sees robots as non-human object and they feel more comfortable to interact with robot rather then human.

The study uses a humanoid robotic doll which have a human like looking in the trials and the unpredictability of robot's action was slowly increased over a period of time. The result of observation shows some increases in the interaction between child and the robot, interactions including eye gaze, touch, imitatin and near. And this result shows that autistic chirldren improve their social responsiveness when they are being imitated.

This would help child with autism to learn human social skills and as the unpredictability is increase over the period of time, the child will slowly get use to it, so they are more comfortable in human's wolrd over the period of time. And as they feel more comfortable the social activity oppoetunities will increase.

ROBOT FOR ELDERLY

Sociable robots are used for health care. Various studies shows that elderly people are often lonely. The idea here is using robot pet to give elderly people companies which aim to decreases stress level and so increase in happiness.

Robot pet such as Paro (a seal like robot) and Aibo (a dog like robot) are widely used in the studies of interacting with elderly people. One of the study done by Kidd CD, Taggart W and Turkle S in two nursing homes is particularly use Paro as their test subject. The results shows that there were some obvious interaction and communication after Paro was introduced to elderly people, especially when Paro is turn on. The increase in social level among elderly are due to exchange information, feeling and experience with each other.

Elderly usually sees the robot as a real pet that is dependant on them, they would try to talk to it and "take care" of the robot. The robot then become part of elderly's life as elderly doing activities with robot pet together and finding any new features of the robot pet. As a reslut, the robot pet forms a common object among the elderlies which increase the social activities among elderlies by exchange information and feeling about the robot pet. Since more socail opportunities here for the elderly, it decreased loneliness of elderly, it increased health by decreased level of stress and provide more positive mood and leads to more positive thinking.

ROBOT FOR OTHER USE

There are robot that is used in other area. Each of different situation have develop different robot to perform some specific tasks.

Robots are used for rescue and search perpose in the emergency. The world Trade Center disaster was the first known use of mobile robots for urban search and rescue. Robots are send into collapese structures because it can entre places that is too small for human or places that people are not permitted to enter because fire have not yet been put out or the structural is too unstable. Those little robot have cameras and thermal imagers which can take pictures of the collapses building from inside and use thermal imagers to detect any survivors.

There are robots that are used in industrial perpose. Those robot tend to have a robot arm that has a shape of human arm. These robot can perform lifting, carrying or some ohter small tasks depending on the job and the size of the robot.

Robots for minitary use includes vehicle form and airplane form. Those robots generally have cameras and radar on it and some of the robot might even containe firearm, it normally used to detect movements and capture images.

Robots are even used for outer spaces such as moon exploration and Mars exploration. Those robots are specially designed that has some wheels to move around and explore, they also have some robotic arms that can pick up samples from outer space, and cameras that took photos.

PROBLEMS

There are lots of problem when using robot. Some of the problems are closely related to human, some of the problems are more general.

The main problem we concerned is safety. Safety is a big issue, critical situation in which a run-time error could result in death, injury, loss of property or environmental harm. We cannot give any gunrentee of safety because there are a lot of unpredicted factors that might result in something we never through or never face before. Situation like this, we can only used common sense and past experience to provide more safety to our user.

There are some other general problems which may not cause any harm to human but still something that will decrease the performance of the robot. For example, using the Paro at nursing home for elderly peopl, some elderly will try to put Paro into water just because it has a seal like appearance, so they try to make it swim. Because the way Paro was designed, put it into water would cause it to malfunction. Some people even think Paro would bit them because seal is a type of wild animal, but of course Paro does not have any teeth and it cannot perform action like bitting. And robot pet is too heavy for some elderly to pick up this would result in decrease in interist of the robot and hence the robot pet cannot give any companies for those elderly. Other problems that is not controlable by the designer such as some people does not like animal and some people think toy is for kids that it is not appropreate to play with.

There are some other problems that is more serious to human, problems such as ethical problem. Ethical problem is not something that can besay as right or wrong, it is very complicate since every individual person has slightly different view about any particular thing, we can only rely on the feedback of people or what the most people agree with and the law if there is one for any given situation. Those ethical problems may include rection in human contact, loss of privacy, personal feeling and freedom. For example, in order to monitoring health of elderly people, some robot pet have camera instell on it. This maybe a good idea since nurse or relative can watch elderly through the camera over distance, monitoring their health and knowing what they need or when they need. But this results in loss of privacy which some people does not feel comfortable.

CONCLUSION

There are clearly some good in use of robot and some bad in use of robot. Advantages such as improving qualities of life, increase interaction oppotunities, make human's daily life easier, performing tasks that are impossible for human, disadvantages such as robots are not as robust as human when performing different jobs, each robot might only able to do a small area of job and the cost of building a robot might be greater then having human to do the task.

A lot of studies has been done on these area, but there are some factors that has not been considered when doing those studies. For example, lots of studies of using assistive social robot are done by targeting elderly in the nursing homes not with elderly live in their own house, but in the reality people prefer to live in their own house rather then sheltered homes or unrsery homes, this might result in a situation where one of the elderly is using robot pet but non of it's neighbour have robot pet, and so the robot cannot become the common object between people and thus it cannot increase the communication opportunities. Other factors such as a lot of studies are using Aibo or Paro robot, that means little has experiment on different form of robot, we do not know if the robot pet actually capture people's eye or just because it look like a popular type of animal. And factor such as a lot of studies has been done in japan, maybe different cultures have different view to robots. Also let's not forget if we use the same robot to different age group we might have different results. If the robot pet is used on little childrens there will have different problem because little children have limited knoledge of the robot and the technology, they are likely to overestimate the abilities of robot, and there is a risk of children spend too much time with robot since they have not yet completely learn the human-human daily social interaction.

Althought with those problems, we cannot denial that robot does bring some good to human, it help improving quality of life and make people's life easier. It is good to human if it can perform the task it was designed to perform whether in areas as industry or minitary or

education or health care. But with all those factors that are not considered in the previous studies, we cannot conclude that same robot will have same effect and advantages for all people. We can only say that those robot will have some positive result for some of the people in the particular situation. But we know in those situations, the robot will interact with human in a good way and we will definitelly get some positive feedback.

FUTURE WORK

There are a lot of work to be done in human-robot interaction. Althrough a lot of studies have already been done but there are details and specific areas where no one or little work has been done. As discribed above, there are some important factors that is not considered in the previous studies. We need have studies in more details when we want use the robot for all of people in the wolrd. There are also many areas that is a good idea to have robot performing jobs for us, such as household robots, informational robots, communicative robots, educational robots, robots for disabilities and also scientific exploration robots. For example, people in wheel chair often find places with stairs is a big problem for them, and in the reality there are a lot of places with stairs like some bank in the city area. It would be nice to have some sort of robot that can lift the wheel chair for them. But the most difficult in human-robot interaction would be make the robot naturally social with human.

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