ENGLISH 206
FINAL EXAM
FALL 2001-2002

Name: _____

PASSAGE A:

Search-and-Rescue Robots Nowadays

1. Emergency management rescue workers are turning to technology for help in finding the dead and wounded, but they've met with limited success (see table). Firemen may have trouble finding people in stacks of bricks and steel, but they could easily scramble over any obstacles. In contrast, robots can locate survivors through body heat or knocking sounds, but they can't negotiate the rubble.

2. There are four major tasks robots can perform at a disaster site, according to the FAQ page at the Perceptual Robotics Lab:
   - reconnaissance of the hazards
   - telling when it's safe for human rescuers
   - detecting victims in the rubble
   - mapping debris for removal

3. But robot developers must be careful not to try to perform all these tasks at once. "People have tried to make Swiss Army Knife robots, but that doesn't work," says Hagen Schempf, a scientist in the Field Robotics Center at Carnegie Mellon University, and CEO of robotics company Automatika, Inc. (Pittsburgh, PA). The best thing for search and rescue would be a robotic gerbil or a robotic cat.

4. Today, live dogs are often used to find bodies, because of their fantastic sense of smell. "Sensors will eventually get there, but the problem is delivery," says Schempf. He admires the gerbil for its size ("how small a hole can you crawl into?") and its agility ("how nimble are you? If it's too big, you've got to climb over or leap on top").

5. The top three challenges in creating robots for USAR (Urban Search Arid Rescue) are locomotion, power (source), and size, Schempf says. An engineer who solves these challenges must also keep the cost down, and then achieve acceptance—convincing proud firefighters to try the new tool. Because of these staggering challenges, many search and rescue robots are relatively simple, tethered to a power source and steered by a human driver instead of navigating themselves.

6. More advanced versions can store maps, so they can "learn" new routes when a person walks them through the path. But even with a map, such a machine still needs the full sensor array to avoid being sidetracked by obstacles like chairs left

in a hallway, or wheel slippage on soapy floors—simple challenges compared to the chaos of a disaster site.

Robot Efficiency in Different Situations

Robotic challenge	Office use	Search and rescue
Job predictability	high	low
Terrain	smooth, geometric	rugged, chaotic
Autonomy	high	low
Mapping	simple	impossible
Power soure	onboard	often thethered

[Source: Ames, B. (2001, November 5). Disaster sites too complex for most robots. Design News, 56 (21), 34.]

PASSAGE B:

Futuristic Search-and-Rescue Robots

1. The next generation of search-and-rescue workers looking for victims in buildings that collapsed in earthquakes or explosions will slither through eight-inch ducts, navigate dark, rubble-strewn corridors and be tossed into third-floor windows. They will be impervious to pain, fire and water. They will be robots-- autonomous and mobile.

2. Industrial robots have been used successfully for decades, but their descendants will be a relatively new breed with sufficient intelligence to carry out complex tasks, including planning ad decision-making in unstructured and dynamic environments where missions are time-critical.

3. But whether the robots are snakelike or rodent-size, they will think and, most important, relay information to human rescuers. Researchers have already found ways to create the necessary artificial intelligence.

4. Take, for instance, the ability to report locations, which has been a robotic catch-22: In order for a robot to add its "perceptions" to a map, it needs to know its location. But for a robot to determine its location, it often needs a map.

5. The answer lies in programming that provides localization capability based on a given environment by correcting localization estimates incrementally and on the fly instead of waiting until an unacceptable error level is accumulated. Navy researchers say the errors are small, so fast correction techniques can be used.

6. The Global Positioning System is also part of the action, as are inertial measurements, gyroscopes and lasers. "We can fuse six or seven relatively cheap sensors together to buy us reliability," says Lt. Col. John Blitch, program manager at the Defense Advanced Research Projects Agency's (DARPA) Advanced Technology Office in Arlington, VA.

Nonexpert End Users

7. Simplifying techniques to guide robots during searches is another goal because operators will be search-and-rescue staff rather than robotics specialists. "We'd like to have one technician working with 10 robots," says Schultz. "So we need to be careful how robots interface with workers. It can't be a complicated connection." With joysticks and keyboards ruled out, voice-recognition technology and touch screens are the most likely options.

8. Robots must have humanlike sensory functions in order to recognize visual, acoustic, tactile and thermal cues and then determine whether they originate from humans or inanimate objects.

9. That collaborative sensory conclusion is a difficult but necessary leap to knowledge representation, explains Adam Jacoff, a mechanical engineer in the Intelligent Systems Division at the National Institute of Standards and Technology (NIST) in Washington. Once robots understand what they "feel" or "see", they can "plan."

10. The bottom line, says John Evans, director of the Intelligent Systems Division at the NIST, is that robotic rescuers must be able to "separate sense perception and planning from navigation."

11. The next goal is to create robots that have adjustable autonomy—the ability to process data and make decisions without direction from a human operator. "They need to know to go further, without instruction, when they see important clues: it's a school, the cafeteria is 40 feet ahead and the earthquake happened at lunchtime," says Jacoff.

12. Robot collaboration, which is the ultimate goal, would involve specialization and information sharing. For example, one robot would find a blocked passage and relay the message to other robots. Or robot teams could apply the "marsupial approach," in which larger units carry smaller ones designed for specific tasks such as locating people trapped in shifting debris. Others could deliver radios and water to victims.

13. Standardized measurements are also needed to create smart machines. "Researchers have identified artificial intelligence in the abstract," says Evans. "But like any other engineering project, to build efficient machines, we have to

4. Explain primary and secondary research techniques, giving examples and stating the difference and the relationship between them. How useful is each type (for what purposes or in which contexts)? (8 pts.)

5. Writers should use gender-free language. Identify three ways to eliminate gender-specific language. (4.5 pts.)

   A. _____

   B. _____

   C. _____

6. Identify five design elements that help a reader locate information in a document. (7.5 pts.)

   A. _____

   B. _____

   C. _____

   D. _____

   E. _____

7. Which visual aid is best suited for each of the following situations? (8 pts.)

   A. Clarifying the stages of the recycling process

      _____

B. Showing the growth that has occurred in the population of Lebanon between 1992 and 2002.

_____

C. Showing the interior of the brain of a 6-month-old infant.

_____

D. Clarifying the different functions and divisions of a hospital wing.

_____

8. Name the kind of document which usually has the following sections: Introduction, problem definition, solution and plan of work/action, qualifications, budget, conclusion. (4 pts.)

_____

9. Which kind of report necessitates that the time period which the report covers be stated? (3 pts.)

_____

10. A. List the three options you can consider when you are writing a report for readers with different knowledge levels and varying degrees of familiarity with your field. (4.5 pts.)

a. _____

b. _____

c. _____

B. Which option is usually recommended? (1.5 pts.)

_____

11. An earthquake has been predicted in a certain city. (You can specify a city, for example, Beirut.) You work for an emergency management agency, and you are asked to conduct a feasibility study to decide on the best way to manage a potential rescue operation. Judging from the information in passages A and B, would you

a. send human rescue personnel only?
b. rely mainly on dogs?
c. rely mainly on robots?

A. Analyze the situation based on your set criteria and report to your manager, John Smith.
B. Include the relevant conventional elements of a feasibility report, and use the organization plan (executive or standard) that is best suited for this situation: Introduction, methods, results, discussion/conclusions, recommendations.
C. Use the report format that is appropriate for this particular situation, and write your report on page 5-6 paying special attention to layout and design. (25 pts.)

12. The format and message of the following draft letter need revision. Edit and rewrite this letter on page 8to make it clear, correct, consistent, courteous, concise, etc. Note that there are no errors in the information inside the addresses. (22 pts.)

University of Leicester
School of Engineering
21 University Road
Leicester LE1 7 RF
UK

Dean Rana Khoury
Faculty of Engineering and Architecture
American University of Beirut
P.O. Box 11-0236
Riad El-Solh Beirut 1107 2020
Lebanon
January 4, 2002

Attention: Chairman

I would like to decline your invitation that I received from you inviting me to make a speech to all graduating students on engineering ethics in Lebanon on January 30. The long and short of it is that this talk would require advance planning and preparation as well as prior research and unfortunately you haven't allowed for sufficient planning time.

I could, however, accept to address the students on something else for that occasion. I will need the following in the lecture room: Copies of all enclosed handouts, and an overhead projector, etc.

I will be arriving at Beirut's international airport on January 29 on middle east airlines. Please be kind to make reservations for me at a convenient hotel for a couple of days. I also expect someone to pick me up from the airport.

I want to thank you, Mrs Khoury, for your concern about the future of our new generation of engineers and I do understand that you are working under pressure and putting a lot of effort in arranging such talks. Thus, I wish to extend my sincere advice concerning the required planning, always having your best interest in mind. In the future, try to contact speakers at least six months ahead of time.

Wishing you the best of luck in your endeavor,

Mathew Deeb
Mathew Deeb

Enclosure: Resume

c. Dr. Rana Khoury

have quantitative measurements." The NIST, the NRL, and DARPA are working together to address that problem. NIST engineers recently built the first standardized test course, an urban disaster scene, to establish performance metrics that would allow the reuse of algorithms and other system components. Researchers have taken the portable ruin on the road; they plan to share ongoing test results with robotics teams everywhere.

Test Course

14. The test course, which is approximately 60 square feet, has three increasingly difficult modules, each a maze with "human" targets. Each area demands increased mobility, such as the ability to climb piles of debris, stairs and ramps, and sensing capabilities. The easiest has a flat surface, pieces of overturned furniture, open doors and jutting walls. The two-floor intermediate stage has ramps, stairways and holes to fall through. Level 3 simulates a collapsed building complete with a section of floor propped perilously on piles of debris amid jumbles of boards and pipes.

15. Creating artificial intelligence is the carrot for these researchers, but saving human lives is the true goal. "We must balance between saving people and putting fully functioning rescuers in harm's way," says Jacoff. "We can send robots into the most dangerous and confined spaces. They are expendable."

[Source: Forster, B. (2000, September 4). Heading for disaster. Computerworld. (on-line). Available: http://web1.infotrac.galegroup.com/itw/]