RAFS - Robot Aided Feng Shui

Social Implications Document

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1.0 Introduction:

Every topic in computer science has some sort of social implications that need to be considered at some point when conducting research. There are two distinctly different types of social implications that may arise, those which are a direct result of the current project, and those which result from the field in general. In this instance, we will be looking at the social implications of the RAFS project and the social implications of the robotics field as a whole.

2.0 Specialized Knowledge:

The skills gained while working on a robotics project tend to be specialized to the area of robotics and Artificial Intelligence. Porting concepts from this discipline to other areas of computer science may be difficult. Robotics applications are unlike many other computer science applications in that they require the use of real-time programming (RTP) techniques. While RTP is not widely used thus far, it is a programming technique that will become more widespread when embedded computer devices are more commonplace.

This argument could be countered quite easily. The Computer Science Department at SIUE is pursuing a strong robotics program because they feel it introduces students to many programming concepts. I will be interesting to watch how this program benefits the students whose interests fall outside the realm of robotics. While it may be beneficial to students who find robotics interesting, it excludes a portion of the Computer Science student body who find robotics uninteresting.

3.0 Interdisciplinary Experience:

Robotics is a research field for many engineering disciplines. As a result, people from many types of backgrounds may collaborate on a project. A common problem among engineers is communications between different disciplines. A project may fail because of a failure to communicate, rather than incompetence of the engineering staff. Increasing the communication between engineers will improve the likelihood of a shared vision and that project specifications are adhered to. When computer scientists have some insight

into other engineering disciplines they may be better prepared to diagnose problems in an application. In the case of the RAFS project, suppose we receive an error when utilizing the camera device. If the code seems error free we could work with a computer engineer to verify the camera device driver is returning accurate data.

4.0 Introduction to Computer Science Research Topics:

Many students are not completely sure what they would like to research until they are actually participating in a project. By providing research projects in robotics, SIUE is helping students evaluate the possible options for research. This provides the student the opportunity to consider the field and determine whether or not they would like to continue working with robotics. This trial basis provides students a chance to work in a specific field of computer science without committing their career for an undesired amount of time. This is also useful to allow students who are mislead by the glorious image of robotics. Media hype tends to portray the robotics industry similarly to the video game industry. Television shows like BattleBots may have students mislead into thinking they will be doing this kind of work with robots.

5.0 Artificial Intelligence:

In Mary Shelley's "Frankenstein", Dr. Frankenstein became completely terrified of his creation that he fled, leaving the creature to provide for itself with no one to care for and teach it. The monster then implements a terrible vengeance on its former master. The same ethical question is relevant to us in the present day. If we can create machines that think and feel, we must be careful how we treat them or suffer the consequences of how they treat us.

6.0 Economic Concerns:

Automation has had both positive and negative consequences throughout human history. First, it has made many jobs safer for people and also more economically efficient. Robots and machines took the dangerous jobs formerly held by people and made formerly labor intensive jobs quick. For example, garments and fabrics used to require the skills of specialized tailors, but the cotton gin made fabrics available to the masses.

Secondly compare the number of human coal miners today with those of a hundred years ago. There are significantly less human coal miners today partly through automation and also through more efficient technologies. The equal concern applies to University robots. Robot's could take the place of not only maintenance personnel but also could take the place of student employees and possibly instructors. While this may have positive effects for university cost, the cost to employees could be devastating.

7.0 Emotional Concerns:

Humans need contact with other humans to live. Without person to person interaction, people can become depressed and sick. If robots become a larger part of human beings day to day life, people may become nothing more than machine operators. This is part of the danger of automation, and the lack of human contact may cause people's emotional and mental health to suffer.

8.0 Broader Programming Exposure:

One of the many issues of this project has been that ¾ of the team has had little or no experience with a UNIX operating system. This has caused great difficulties in development and also testing. Therefore, one of the conclusions that we have made from this project is that the Computer Science Department should offer (or compel) its students to have broader exposure to other operating systems and development environments.

9.0 Real Time Programming:

Another issue that has come up is Real Time Programming (RTP). Real Time does not necessarily mean "very-fast". However, it does tell us that the order (sequence) in which events occur are important. In some cases, pauses between modules would block the other module from acquiring shared resources such as the laser, gripper, and camera. While these issues are considered in the 414 operating systems class, more could be added to help with this topic as it affects almost all large scale programming.

10.0 Assisting the Disabled & Elderly:

One of the more positive aspects of robot's increased involvement in our lives is the

possibility that robots can assist the disabled and elderly to have a more normal life. For example, a robot could help hold open doors for a person in a wheel chair. A robot could "walk" elderly people at nursing homes where staffing is always difficult and thus ensuring safe exercise for the nursing home residents. Another implication is that robotic prosthetics could replace current conventional prosthetic limbs, allowing people who have been lost arms and legs in devastating accidents to have new arms and legs.

11.0 Liability:

Any product that is sold on the open market today has certain liabilities against it. The same is true with robots. This issue is very important if while during the normal operation cycle of a robot it injures or kills someone or destroys property. If this unsavory event happens, who is responsible? Is the manufacturer of the robot responsible for making a "faulty" product? Is the programmer of the robot responsible? Is the user responsible for not having adequate training or poor judgment? These issues are the largest Pandora's Box for robots in general.

12.0 Power Concerns:

Robots need power. It must come from somewhere. Whether they are electric and powered by rechargeable batteries, or if they run from gasoline or diesel generators, they must have energy to run. This power issue began to come to light in 2001 during the California Power Crisis. Our current power grid is already becoming over taxed with large quantities of electronic equipment and many homes having multiple large power consuming devices (i.e. multiple refrigerators and freezers). If there are more and more robots consuming power, there must be some entity generating that power. Second, there must be a transmission system to deliver that power.

13.0 Critiques from Team Members

Brad White

The long range social implications that are most prevalent to this project are the Power Concerns and help for the Elderly & Disabled. These concerns are most prevalent for many reasons. First, having personally dealt with elderly people and observing nursing

home care, the idea of robots helping elderly people safely get exercise is exciting and very positive. Having seen the positive effects of 15 minutes of exercise three times a week on an octogenarian, the increased health and mental activity of more elderly exercise makes the use of robots a very positive tool for the aged.

Second, last year's California power crisis has shown that electric power is difficult and expensive to generate, and has environmental concerns to its creation (i.e. nuclear waste, smoke stacks from coal fired plants). This begs the question if we can really afford more electric and electronic devices when desktop computers and servers consume such a large percentage of our generated power. If we need these robots, we must also find a way to power them.

J.D. Pohlman

As far as the implications of our specific project go, I think that a broader programming experience to UNIX would have helped out. We had one member who actually knows UNIX, and he was indispensable to our project. He helped to reduce the learning curve for the new programming environment. If he was not in our group, we would have had to taken the time to learn the UNIX environment, which could have taken an enormous amount of time. If we have a question to this day about how something works in UNIX, we can simply ask him how to do it, as opposed to researching the topic for hours on end.

With robotics in general, I think robots could help out the economy. They could help people with disabilities to get around. A good example of this would be the mailman robot. Robots were developed that a mailman can stand in, and drive around. This makes it easier for him or her to get around, without getting tired and not being able to finish the routes. Robots can have a bad effect on the economy as well. Automations of robots can lead to ease of life for people. This could lead to society becoming lazy, relying on robots to do the dirty work while the people just sit.

Artificial Intelligence can have a major role on the state of robotics. If a robot can be programmed to “think,” where does it end? What if a way is developed to get the robot

to feel emotion? An example of this would be the movie, "A.I.: Artificial Intelligence." In the movie, the boy is given feelings, and he can love people. This had a major psychological effect on his "mother," or the person who adopted him. What could happen to our society if robots were given the ability to love? Sound like a long way off? Did people ever think robots would be able to run by themselves, without any interference from people? Now they are. Time will only tell what else can be done in the field of robotics.

Peter Motykowski

My concerns focus more on the questionable aspects of the robotics discipline. While I appreciate SIUE investing in quality robotics equipment, I would like to see funds more fairly distributed to obtain other types of Computer Science related equipment. Since robotics courses are electives and users are a focused interested community at SIUE, I find the 3 robot fleet to be a bit excessive.

Robotics and automation is something that scares me when evaluating the status of the world economy. Any technological advance that threatens the position of the semi-skilled laborer is something that needs to be considered. These technological advances usually stem from the financial resources of those whom will benefit most. For example, large corporations lead research in techniques to automate elements of production, therefore making labor costs cheaper. The motives for this development are questionable. Are we seeking safer alternatives for risky labor, or are we seeking options to maximize profits by putting semi-skilled laborers out of work. It depends on the context of the automation, however much automation has been selfishly motivated with the intentions of cutting labor cots. I do realize that not all robotics research has malicious intentions. However, participating in the discipline inevitably provides fuel to the fire in the form of research and development.

I am very happy about the operating system we worked in on this project. Not only did we further our UNIX skills, we were able to get more familiar with the Linux implementation of UNIX. While the entire team did not gain the skills I did as the robot

administrator, we still managed to gain a fair amount of exposure to this gem of the open source community.

Matt Allen

SIUE's CS department covers many topics in computer science; however, most of these involve work in the MS Studio C++ development environment. Having been plunged into a robotics project that is largely developed in the Linux environment has proved to be quite a challenge. Fortunately, we had one team member that was proficient in this programming environment. Our curriculum definitely could use a course to develop fundamental UNIX/Linux skills. Some other languages could also stand to be incorporated into our curriculum. Topics classes are offered that occasional will cover other languages such as Java, but there need to be more frequent availability to such courses. A Broader programming curriculum would better prepare students for a career in computer science.

RTP is an issue in robotics. RTP brings about many issues that are not countered in non-RTP development projects. Time is of the essence. In most development, time is important, but in most RTP projects timing is crucial. In our project, the robot must get and interpret data as it is moving. If it doesn't process the data in a certain amount of time, it will end up hitting every obstacle in its path. Our project incorporates a "main" function for each module which fires through repeatedly getting information from the robots sensory devices and reacting in the appropriate manner. While testing, we found that this structure of reactive programming has made us re-structure our code and think in a different way when writing code.

Economic concerns are the one of the most discussed topics when robots (automation) come into a discussion. Yes, robots could take away some working class jobs; however, what few jobs this would threaten would be replaced by new jobs. Factory assemblers for example would be replaced by a robotics maintenance crew, development teams, and safety testers. People could potentially lose their jobs, but this change from a manual

labor force to a technologically skilled work force has been coming about for some time now.

14.0 Conclusions:

While the future involvement with greater numbers of robots seems to be inevitable, this issues they bring with them is diverse and sometimes devastating. Hopefully the future will bring positive uses for robots and negative issues will be minimized.