

Freshman Engineering Clinic I
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Mechanical Engineering Module

Programming the BOE-Bot

Objectives

Learn about sensors

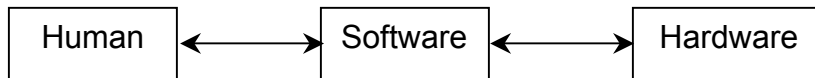
Learn components, operations and basic structure of a program

Control a robot to accomplish several tasks automatically

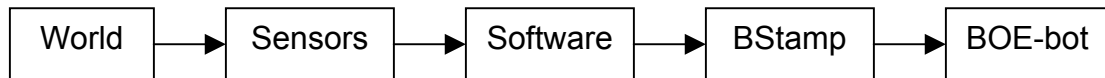
Have fun

Robot and programming

General interface between the robot and human



How does the BOE-bot works?



Components of a program

1. Variable: x, y, distance, time, age, salary, etc. The variables can have different lengths.
2. Operators: +, -, *, /, &, |, etc
3. Command: READ, WRITE, IF... THEN, FOR...NEXT, INPUT, OUTPUT, FREQOUT, etc.

If we consider the variables as the cars of a train, we use the operators to connect the variables together, and use commands to tell the trains what to carry, where to go, and how to go there.

Structure of a program

1. Declarations: Define the variables to be used
2. Initialization: Initialize the variables and hardware
3. Main routines

Exercises

1. Turn the LED to **green**, and move the robot **forward** for 100mm, then turn the LED to **red**, and move the robot **backward** for 100mm
2. Program the robot to follow the pattern: an equilateral triangle, sides of length 200 mm
3. Let the robot beep and turn left for 90 degrees when it is in shadow (i.e., when the sum of the light sensors is greater than 100).

Operator list

Operator	Example	Description	Returned value
+	a=3+5	3+5	8
-	a=5-2	5-2	3
*	a=2*4	2*4	8
/	a=4/3	4/3	1
= (as a math operator)	a=3	let the value of a=3	a=3
= (as a Boolean operator)	a = 3	a equal to 3?	if a is already defined to be 3, then result is true, otherwise false
>	a>3	a>3?	true or false
<	a<3	a<3?	true or false
ABS	abs(-3)	Absolute value of -3	3
SQR	sqr(10)	$\sqrt{10}$	3

Command Block Description	Contents of Block
FORWARD – Move forward for about 4mm.	PULSOUT 12, 500 PULSOUT 13, 1000 PAUSE 20
BACKWARD – Move backward for about 4mm.	PULSOUT 12, 1000 PULSOUT 13, 500 PAUSE 20
TURN RIGHT – spin clockwise for about 3°	PULSOUT 12, 1000 PULSOUT 13, 1000 PAUSE 20
TURN LEFT – spin counter-clockwise for about 3°	PULSOUT 12, 500 PULSOUT 13, 500 PAUSE 20
LEFT LED (RED) – Turn on its left LED as red	LOW 8 HIGH 7
LEFT LED (GREEN) – Turn on its left LED as green	LOW 7 HIGH 8
RIGHT LED (RED) – Turn on its right LED as red	LOW 9 HIGH 6
RIGHT LED (GREEN) – Turn on its right LED as green	LOW 6 HIGH 9
BEEP SPEAKER –Beep the speaker for <i>tms</i> at frequency <i>freq</i>	FREQOUT 11, <i>t</i> , <i>freq</i>
Measure light level from left photo-resistor , and record the output to variable <i>left_photo</i> with word size	High 5 Pause 5 Rctime 5, 1, <i>left_photo</i>
Measure light level from right photo-resistor , and record the output to variable <i>right_photo</i> with word size	High 4 Pause 5 Rctime 4, 1, <i>right_photo</i>

		C	D	E	F	G
		1046	1174	1318	1396	1567
A	B	C	D	E	F	G
1760	1976	2093	2349	2637	2793	3136
A	B	C				
3520	3951	4186				