

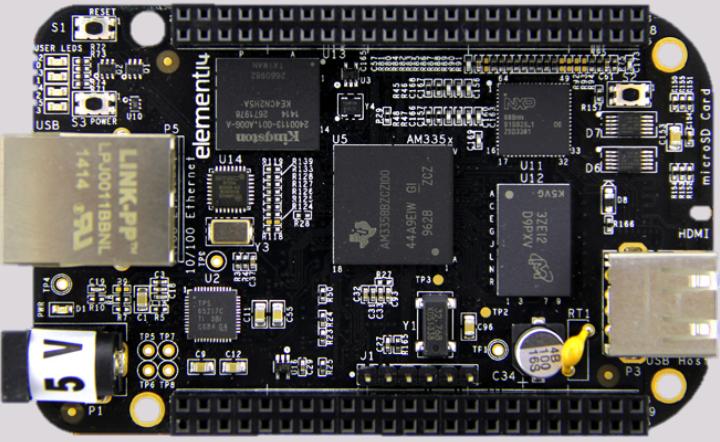
Internet of Things



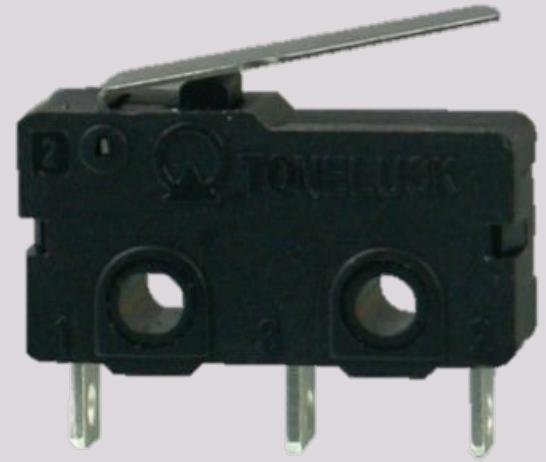
Activity: Using Sensors to Measure Distances



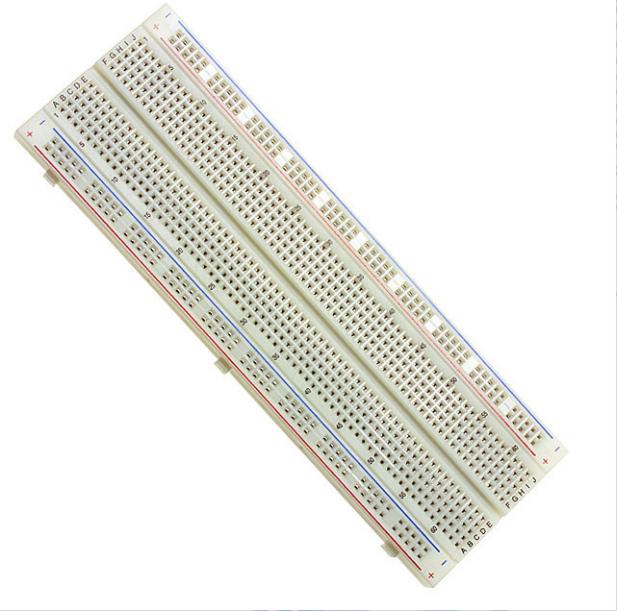
Sensor



Beaglebone



Switch



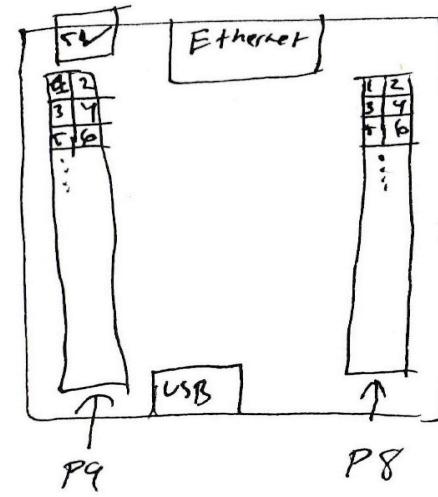
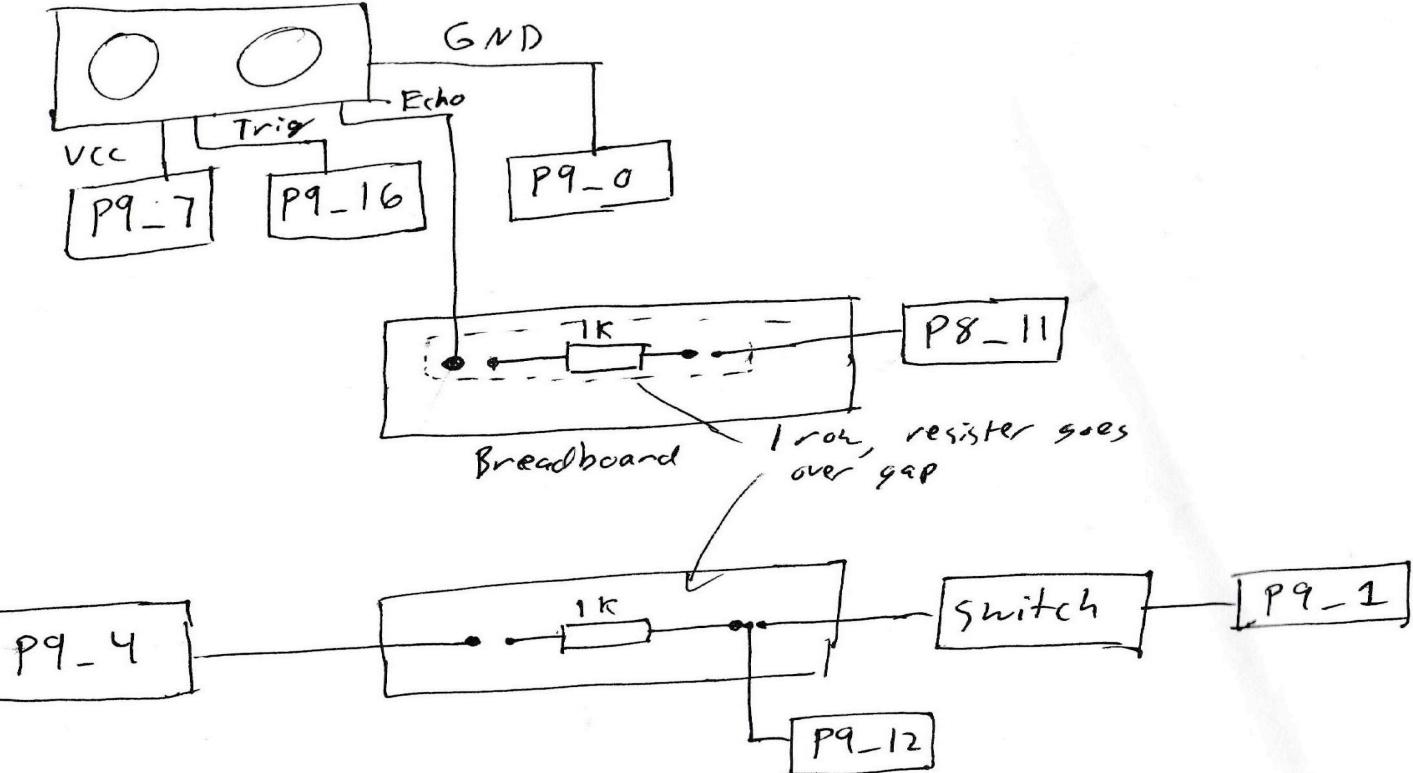
Breadboard

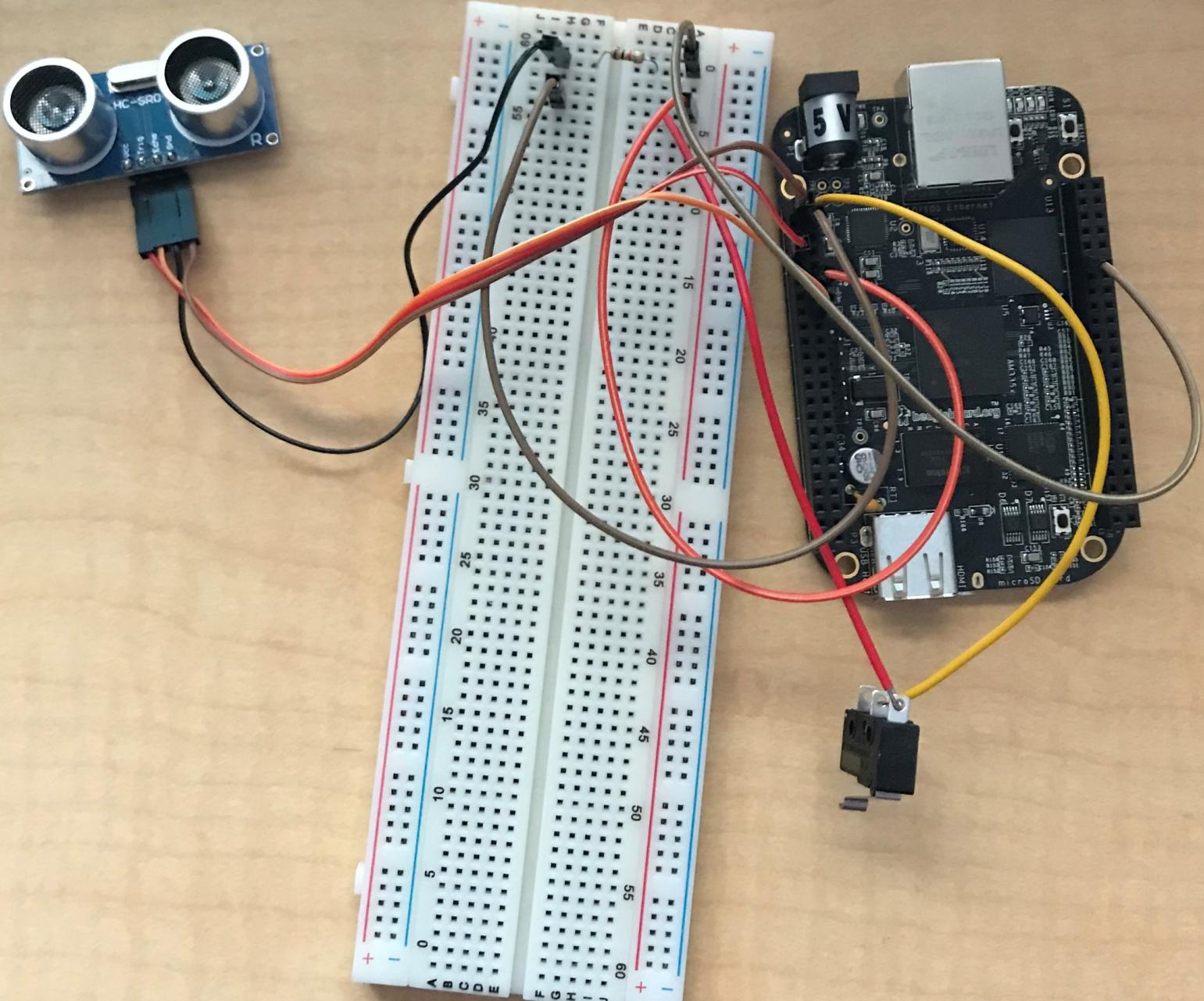


Wires



Resistors





192.168.7.2 - PuTTY

```
int main()
{
    FILE *pwm,*duty,*period,*polarity,*run,*gpi,*p45,*direction, *direction2, *gpi2;
    FILE *output;

    int value,i,count,enable;

    output = fopen("output.csv", "w");

    uint16_t input=0;
    uint8_t input_no=0,input_state=0;
    unsigned int duty_cycle =500000;
    pwm = fopen("/sys/devices/bone_capemgr.9/slots", "w");
    if(pwm == 0)
    {
        printf("Error opening slots\n");
        return 1;
    }
    fseek(pwm, 0, SEEK_SET);
    fprintf(pwm, "am33xx_pwm");
    fflush(pwm);

    fprintf(pwm, "bone_pwm_P9_16");
    fflush(pwm);
    period = fopen("/sys/devices/ocp.3/pwm_test_P9_16.15/period", "w");
    if(period == 0)
    {
        printf("Error opening period\n");
        return 1;
    }
    fseek(period, 0, SEEK_SET);
    fprintf(period, "%d",500000);
    fflush(period);

    duty = fopen("/sys/devices/ocp.3/pwm_test_P9_16.15/duty", "w");
    if(duty == 0)
    {
        printf("Error opening duty\n");
        return 1;
    }
```

192.168.7.2 - PuTTY

```
while(1)
{
    gpi2 = fopen("/sys/class/gpio/gpio60/value", "r");
    fseek(gpi2,0,SEEK_SET);
    fscanf(gpi2,"%d",&enable);
    fclose(gpi2);

    if(enable == 1)
        continue;

    gpi = fopen("/sys/class/gpio/gpio45/value","r");
    fseek(gpi,0,SEEK_SET);
    fscanf(gpi,"%d",&value);
    fclose(gpi);

    if(value==1)
    {
        count++;
    }
    else
    {
        if(count!=0)
        {
            //printf("      Centimeters: %5d\n",count*2);
            //printf("      Inches: %5d\n",count*5);
            printf("%d\n",count*2);
            fprintf(output, "%d\n", count*2);
            fflush(output);

            count=0;
        }
    }

    //printf("      value: %5d\n",value);
    //for(i = 0; i<100000;i++);

}

fclose(output);
```



Local Mark Files Commands Session Options Remote Help

Synchronize

Transfer Settings

Default

New Session

My documents

Upload

Edit

X

Y

Z

C:\Users\Jacie\Documents\

Name	Size
..	
Custom Office Templa...	
Electronic Arts	
RCT3	
DMZ Lab.docx	131 KB
Wave.mtn	30 KB

Login

New Site

Session

File protocol:

SFTP

Host name:

192.168.7.2

Port number:

22

User name:

root

Password:

Save

Advanced...

Tools

Manage

Login

Close

Help

0 B of 159 KB in 0 of 5

4 hidden

Not connected.

Documents - root@192.168.7.2 - WinSCP



Local Mark Files Commands Session Options Remote Help



root@192.168.7.2 New Session



C:\Users\Jacie\Documents\

Name	Size	Type	Changed
		Parent directory	11/12/2017 6:05:34 PM
Custom Office Templa...		File folder	10/25/2017 12:05:26 PM
Electronic Arts		File folder	10/18/2017 10:36:17 PM
RCT3		File folder	10/28/2017 3:27:09 PM
DMZ Lab.docx	131 KB	Microsoft Word Do...	10/25/2017 12:48:25 PM
Wave.mtn	30 KB	RoboPlus Motion ...	11/12/2017 6:39:34 PM



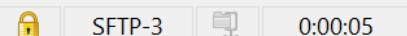
/root/

Name	Size	Changed	Rights	Owner
..		12/31/1999 6:02:25 PM	rwxr-xr-x	root
output.csv	1 KB	3/1/2015 2:46:59 PM	rw-r--r--	root
ultrasonic	7 KB	11/12/2015 7:02:36 PM	rw-r--r--	root
ultrasonic.c	2 KB	11/12/2015 7:02:36 PM	rw-r--r--	root
ultrasonic2	8 KB	11/12/2015 7:02:36 PM	rwxr-xr-x	root
ultrasonic2.c	3 KB	11/12/2015 7:02:36 PM	rw-r--r--	root

0 B of 159 KB in 0 of 5

4 hidden 0 B of 18.5 KB in 0 of 5

6 hidden



AutoSave Off

output.csv - Excel

Jacie Rifer

File Home Insert Page Layout Formulas Data Review View Tell me what you want to do

PivotTable Recommended Table Pictures Online Pictures Store Shapes Icons My Add-ins Recommended Charts Charts Maps PivotChart 3D Map Tours Sparklines Filters Slicer Timeline Link Text Symbols

PivotTables Tables Illustrations Add-ins Charts Charts Tours Sparklines Filters Links Symbols

A1 26

1 26
2 24
3 24
4 24
5 24
6 24
7 26
8 24
9 24
10 26
11 24
12 24
13 24
14 24
15 24
16 24
17 24
18 24
19 26
20 24
21 24
22 24

Chart Title

Value	Count
65	~1250
193	~1700
1409	~1700
Others (e.g., 1, 257, 321, 385, 449, 513, 577, 641, 705, 769, 833, 897, 961, 1025, 1089, 1153, 1217, 1281, 1345, 1473, 1537, 1601, 1665, 1729)	0

output

Average: 26.43374858 Count: 1766 Sum: 46682

100%

Building The Robot



Parts

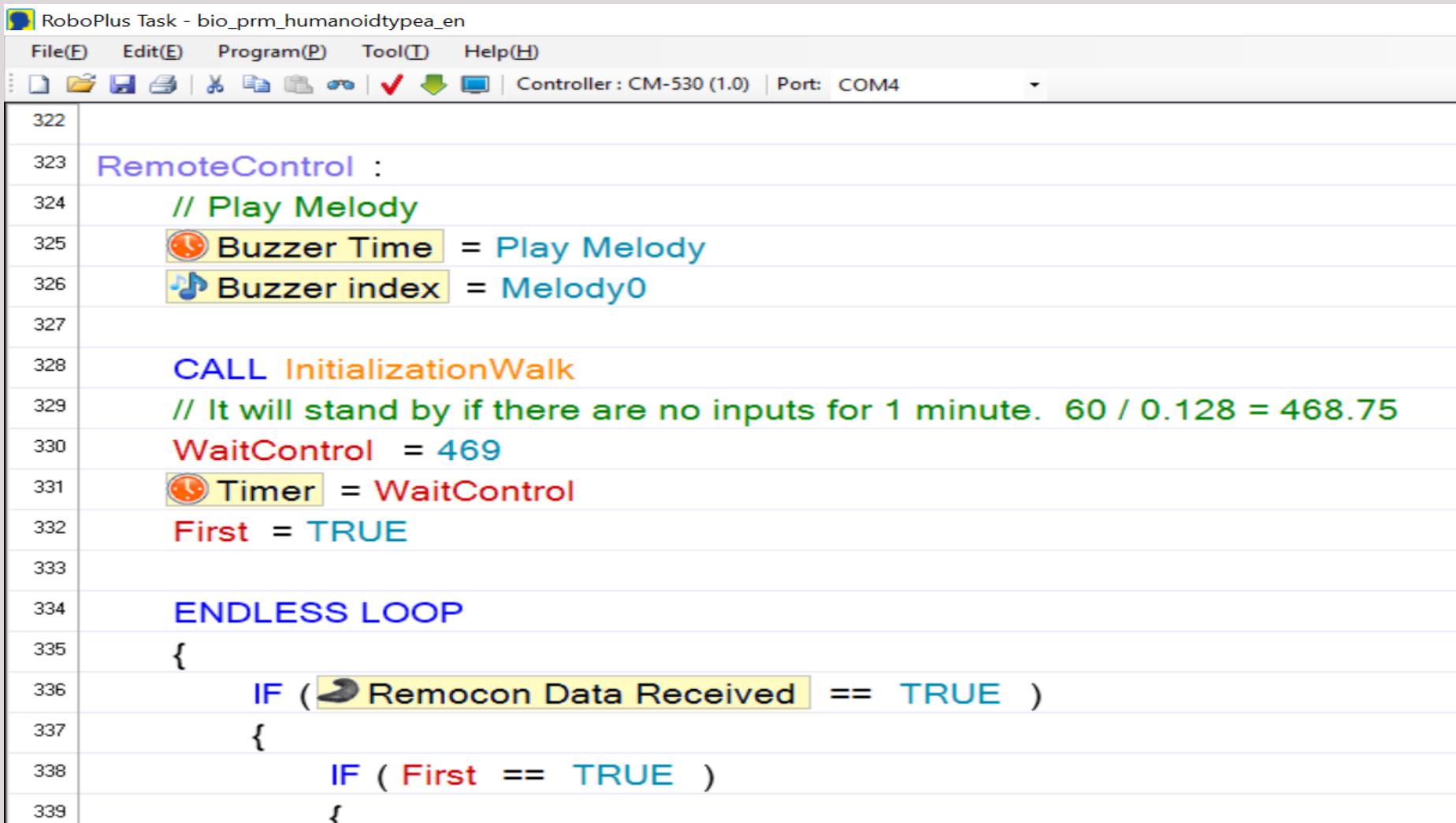


Controls



Button	Move
U	Forward
D	Backward
L	Turn Left
R	Turn Right
1 + L	Push-up
1 + R	Handstand
2 + U	Pound Chest
2 + D	Scratch Head
2 + L	Cheer
2 + R	Bow

Programming the Robot



The screenshot shows the RoboPlus Task software interface with the title bar "RoboPlus Task - bio_prm_humanoidtypea_en". The menu bar includes File(F), Edit(E), Program(P), Tool(T), and Help(H). The toolbar contains icons for file operations like Open, Save, and Print, along with a red checkmark and green downward arrow. The status bar indicates "Controller : CM-530 (1.0)" and "Port: COM4". The main code area displays the following pseudocode:

```
322
323 RemoteControl :
324     // Play Melody
325     ⏱ Buzzer Time = Play Melody
326     🎵 Buzzer index = Melody0
327
328     CALL InitializationWalk
329     // It will stand by if there are no inputs for 1 minute. 60 / 0.128 = 468.75
330     WaitControl = 469
331     ⏱ Timer = WaitControl
332     First = TRUE
333
334     ENDLESS LOOP
335     {
336         IF ( 📡 Remocon Data Received == TRUE )
337         {
338             IF ( First == TRUE )
339             {
```

Programming the Robot

RoboPlus Task - bio_prm_humanoidtypea_en

File(F) Edit(E) Program(P) Tool(T) Help(H)

Controller : CM-530 (1.0) Port: COM4

```
343
344     Timer = WaitControl
345     ReceiveData = Remote RXD
346     IF ( ReceiveData == U )
347     {
348         WalkCommand = 1
349         CALL WalkExecute
350     }
351     ELSE IF ( ReceiveData == D )
352     {
353         WalkCommand = 2
354         CALL WalkExecute
355     }
356     ELSE IF ( ReceiveData == L )
357     {
358         WalkCommand = 3
359         CALL WalkExecute
360 }
```

_humanoidtypea_en

Program(P) Tool(T) Help(H)

Controller : CM-530 (1.0) Port: COM4

```
IF ( ReceiveData == U+1 )
{
    Motion Index Number = 27
    CALL WaitMotion
}
ELSE IF ( ReceiveData == D+1 )
{
    Motion Index Number = 28
    CALL WaitMotion
}
ELSE IF ( ReceiveData == L+1 )
{
    Motion Index Number = 8
    CALL WaitMotion
}
ELSE IF ( ReceiveData == R+1 )
{
```

Programming Motions

RoboPlus Motion

Files(F) Edit(E) Robot(R) Tool(T) Help(H)

Port: COM4

bio_prm_humanoidtypea_en

	Name	Next	Exit
1	Bow	0	0
2	Bravo	3	0
3		4	0
4		0	0
5	Rap chest	6	0
6		0	0
7	Scratch head	0	0
8	Push up	9	0
9		10	0
10		0	0
11	Hand standing	12	0
12		13	0
13		0	0
14	R blocking	14	15
15		0	0
16	L blocking	16	17
17		0	0
18	L kick	0	0
19	R kick	0	0
20	R attack	0	0
21	L attack	0	0
22	F attack	0	0
23	Defence	23	24
24		0	0
25	Sit down	0	0
26	Stand up	0	0
27	F getup	0	0

	Pause	Time
STEP 0	0	0.296
STEP 1	0	0.496
STEP 2	0.496	1
STEP 3	0	1
STEP 4	0	0.296
STEP 5	0	0.4

Page Parameters

Repeat time: 1

Speed rate: 1.0

Ctrl Inertial force: 32

Real Play Time
 $(3.984\text{sec} / 1.0) \times 1 = 0\text{min } 3.984\text{sec}$

[Joint Softness]

	Level
ID[1]	5
ID[2]	5
ID[3]	5
ID[4]	5
ID[5]	5
ID[6]	5
ID[7]	5
ID[8]	5
ID[9]	5
ID[10]	5
ID[11]	5
ID[12]	5

Basic Pose Editor | **Pose Utility** | **Edit All page**

<Pose of Step>

	Value
ID[1]	335
ID[2]	688
ID[3]	279
ID[4]	744
ID[5]	462
ID[6]	561
ID[7]	353
ID[8]	670
ID[9]	508
ID[10]	515
ID[11]	347
ID[12]	676
ID[13]	282
ID[14]	741
ID[15]	617
ID[16]	406
ID[17]	508
ID[18]	515

<Pose of Robot>

	Value
ID[0]	
ID[1]	
ID[2]	
ID[3]	
ID[4]	
ID[5]	
ID[6]	
ID[7]	
ID[8]	
ID[9]	
ID[10]	
ID[11]	
ID[12]	
ID[13]	
ID[14]	
ID[15]	
ID[16]	
ID[17]	
ID[18]	
ID[19]	
ID[20]	
ID[21]	
ID[22]	
ID[23]	
ID[24]	
ID[25]	

Ready

Programming Motions

