EERE Robotics Internship Program

What makes a good robotics internship project?

Robotics involves technologies used to develop machines that can substitute for humans and replicate human actions automatically. The capabilities of a robotic system can even perform "better" than humans in many cases. A robotic system has the following characteristics:

1. **The ability to perceive the world.** This involves sensors on many levels as needed. It also includes the instrumentation needed to acquire the information from the sensors such as data acquisition systems. A basic sensor may be as simple as identifying proximity as being yes or no. Or as complex as a vision system.
2. **The ability to interpret the information perceived about the world.** This involves some form of a computer that operates on the information from the sensors to make decisions on some course of action. This can be as simple as determining if an object is present at location A and then deciding to move it to location B. Or making a more complex decision based on multiple sensors, past actions, potential future actions, etc.
3. **The ability to act on the world.** This involves some form of actuation or function. This can be as simple as a piston that pushes an object from location A to location B. Or much more complex actions acting in coordination to perform a complex task.
4. **The structural ability interpret the world and act upon the world.** This is the physical design that embodies the sensors, intelligence and actuation so that it can operate functionally.
5. **The ability to communicate and coordinate with humans and others.** This involves the interactions and/or human/machine interfaces that support the potential alternatives and roles of actions of the robotic system.

Each of these five characteristics can be more or less sophisticated. A high-perception robotic system would have many sensors interpreting many phenomena. A high-interpreting (high intelligent) robotic system would employ complicated programming algorithms and approaches such as artificial intelligence and machine learning. A high-acting robotic system would be capable of performing many different tasks with high interaction and coordination. A high-structure robotic system would possess multiple capabilities to allow highly complex actions such as having many degrees of freedom. A high communicating robotic system would be able to deploy multiple and complex modes such as visual feedback, writing, talking, etc.

Robotics systems therefore have degrees of sophistication based on the capability level of each of these five characteristics (and likely others). While the complete absence of a characteristic may still be interpreted as a robotic system, the complete absence of several characteristics likely would not.

Robotics is therefore a highly interdisciplinary field. A project is unlikely to have a single individual working on all five characteristics. So, a good project can have an intern working on a subset of the

robotic technologies for the five characteristics with consideration of the other characteristics in the system.

Examples of robotics projects:

1. Programming for a system that has sensing, acting, and/or communicating.
2. Designing and/or fabricating structural aspects of a robotic system or improvements to one.
3. Integrating sensors or exploring the integration of sensors to a system so that it can be made more robotic or smart.
4. Adding actuation or functional capability to a system so that it can improve its ability level of action.
5. Enhancing the human/machine interface to improve the communication with a system employing robotic technologies.
6. Designing experiments that involve robotic technologies at some level of sophistication.
7. Exploring ways to make traditionally “dumb” systems more “smart” with robotic characteristics. I.e. Smart homes, smart buildings, smart products, etc.

The project need not and likely should not involve the design and fabrication of a full robotic system (tough to do in 10 weeks). However, the project should have a clear connection to the employment of robotic technologies and relation to the five characteristics as appropriate. A good project description will explain the expected efforts of the intern in relationship to the field of robotics and what they will learn.