H. 4DOF Robot Arm

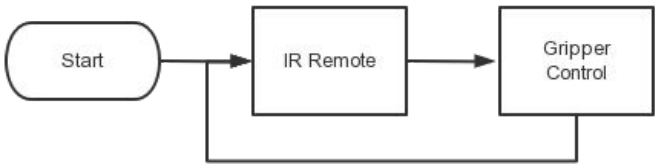
Material

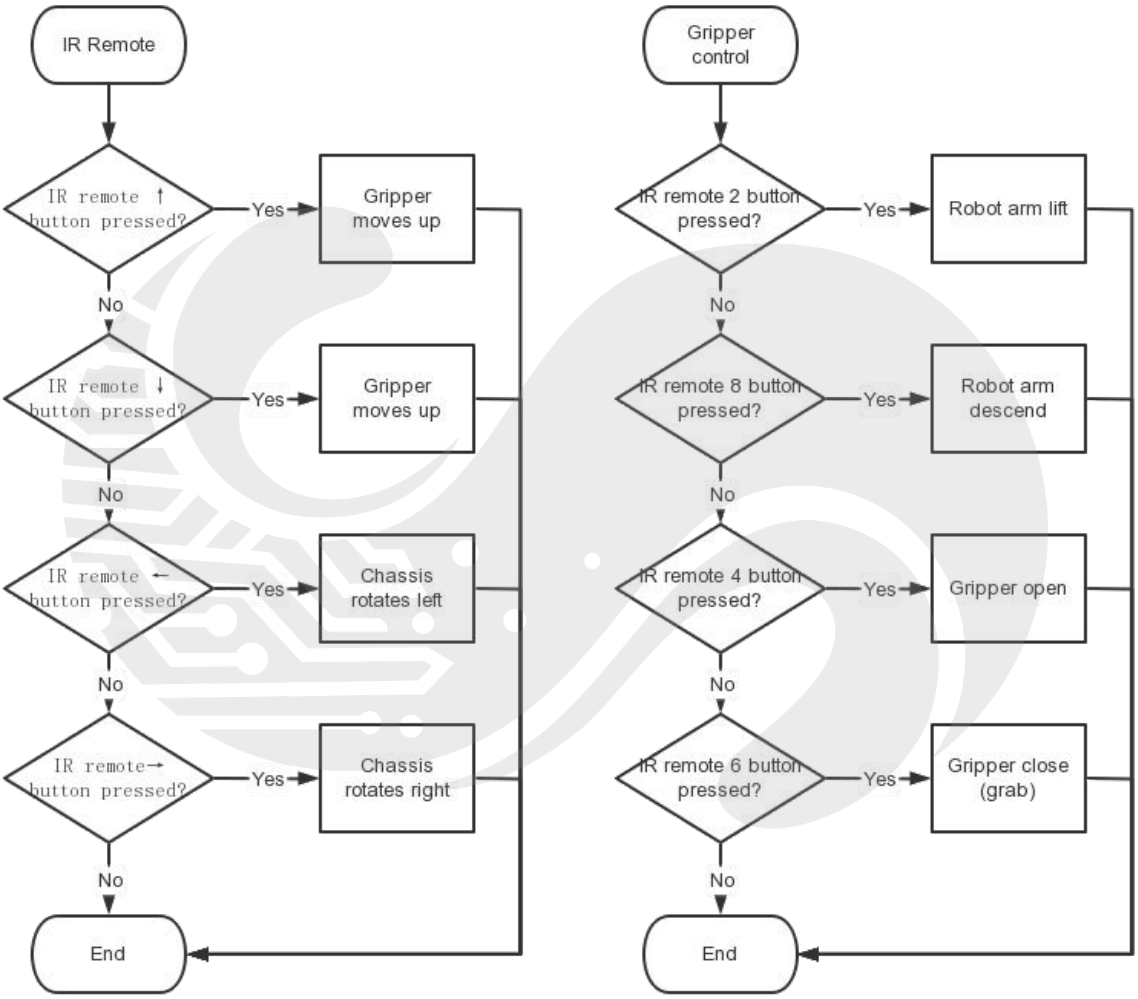
1. 4DOF Robot Arm
2. Computer

Project #1: Remote control three-axis mechanical arm

1. Utilize the remote controller's up and down buttons to regulate the M1 motor, which governs the vertical motion of the first mechanical arm.
2. Employ the remote controller's left and right buttons to command the DC motor in Port 3, which determines the lateral movement of the robot arm.
3. Utilize the remote controller's 2 and 8 buttons to operate the DC motor in Port 4, thus controlling the vertical swing of the second mechanical arm.
4. Utilize the remote controller's 4 and 6 buttons to manipulate the Port B servo motor, responsible for the actuation of the robot gripper's opening and closing mechanism.

Program Idea


Start
IR Remote
Gripper Control


IR Remote
IR remote ↑ button pressed?
Yes
Gripper moves up
No
IR remote ↓ button pressed?
Yes
Gripper moves up
No
IR remote ← button pressed?
Yes
Chassis rotates left
No
IR remote→ button pressed?
Yes
Chassis rotates right
No
End
Gripper control
IR remote 2 button pressed?
Yes
Robot arm lift
No
IR remote 8 button pressed?
Yes
Robot arm descend
No
IR remote 4 button pressed?
Yes
Gripper open
No
IR remote 6 button pressed?
Yes
Gripper close (grab)
No
End

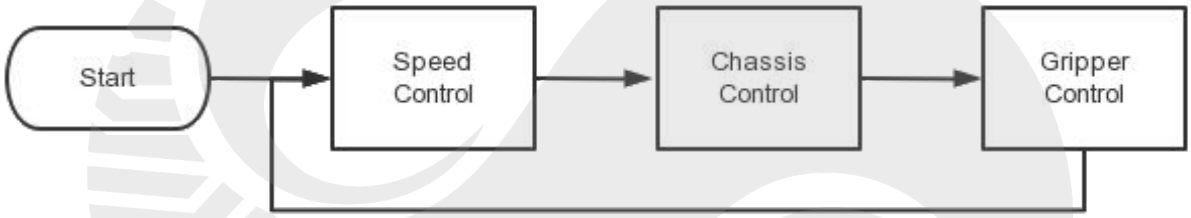
Reference Code

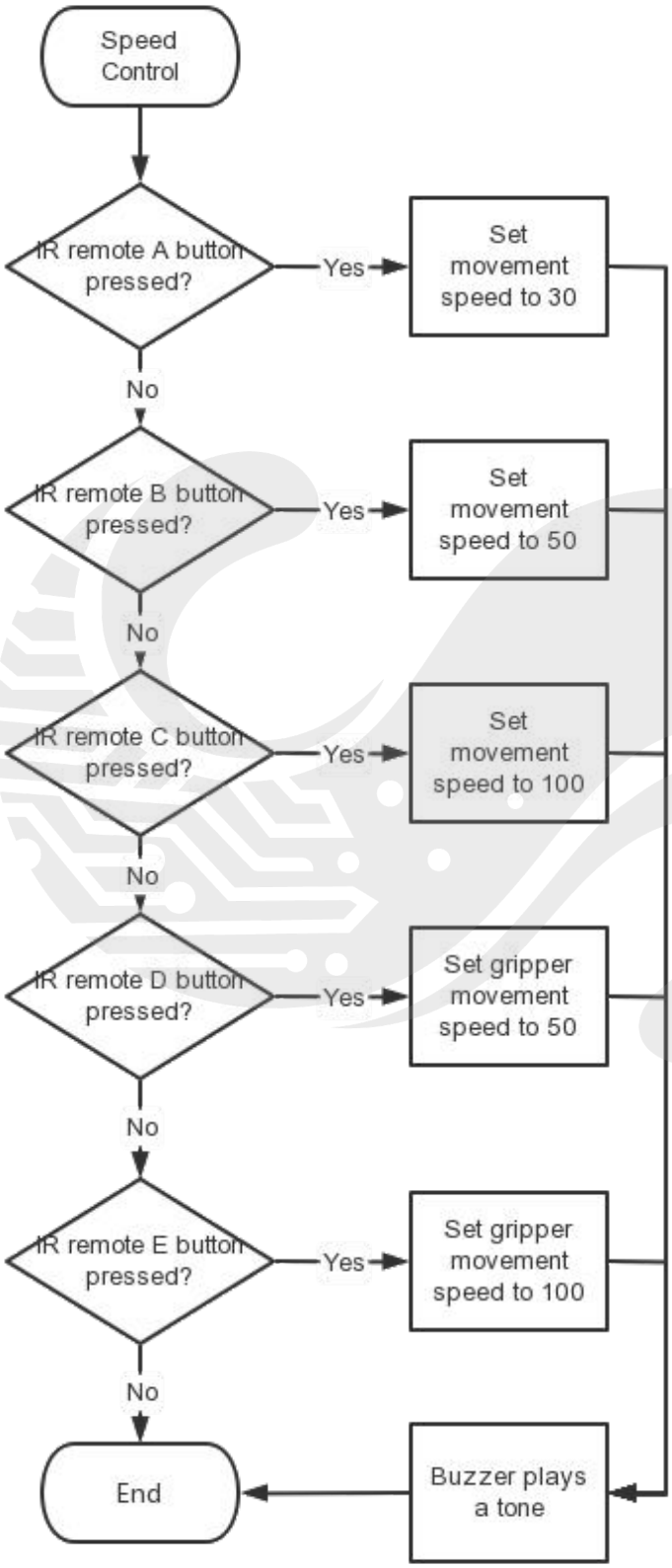
```
Generate Code
set servo motor angle to 0
forever
  IR remote
  Gripper control

define IR remote
if IR Port2 received ↑ then
  dc motor M1 speed 100
else
  if IR Port2 received ↓ then
    dc motor M1 speed -100
  else
    if IR Port2 received ← then
      encoder motor Port3 power to 100
    else
      if IR Port2 received → then
        encoder motor Port3 power to -100
      else
        dc motor M1 speed 0
        encoder motor Port3 power to 0

define Gripper control
if IR Port2 received R2 then        [Arm lift]
  encoder motor Port4 power to 100
else
  if IR Port2 received R8 then      [Arm descend]
    encoder motor Port4 power to -100
  else
    if IR Port2 received R4 then    [Gripper open...]
      if servo motor angle < 80 then
        change servo motor angle by 1
    else
      if IR Port2 received R6 then  [Gripper clos...]
        if 0 < servo motor angle then
          change servo motor angle by -1
      else
        encoder motor Port4 power to 0
wait 0.01 seconds
servo PortD angle servo motor angle
```

Project #2: Creating a variable speed three-axis robotic arm.

Building upon project 1, an enhanced feature is introduced to the remote-controlled 4DOF robot arm, allowing for speed regulation. The A, B, and C buttons on the remote controller are utilized to adjust the lateral movement speed of the chassis, while the D and E buttons are used to modify the speed of the mechanical arm (near the mechanical claw).

Program Idea




Speed Control
IR remote A button pressed?
Yes
Set movement speed to 30
No
IR remote B button pressed?
Yes
Set movement speed to 50
No
IR remote C button pressed?
Yes
Set movement speed to 100
No
IR remote D button pressed?
Yes
Set gripper movement speed to 50
No
IR remote E button pressed?
Yes
Set gripper movement speed to 100
No
End
Buzzer plays a tone

ce Code

```
Generate Code
set servo motor angle to 0
set speed to 100
set robot gripper movement speed to 100
forever
  chassis control
  Speed control
  robot gripper control
```

```
define Speed control
if IR Port2 received A then
  set speed to 30
  play tone on note C4 beat Half
else
  if IR Port2 received B then
    set speed to 50
    play tone on note C4 beat Half
  else
    if IR Port2 received C then
      set speed to 100
      play tone on note C4 beat Half
    else
      if IR Port2 received D then
        set robot gripper movement speed to 50
        play tone on note C4 beat Half
      else
        if IR Port2 received E then
          set robot gripper movement speed to 100
          play tone on note C4 beat Half
```

```
define robot gripper control
if IR Port2 received R2 then                    [gripper lift]
  encoder motor Port4 power to robot gripper movement speed
else
  if IR Port2 received R8 then                  [gripper desc...]
    encoder motor Port4 power to (0 - robot gripper movement speed)
  else
    if IR Port2 received R4 then                [gripper open]
      if (servo motor angle < 80) then
        change servo motor angle by 1
    else
      if IR Port2 received R6 then              [gripper clos...]
        if (0 < servo motor angle) then
          change servo motor angle by -1
      else
        encoder motor Port4 power to 0
wait 0.01 seconds
servo PortD angle servo motor angle
```

```
define chassis control
if IR Port2 received ↑ then
  dc motor M1 speed 100
else
  if IR Port2 received ↓ then
    dc motor M1 speed -100
  else
    if IR Port2 received ← then
      encoder motor Port3 power to speed
    else
      if IR Port2 received → then
        encoder motor Port3 power to (0 - speed)
      else
        dc motor M1 speed 0
        encoder motor Port3 power to 0
```

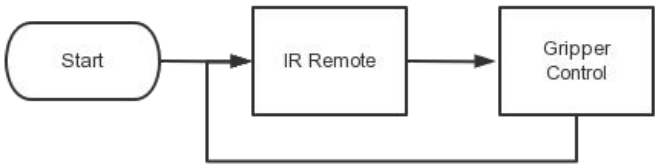
Extension: You can place a lot of small objects around the three-axis manipulator, and control the manipulator to move them to the same place or stack them up in a certain period of time.

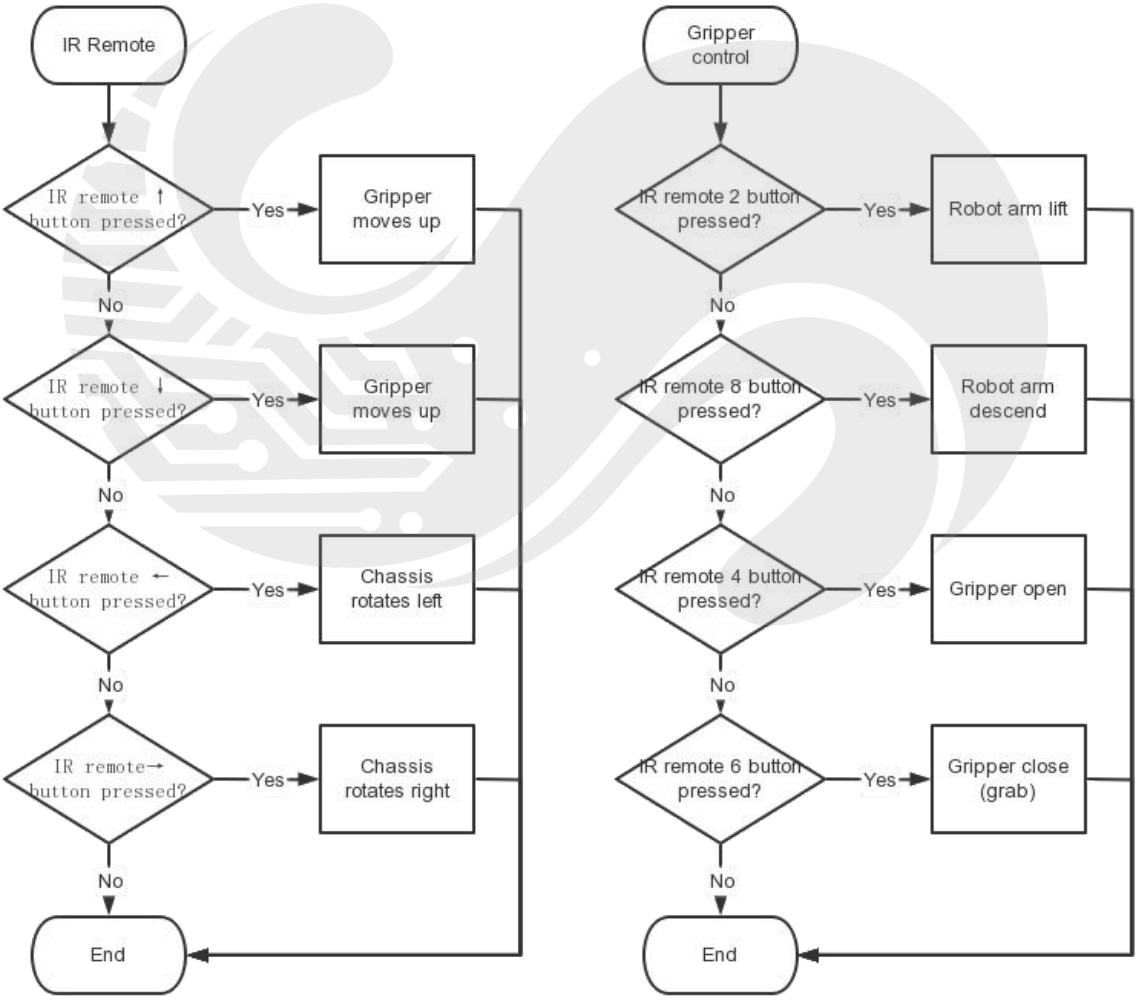
ARDUINO

Project #1: Remote Control Three-axis Mechanical Arm Arduino

1. Utilize the remote controller's up and down buttons to regulate the M1 motor, which governs the vertical motion of the first mechanical arm.
2. Employ the remote controller's left and right buttons to command the DC motor in Port 3, which determines the lateral movement of the robot arm.
3. Utilize the remote controller's 2 and 8 buttons to operate the DC motor in Port 4, thus controlling the vertical swing of the second mechanical arm.
4. Utilize the remote controller's 4 and 6 buttons to manipulate the Port B servo motor, responsible for the actuation of the robot gripper's opening and closing mechanism.

Program Idea





Reference Code

```
#include<WeELF328P.h>

void sleep(unsigned long duration);
//              Gripper control()
void f_Gripper_control();
//              IR remote()
void f_IR_remote();
void update();

WeInfraredReceiver ir(PORT_2);
WeEncoderMotor encoder_4(PORT_4);
Servo servo_D;
WeDCMotor dc_1(1);
WeEncoderMotor encoder_3(PORT_3);
double v_servo_motor_angle;         //servo motor angle;

void setup(){
                ir.begin();
                servo_D.attach(PORT_D);

                v_servo_motor_angle = 0;                //servo motor angle
}

void loop(){
                update();
                f_IR_remote();              //IR remote
                f_Gripper_control();        //Gripper control
}

void sleep(unsigned long duration){
                unsigned long end = millis() + duration;
                while(millis() < end)update();
}
```

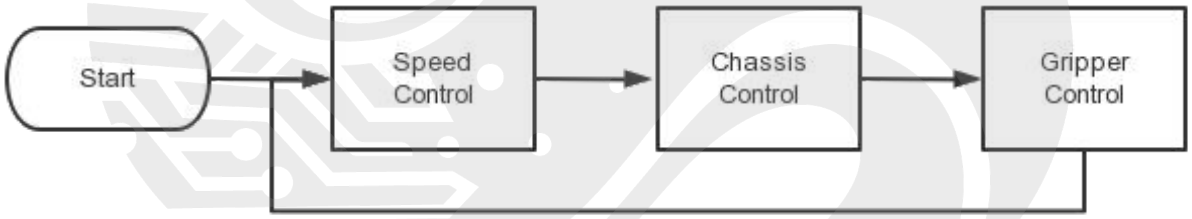
Reference Code

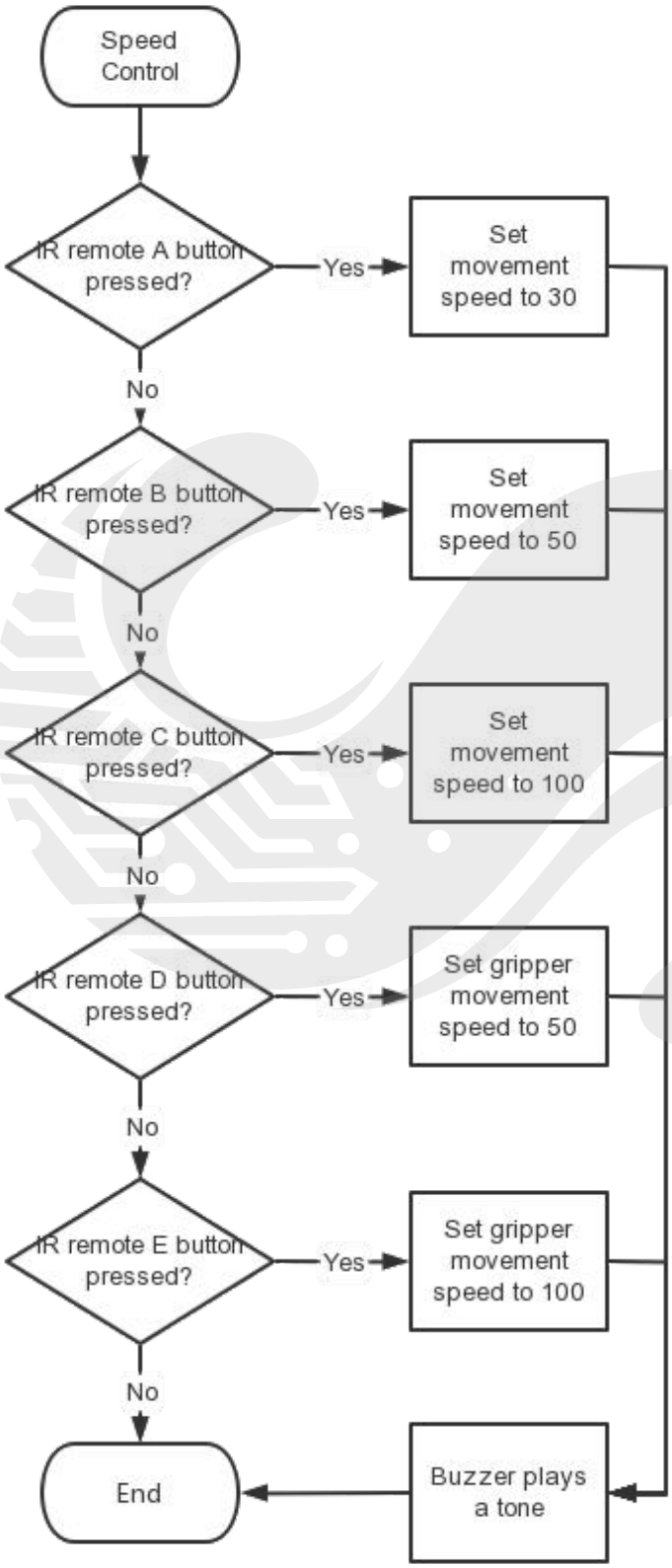
```
//		Gripper control()
void f_Gripper_control(){
		if(ir.isKeyPressed(IR_CONTROLLER_2)){
			encoder_4.run(100);
		}else if(ir.isKeyPressed(IR_CONTROLLER_8)){
			encoder_4.run(-100);
		}else if(ir.isKeyPressed(IR_CONTROLLER_4)){
			if(v_servo_motor_angle/*servo motor angle*/ < 80){
				v_servo_motor_angle += 1;
				//servo motor angle
			}
		}else if(ir.isKeyPressed(IR_CONTROLLER_6)){
			if(0 < v_servo_motor_angle/*servo motor angle*/){
				v_servo_motor_angle += -1;
				//servo motor angle
			}
		}else{
			encoder_4.run(0);
		}
		sleep(10);
		servo_D.write(v_servo_motor_angle/*servo motor angle*/);
}

//		IR remote()
void f_IR_remote(){
		if(ir.isKeyPressed(IR_CONTROLLER_UP)){
			dc_1.run(100);
		}else if(ir.isKeyPressed(IR_CONTROLLER_DOWN)){
			dc_1.run(-100);
		}else if(ir.isKeyPressed(IR_CONTROLLER_LEFT)){
			encoder_3.run(100);
		}else if(ir.isKeyPressed(IR_CONTROLLER_RIGHT)){
			encoder_3.run(-100);
		}else{
			dc_1.run(0);
			encoder_3.run(0);
		}
}

void update(){
		ir.loop();
}
```

Project #2: Creating a Variable Speed Three-axis Robotic Arm Arduino

Building upon project 1, an enhanced feature is introduced to the remote-controlled 4DOF robot arm, allowing for speed regulation. The A, B, and C buttons on the remote controller are utilized to adjust the lateral movement speed of the chassis, while the D and E buttons are used to modify the speed of the mechanical arm (near the mechanical claw).

Program Idea




Speed Control
IR remote A button pressed?
Yes
Set movement speed to 30
No
IR remote B button pressed?
Yes
Set movement speed to 50
No
IR remote C button pressed?
Yes
Set movement speed to 100
No
IR remote D button pressed?
Yes
Set gripper movement speed to 50
No
IR remote E button pressed?
Yes
Set gripper movement speed to 100
No
End
Buzzer plays a tone

Reference Code

```
#include<WeELF328P.h>

void sleep(unsigned long duration);
//		robot gripper control()
void f_robot_gripper_control();
//		Speed control()
void f_Speed_control();
//		chassis control()
void f_chassis_control();
void update();

WeInfraredReceiver ir(PORT_2);
WeEncoderMotor encoder_4(PORT_4);
Servo servo_D;
WeBuzzer buzzer(OnBoard_Buzzer);
WeDCMotor dc_1(1);
WeEncoderMotor encoder_3(PORT_3);
double v_speed;		//speed;
double v_robot_gripper_movement_speed;		//robot gripper movement speed;
double v_servo_motor_angle;		//servo motor angle;

void setup(){
		ir.begin();
		servo_D.attach(PORT_D);

		v_servo_motor_angle = 0;		//servo motor angle
		v_speed = 100;
		v_robot_gripper_movement_speed = 100;		//robot gripper movement speed
}

void loop(){
		update();
		f_chassis_control();		//chassis control
		f_Speed_control();		//Speed control
		f_robot_gripper_control();		//robot gripper control
}

void sleep(unsigned long duration){
		unsigned long end = millis() + duration;
		while(millis() < end)update();
}

//		robot gripper control()
void f_robot_gripper_control(){
		if(ir.isKeyPressed(IR_CONTROLLER_2)){
```

Reference Code

```
encoder_4.run(v_robot_gripper_movement_speed/*robot gripper movement speed*/);
		}else if(ir.isKeyPressed(IR_CONTROLLER_8)){
encoder_4.run(0 - v_robot_gripper_movement_speed/*robot gripper movement speed*/);
		}else if(ir.isKeyPressed(IR_CONTROLLER_4)){
			if(v_servo_motor_angle/*servo motor angle*/ < 80){
				v_servo_motor_angle += 1;
				//servo motor angle
			}
		}else if(ir.isKeyPressed(IR_CONTROLLER_6)){
			if(0 < v_servo_motor_angle/*servo motor angle*/){
				v_servo_motor_angle += -1;
				//servo motor angle
			}
		}else{
			encoder_4.run(0);
		}
		sleep(10);
		servo_D.write(v_servo_motor_angle/*servo motor angle*/);
}

//		Speed control()
void f_Speed_control(){
		if(ir.isKeyPressed(IR_CONTROLLER_A)){
			v_speed = 30;
			buzzer.tone(262, 500);
		}else if(ir.isKeyPressed(IR_CONTROLLER_B)){
			v_speed = 50;
			buzzer.tone(262, 500);
		}else if(ir.isKeyPressed(IR_CONTROLLER_C)){
			v_speed = 100;
			buzzer.tone(262, 500);
		}else if(ir.isKeyPressed(IR_CONTROLLER_D)){
			v_robot_gripper_movement_speed = 50;
			//robot gripper movement speed
			buzzer.tone(262, 500);
		}else if(ir.isKeyPressed(IR_CONTROLLER_E)){
			v_robot_gripper_movement_speed = 100;
			//robot gripper movement speed
			buzzer.tone(262, 500);
		}
}
```

Reference Code

```
//          chassis control()
void f_chassis_control(){
        if(ir.isKeyPressed(IR_CONTROLLER_UP)){
                dc_1.run(100);
        }else if(ir.isKeyPressed(IR_CONTROLLER_DOWN)){
                dc_1.run(-100);
        }else if(ir.isKeyPressed(IR_CONTROLLER_LEFT)){
                encoder_3.run(v_speed);
        }else if(ir.isKeyPressed(IR_CONTROLLER_RIGHT)){
                encoder_3.run(0 - v_speed);
        }else{
                dc_1.run(0);
                encoder_3.run(0);
        }
}

void update(){
        ir.loop();
}
```