Robots and Job-Bots

Student Worksheet

Specification Page

Read the following: What is a Robot?

There are many definitions of robots. Several of these are shown below. Circle the numbers of the definitions which fits your understanding of what is a robot?

1. A robot is any mechanical apparatus that does the work of a human being. (*One of the simplest definitions.)*
2. A robot is a machine in the form of a human being that performs the mechanical functions of a human being. (*Webster's New International Dictionary, 3rd edition)*
3. A robot is an automated machine with the motor capabilities to duplicate some human motor functions or a shape that emulates the human shape. (*Anthony Reicheit, Founder of Quasar Industries)*
4. A robot is a reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialized devices through varied programmed motions for the performance of a variety of tasks. (*Robot Institute of America)*
5. A robot is an artificial agent-a machine that can take action without direct supervision. (*M. Mitchell Waldrop, a senior-writer for Science, the journal of the American Association for the Advancement of Science)*

Three Laws of Robot Behavior (from Isaac Asimov's science fiction)

1. A robot may not injure a human being or allow a human being to come to harm.
2. A robot must obey orders given to it by human beings, except when such orders break the first law.
3. A robot must protect its own existence as long as such protection does not conflict with the first or second law.

Job-Bot Specifications (Limitations)

Job-Bots cannot...

- learn.
- think.
- talk.
- sense pressure on an object (Warning: Job-Bot will crush fragile object unless it is commanded to stop).
- see objects (could blindfold Job-Bot).
- tell the difference between cup, plate, spoon, etc.
- use both arms to follow commands.

Robots and Job-Bots

Student Worksheet (continued)

Specification Page

Job-Bot Specifications (Capabilities)

Job-Bots can

- use one arm for commands.
- use the other arm to indicate errors.
- rotate at the wrist and shoulder.
- interpret centimeters, meters, and degrees if preceded by a number.
- stop movement to avoid damage to environment or self
- recognize and respond to the codes and commands listed on the next page.
- operate if it receives codes and commands in proper order (Examples: Identification Code, Action Command – JBT, STP; or Identification Code, Information Code, Action Command – JBT, 2M, FD)

Action Commands

ON – power on
OFF – power off
STR – start
STP – stop
LT – left
RT – right
FD – forward
BK – back
UP – up
DWN – down
CLS – close
OPN – open
ERS – erase

Identification Codes

JBT – Job-Bot (body)
MOPR – manual (voice) operation
ARM – arm
WRST – wrist
HND – hand

Robots and Job-Bots

Student Worksheet (continued)

Robots and Job-Bots
Specification Page

Information Codes

DGR – degrees
CM – centimeters
M – meters

Manual Operation Example

Example of a step-by-step manual operation or program for a robot to pick up an object from a table. (These specifications are for students *familiar* with centimeters, meters, and degrees.)

Assume Job-Bot is in "home" position, 60 cm from edge of table, with arm directly in front of knife.

JBT, ON……power on
JBT, MOPR, STR……places Job-Bot in manual mode of operation (responds to voice commands on Job-Bot Specifications sheet)
ARM, 90DGR, UP……raises arm 90 degrees
JBT, 40CM, FD…… moves Job-Bot forward 40 cm
ARM, 45DGR, DWN……arm lowered 45 degrees
WRST, 90DGR, UP……wrist up 90 degrees (places hand over knife)
ARM, 10CM, DWN……arm down 10 cm (places hand on knife)
HND, CLS…… hand closed on knife
ARM, 45DGR, UP……raises arm (knife in hand)
JBT, 180 DGR, RT…… Job-Bot faces opposite direction
JBT, STP…… Job-Bot stops

Robots and Job-Bots

Student Worksheet (continued)

Activity Page

Would you like to have a robot to do your chores? Could you program a robot to set the table? Remember that computers control robots. The computer must have a memory unit and a system to receive information. A program is the set of instructions that tells the computer what to do with the information it receives and stores. Under the guidance of the program, the computer gives step-by-step detailed instructions to the robot, and the robot performs the tasks. You will write a program for a robot to follow and find some capabilities and limitations of robots.

Materials

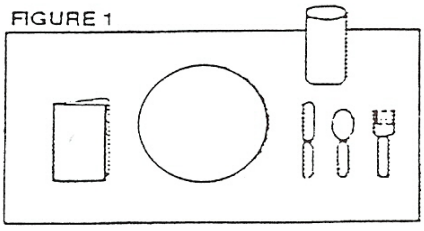
1 paper plate, napkin, and cup
1 plastic knife, fork, and spoon
1 meter stick
2 desks or tables for the group
1 blank card
paper
pencils
markers

Procedures

1. Look over your copy of Job-Bot Specifications. Listen as the teacher explains a sample computer program to you.
2. In your team of four to six persons, one student is selected by the teacher to be the Job-Bot. The rest of the team will be the computer programmers.
3. Set up your Job-Bot work area. You will need two desks or tables that are two meters apart. One desk will be the dining table and the other will be the cupboard.
4. Collect the table setting materials listed above. Put all these items on top of the "cupboard" according to **Figure 1**.
5. Your Job-Bot will have two tasks: 1) move the plate, napkin, cup, fork, and spoon from the cupboard to the table; 2) arrange the items correctly according to **Figure 2**.
6. Develop a program that will instruct the Job-Bot how to set the table. Remember you can only use the language on the Job-Bot Specification Sheet. Commands must be short, precise, and in the correct order.

Determine a "home" or starting position of the Job-Bot before beginning your program.

FIGURE 1



Cupboard Setting

FIGURE 2

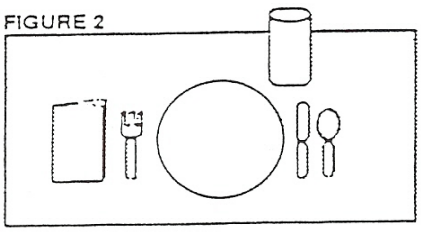


Table Setting

Robots and Job-Bots

Student Worksheet

Program Page

Develop a program that will instruct the Job-Bot how to set the table. Remember you can only use the language on the Job-Bot Specification Sheet. Commands must be short, precise, and in the correct order. Use the lines below to write the program. Then, try the program out on the Job-Bot.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____

Continue on the back if more space is needed.