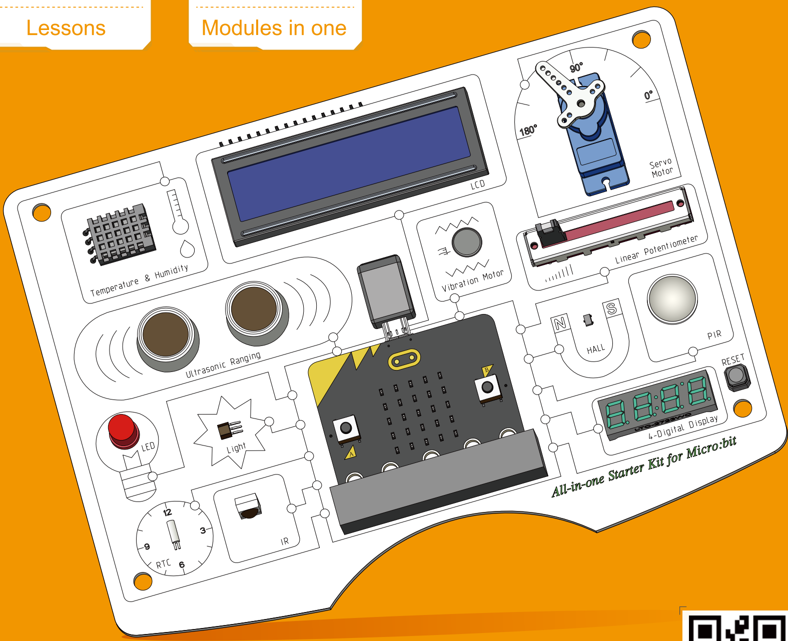
All-in-one Starter Kit for Micro:bit

- STEAM Education
- Open-source Hardware

20+ Lessons

13 Modules in one



www.elecrow.com

Table of contents

Introduction

Welcome to the User Manual for the All-in-one Starter Kit for Micro:bit. Let's begin our journey into the world of the Micro:bit development board and its sensors.

This development board comes with 22 well-designed courses that gradually increase in challenge, engagement, and creativity. These courses will guide you step-by-step to master essential knowledge. Throughout this learning journey, you will become familiar with various electronic modules, develop logical thinking skills, enhance your creative design abilities, and implement module functions through programming.

The learning process starts with an introduction to the Micro:bit development board and its different sensors. You will then explore how to program these sensors and apply them in practical projects. Each step is clearly explained, making it easy for beginners to quickly get started with programming in a user-friendly environment. The All-in-one Starter Kit for Micro:bit includes 13 electronic modules, each with its own unique features and functions. These modules are specially designed for beginners and are an excellent choice for learning and experimentation. For example, the light sensor enables beginners to control real-world lighting devices through programming.

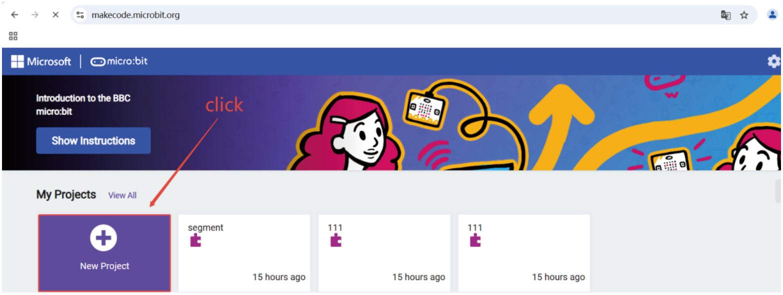
In summary, by using this development board, you will learn the basic knowledge and working principles of sensors, understand important concepts such as digital and analog signals, analog-to-digital conversion, and programming logic, and master the usage of some complex electronic modules. Most importantly, through Micro:bit programming, you will further strengthen your logical thinking skills.

For the programming software, we will use the official Micro:bit online programming platform provided on the Micro:bit website. No software installation is required, making it simple and convenient for beginners to start programming directly online.

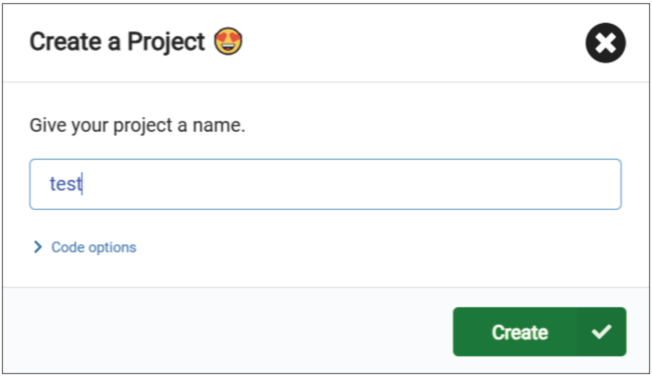
***Note:** Turn off the power before inserting the Micro:bit

Getting Started

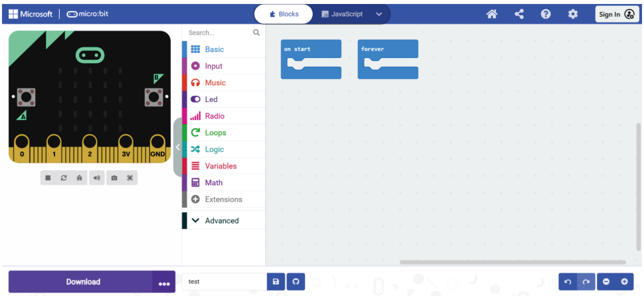
- Go to the Micro:bit website: https://makecode.microbit.org/



- To create a project, enter a name and click "Create".



- Enter the online editor.

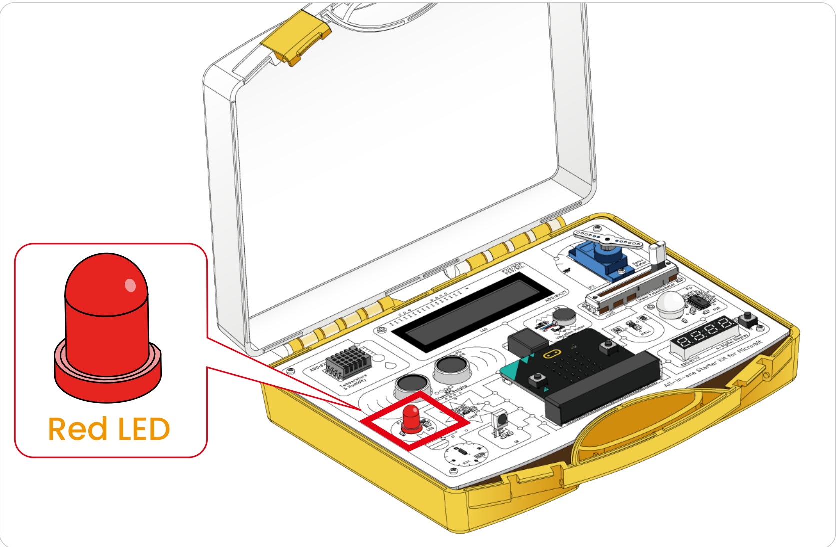


Lesson 1 - LED Control

Introduction

In this lesson, we will learn how to programmatically control the periodic blinking of an LED. By toggling digital signals between high and low levels to switch the circuit, and using precise delay functions, we can achieve adjustable on/off durations. This fundamental exercise provides essential groundwork for future studies in electronic control and IoT application development.

Hardware Required

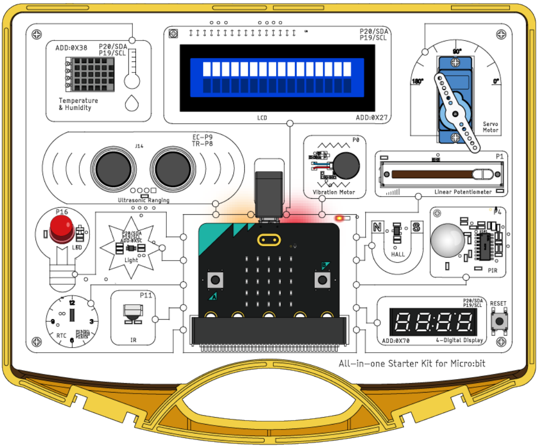


Working Principle of LED

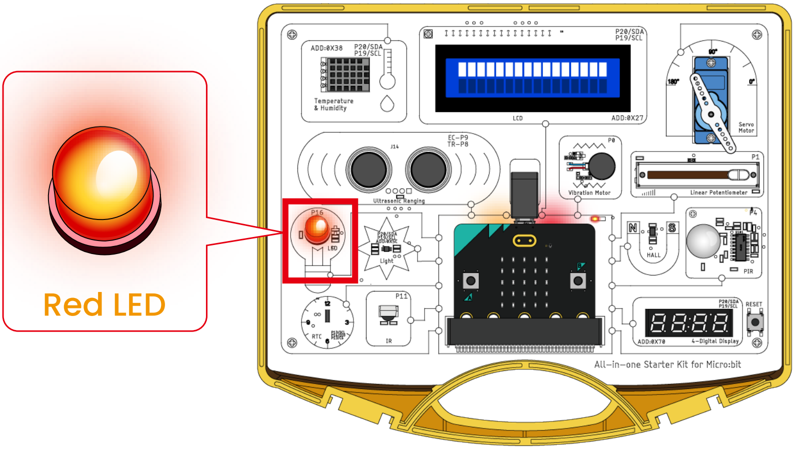
An LED (Light Emitting Diode) operates via carrier recombination in a semiconductor PN junction. Under forward bias, electrons and holes recombine in the depletion region, releasing energy as photons. The emission wavelength is determined by the material's bandgap (e.g., GaAs for IR, GaP for red/green, InGaN for blue/white). Drive circuits must limit current (typically 5-20mA) to prevent thermal damage. LEDs feature high efficiency, long lifespan, and fast response, widely used in displays and lighting.

Operation Effect Diagram

Before Operation

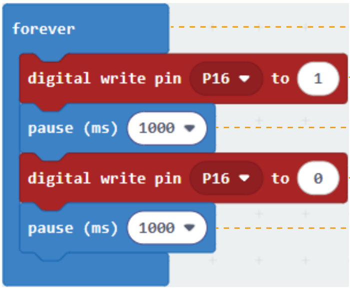


After Operation



After running the program, you will see the LED light up for one second, then turn off for one second, and repeat this cycle. If this process is not observed, please ensure that the program is running correctly.

Code Explanation



Forever Loop

The LED lights up when the P16 pin is high

Wait 1000 milliseconds

The LED light is off when pin 16 is low

Wait 1000 milliseconds

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

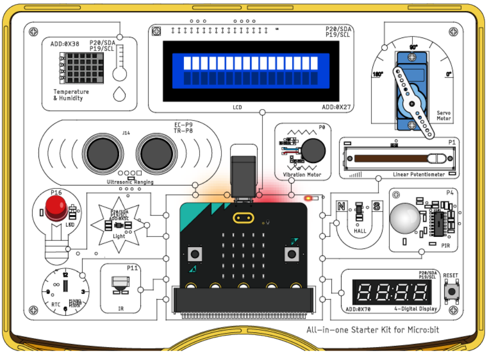
Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

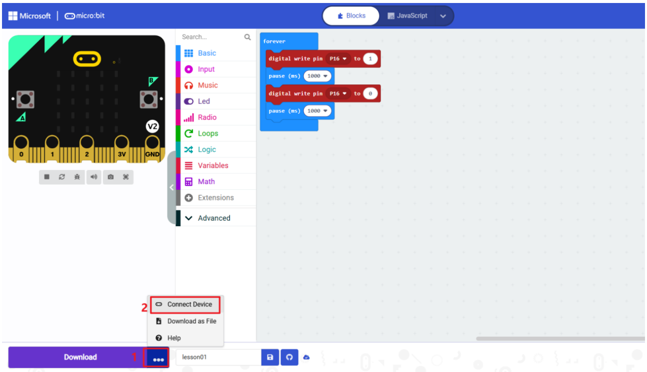
Programming Steps

To flash the code into the All in One Starter Kit for micro:bit, first connect your computer to the All in One Starter Kit for micro:bit. At this point, the LED on the development board may briefly light up, indicating normal power supply.

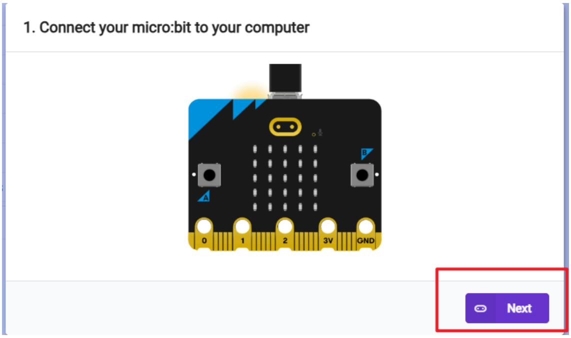
Hardware Connection Diagram to Host:



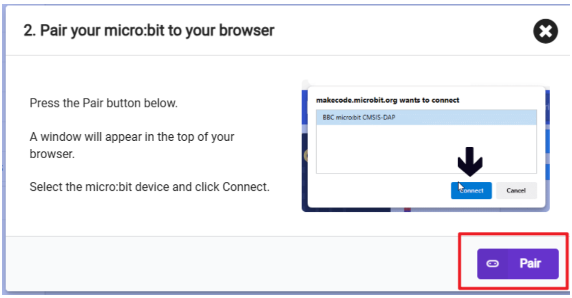
Next, locate the three-dot icon (...) at the bottom of the programming interface, click to expand the menu, and select "Connect device".



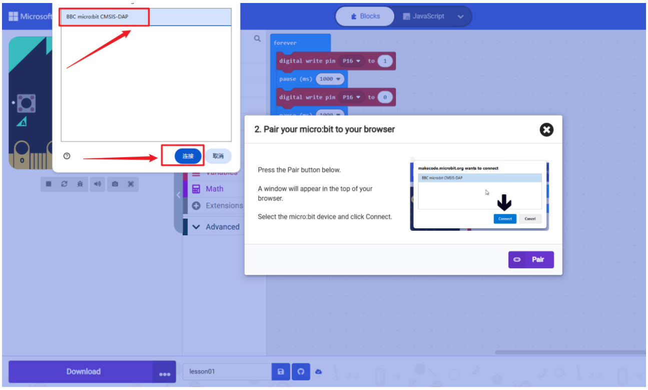
Identify the development board: Click "Next", and the system will automatically search for connected devices.



Click "Pair"

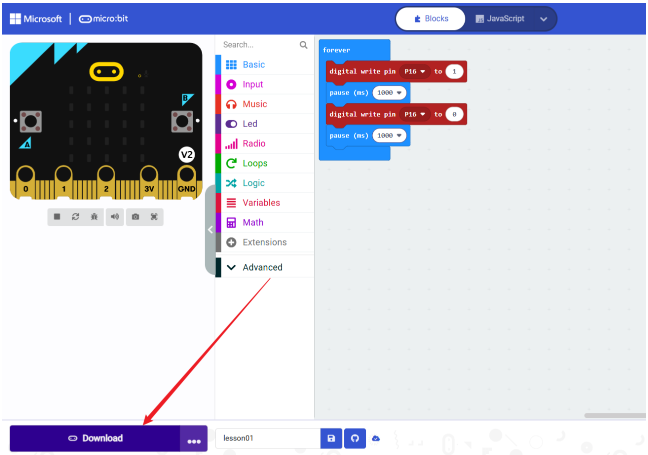


In the pop-up window, select "BBC micro:bit CMSIS-DAP" and click "Connect".

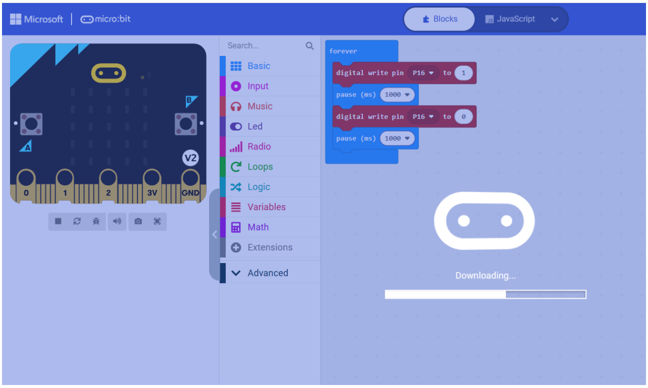


After successful connection, the lower left corner of the programming interface will display "Connected to micro:bit".

Finally, After importing, click “Download”.



Wait for a moment.



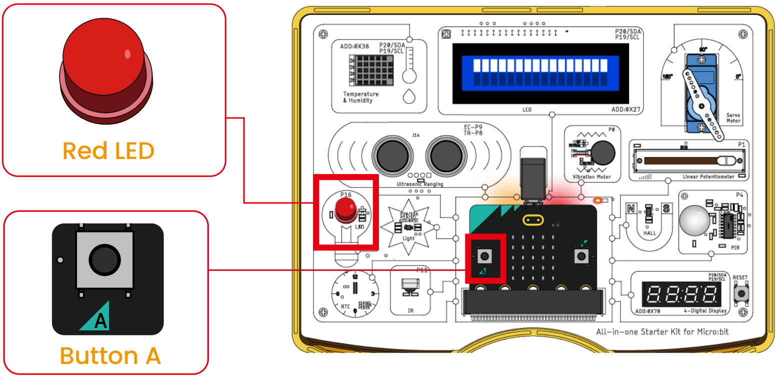
The browser will automatically transfer the code to the development board. When you observe the LED blinking, it proves that the code burning is successful!

Lesson 2 - Button Control LED

Introduction

In this lesson, we will learn how to implement button-controlled LED interaction using Microbit. When button A is pressed, the program outputs high level(1) to pin P16 to light the LED, and outputs low level(0) to turn it off when released. This real-time polling detection mechanism demonstrates fundamental digital I/O control principles, laying the foundation for embedded system development.

Hardware Required



Working Principle of LED

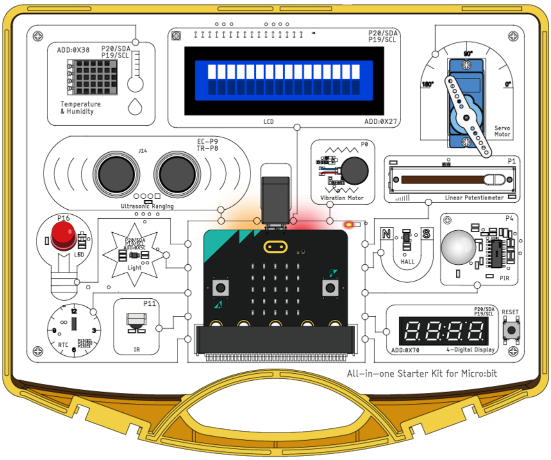
An LED (Light Emitting Diode) operates via carrier recombination in a semiconductor PN junction. Under forward bias, electrons and holes recombine in the depletion region, releasing energy as photons. The emission wavelength is determined by the material's bandgap (e.g., GaAs for IR, GaP for red/green, InGaN for blue/white). Drive circuits must limit current (typically 5-20mA) to prevent thermal damage. LEDs feature high efficiency, long lifespan, and fast response, widely used in displays and lighting.

Working Principle of Button Control

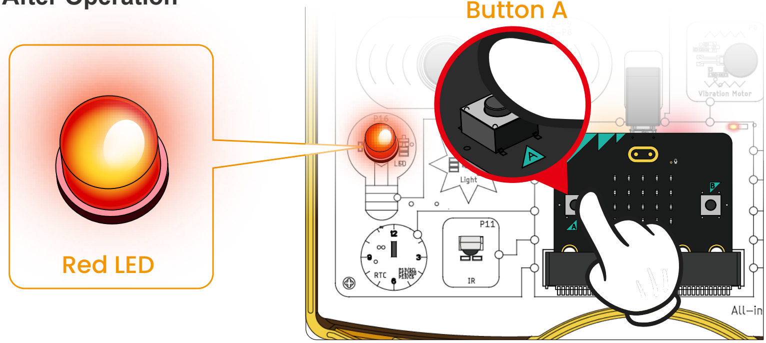
Button switch control relies on mechanical contacts for circuit switching. In default state, the open contacts maintain high-level signal via pull-up resistor; when pressed, closed contacts create conduction path pulling the signal line low. For reliable operation, hardware debouncing (e.g. RC low-pass filter) or software algorithms (delayed sampling) must be implemented to eliminate false triggers from contact bounce. Design considerations include contact material, on-resistance and mechanical endurance parameters.

Operation Effect Diagram

Before Operation

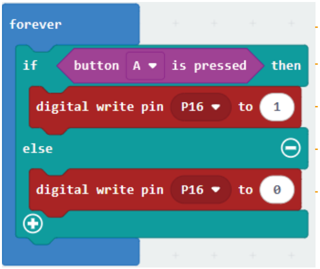


After Operation



After running the program, you will see that pressing button A on the Microbit will turn on the LED. Releasing the button will turn the LED off.

Code Explanation



- Forever Loop
- If the onboard button A on the Micro:bit is pressed
- The LED lights up when the P16 pin is high
- "else" here means button A is not pressed
- The LED light is off when pin 16 is low

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

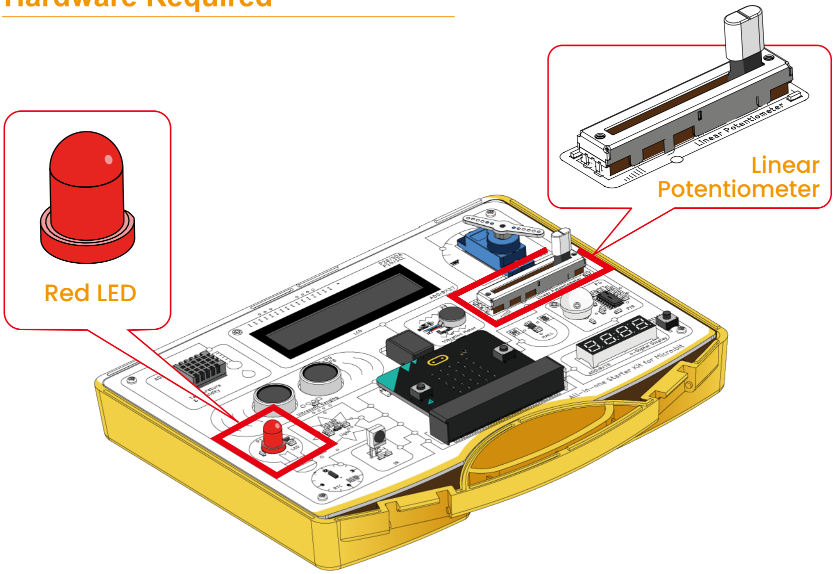
For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

Lesson 3 - Breathing LED

Introduction

In this lesson, we will use a potentiometer with a maximum resistance of 10kΩ to achieve the breathing effect of the LED. As you slide it from left to right, its output voltage will range from 0V to 5V (VCC). In this session, we will adjust the LED using the potentiometer to create the breathing light effect!

Hardware Required



Working Principle of LED

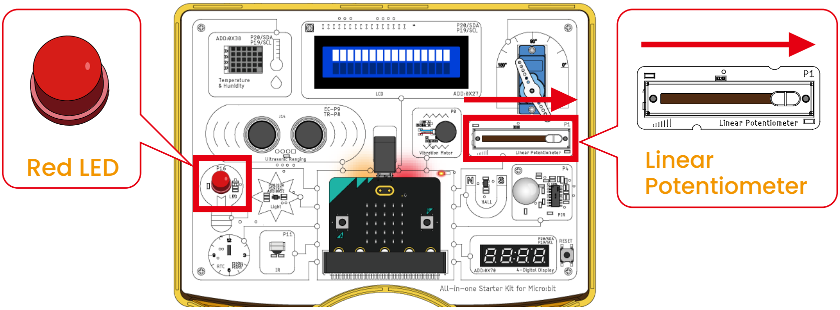
An LED (Light Emitting Diode) operates via carrier recombination in a semiconductor PN junction. Under forward bias, electrons and holes recombine in the depletion region, releasing energy as photons. The emission wavelength is determined by the material's bandgap (e.g., GaAs for IR, GaP for red/green, InGaN for blue/white). Drive circuits must limit current (typically 5-20mA) to prevent thermal damage. LEDs feature high efficiency, long lifespan, and fast response, widely used in displays and lighting.

Working Principle of Linear Potentiometer

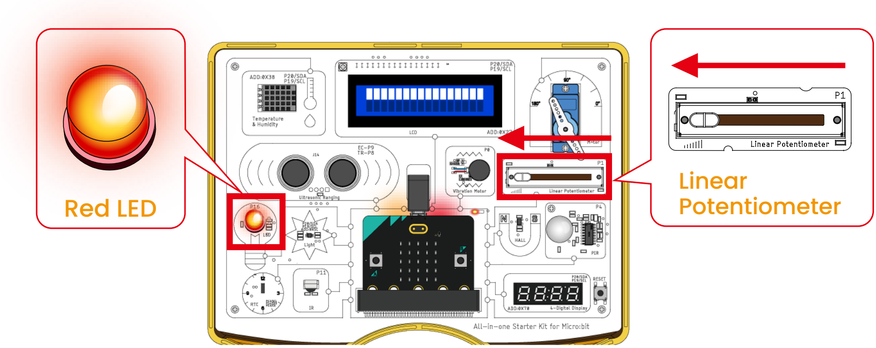
A linear potentiometer varies resistance through a wiper's linear movement along a resistive track. The resistive track, typically made of carbon film, conductive plastic or metal film, features uniform resistance distribution. The wiper divides the resistive element into two sections, creating an adjustable voltage divider. This design enables precise resistance adjustment, widely used in volume control, position sensing and instrument calibration applications.

Operation Effect Diagram

When I move the slider module to the far right, the LED brightness is at its lowest.



When I move the slider module to the far left, the LED brightness is at its highest.



After uploading the code, the LED brightness will vary according to the position of the potentiometer. When the linear potentiometer is pushed to the far left (minimum position), the LED will be at its brightest. When it is pushed to the far right (maximum position), the LED will turn off. If the LED does not respond as expected, please check whether the program is running correctly.

Code Explanation

The sliding rheostat outputs an analog value between 0 and 1020. A higher resistance means the LED will be dimmer. So we need to write:1020 - the value from the sliding rheostat

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

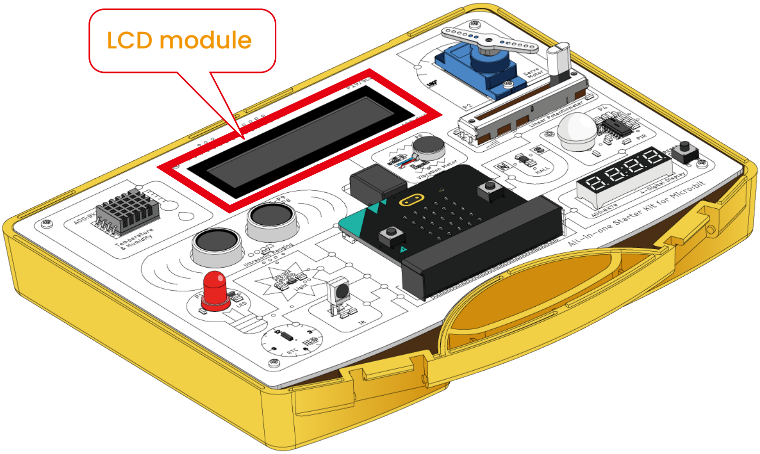
For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

Lesson 4 - LCD Display

Introduction

In this lesson, we will learn how to display text on an LCD screen. You will gain an understanding of the basic working principles of LCDs, learn how to control the displayed content through programming, and develop the skills to update information dynamically in your projects. Through hands-on practice, you will enhance your knowledge and application of LCD control. By the end of this lesson, you will not only be able to independently implement basic text display functions, but also be well-prepared for more advanced graphical interface development and interactive projects.

Hardware Required

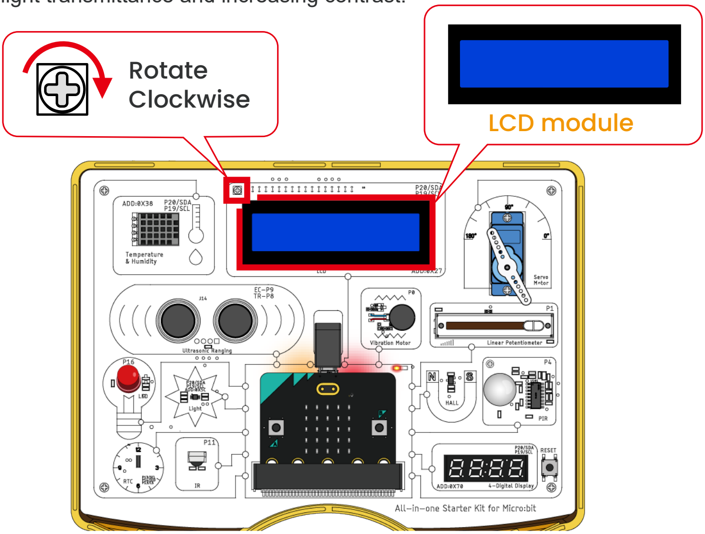


Working Principle of LCD Display

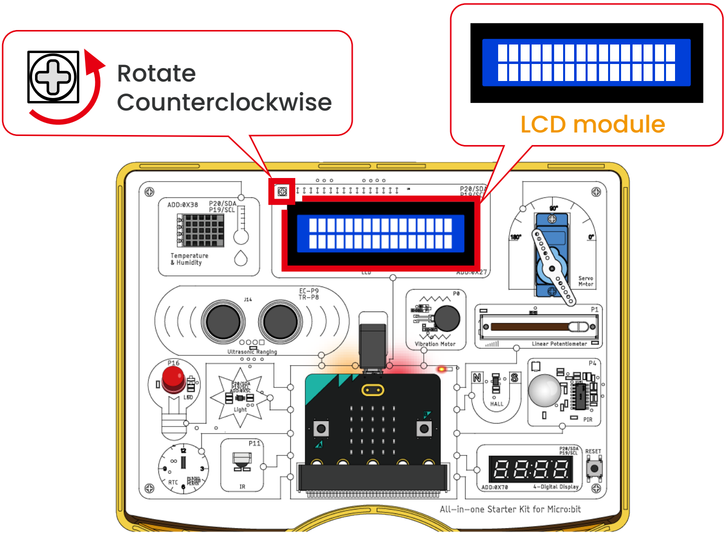
An LCD (Liquid Crystal Display) modulates light by controlling the alignment of liquid crystal molecules. The LC layer is sandwiched between polarizers: without voltage, molecules allow light transmission; when electrified, they rotate to block light by altering polarization. Each pixel is independently controlled by a TFT (Thin-Film Transistor), adjusting voltage to change LC orientation for grayscale or color display.

The adjustment screw located at the top left corner of the LCD can be used to modify the screen's contrast.

The principle behind this adjustment involves changing the VCOM offset voltage of the LCD driving circuit by rotating the contrast screw. Rotating it clockwise increases the bias voltage, which enhances the twist angle of the liquid crystal molecules, thereby reducing light transmittance and increasing contrast.

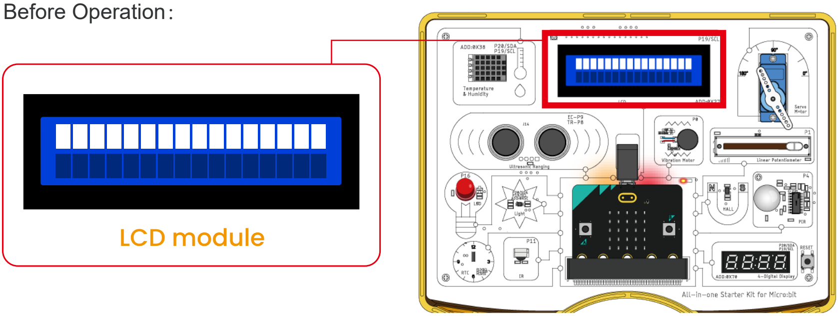


Conversely, rotating it counterclockwise decreases the voltage, reduces the twist angle, increases light transmittance, and lowers the contrast.

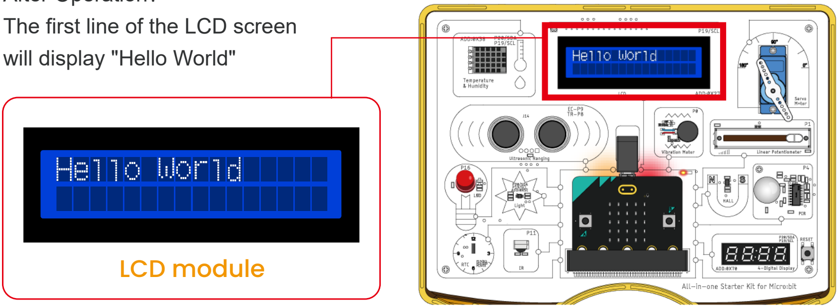


Operation Effect Diagram

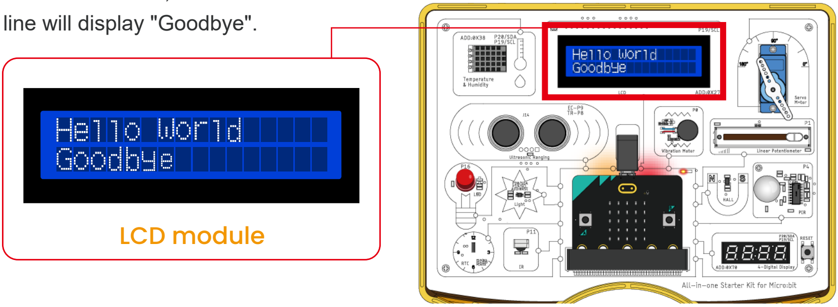
Before Operation:



After Operation:
The first line of the LCD screen will display "Hello World"

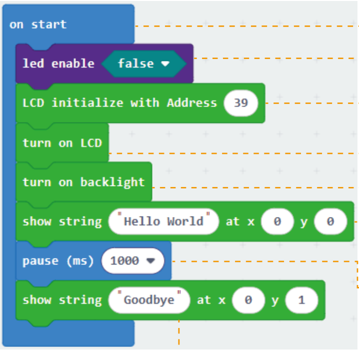


After one second, the second line will display "Goodbye".



After running the program, you will see: the first line of the LCD screen will display "Hello World", and after one second, the second line will display "Goodbye".

Code Explanation



When the Micro:bit starts

Set the onboard LED to OFF

On the development board, the LCD's address is 0x27 in hexadecimal, which corresponds to 39 in decimal.

Turn on the LCD

Turn on the LCD backlight

Display "Hello World" on the LCD at the first row, first column

Wait 1000 milliseconds

Display "Goodbye" on the LCD at the second row, first column

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

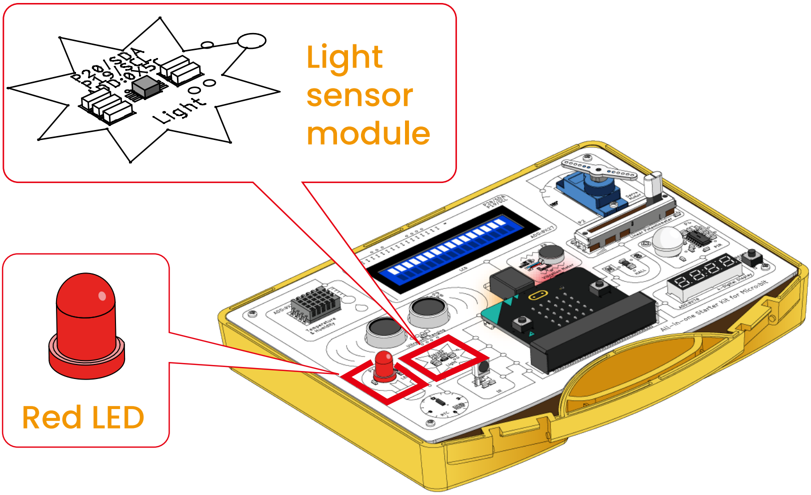
For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

Lesson 5 - Intelligent Street Light

Introduction

In this lesson, you will gain an in-depth understanding of how to acquire real-time ambient light intensity data using a light sensor module and implement intelligent control of an LED based on this data. You will learn how to set different light threshold levels, enabling the LED to automatically turn on or off according to the surrounding brightness, thereby avoiding unnecessary power consumption and improving energy efficiency.

Hardware Required



Working Principle of LED

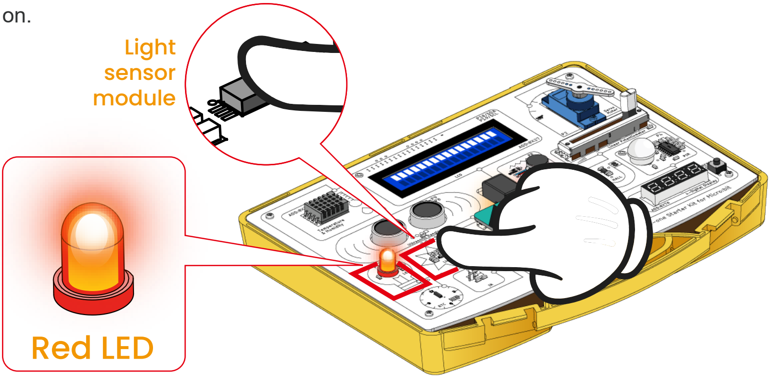
An LED (Light Emitting Diode) operates via carrier recombination in a semiconductor PN junction. Under forward bias, electrons and holes recombine in the depletion region, releasing energy as photons. The emission wavelength is determined by the material's bandgap (e.g., GaAs for IR, GaP for red/green, InGaN for blue/white). Drive circuits must limit current (typically 5-20mA) to prevent thermal damage. LEDs feature high efficiency, long lifespan, and fast response, widely used in displays and lighting.

Working Principle of Light Sensor

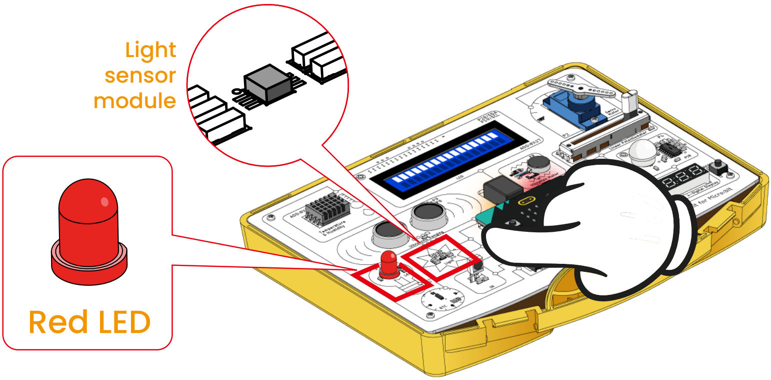
A light sensor converts optical signals to electrical signals via photoelectric devices (e.g., photoresistor, photodiode, or phototransistor). Photons striking semiconductor materials generate electron-hole pairs, creating photocurrent. This current is processed by signal conditioning circuits (e.g., op-amp or ADC) to output electrical signals (voltage/digital values) proportional to light intensity, enabling precise ambient light detection.

Operation Effect Diagram

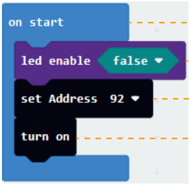
Simulating a no-light environment: Cover the top of the light sensor with your hand. At this time, the ambient brightness decreases, and the red LED will automatically turn on.



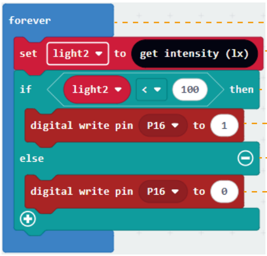
Simulating a light environment: Remove your hand from the sensor. The ambient brightness increases, and the red LED will automatically turn off.



Code Explanation



- When the Micro:bit starts
- Set the onboard LED to OFF
- The light sensor address is initialized to 92
- Example:Initializing the BH1750



- Forever Loop
- Get the ambient light intensity and save it to “light2”
- If the value of the variable "light2" is less than 100, the ambient light intensity is too low
- The LED lights up when the P16 pin is high
- If the conditions fail
- The LED light is off when pin 16 is low

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

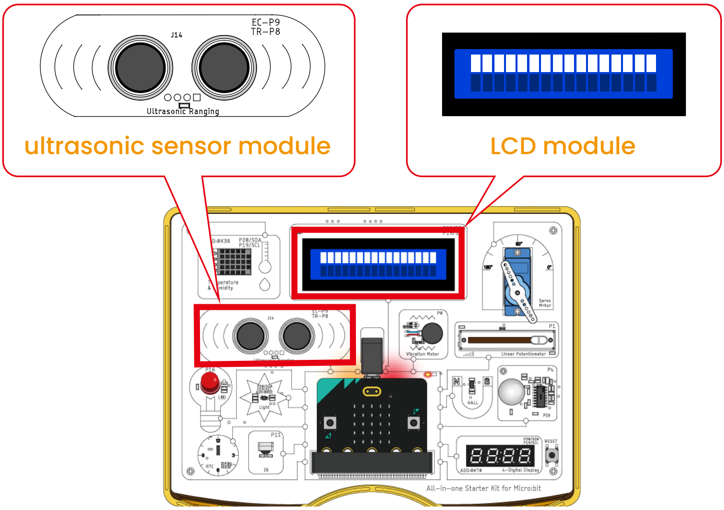
For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

Lesson 6 - Ultrasonic Ranging Display

Introduction

In this lesson, we will learn how to use the ultrasonic sensor module. With this module, we can measure the distance between the module and a flat surface in front of it. We can create an ultrasonic distance meter, and the measured distance will be displayed on the LCD module.

Hardware Required



Working Principle of Ultrasonic Distance Sensor

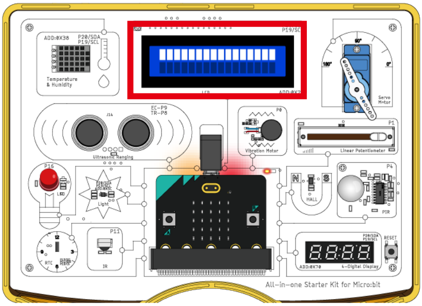
The ultrasonic sensor measures distance by emitting high-frequency sound waves (typically 40 kHz) and detecting the reflected echo. The transmitter emits an ultrasonic pulse, which reflects off an object and is detected by the receiver. The microcontroller (MCU) calculates the time-of-flight (ToF) between transmission and reception. Based on the speed of sound (~343 m/s at 25 °C), the distance can be calculated. Temperature compensation can be applied to improve accuracy. Ultrasonic sensors are suitable for short-range, non-contact distance detection. They are resistant to light interference but can be affected by soft materials.

Working Principle of LCD Display

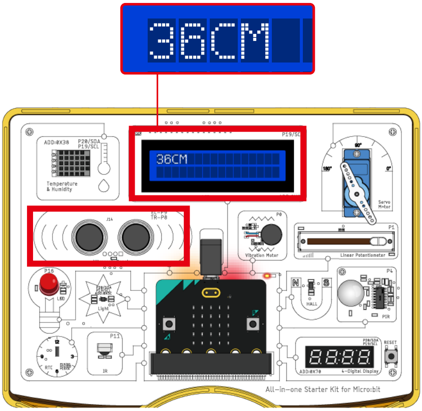
An LCD (Liquid Crystal Display) modulates light by controlling the alignment of liquid crystal molecules. The LC layer is sandwiched between polarizers: without voltage, molecules allow light transmission; when electrified, they rotate to block light by altering polarization. Each pixel is independently controlled by a TFT (Thin-Film Transistor), adjusting voltage to change LC orientation for grayscale or color display.

Operation Effect Diagram

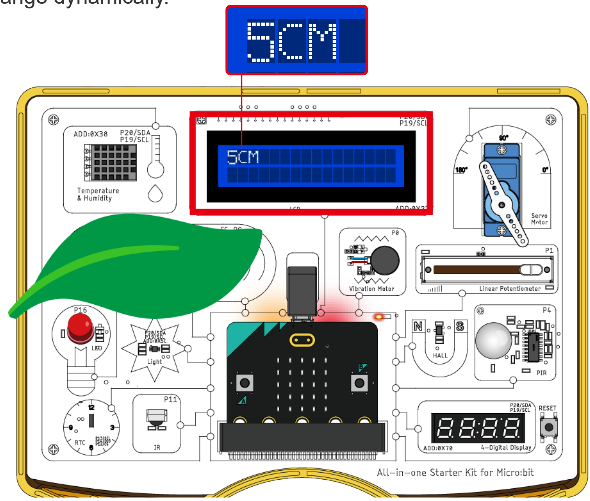
Before Operation:

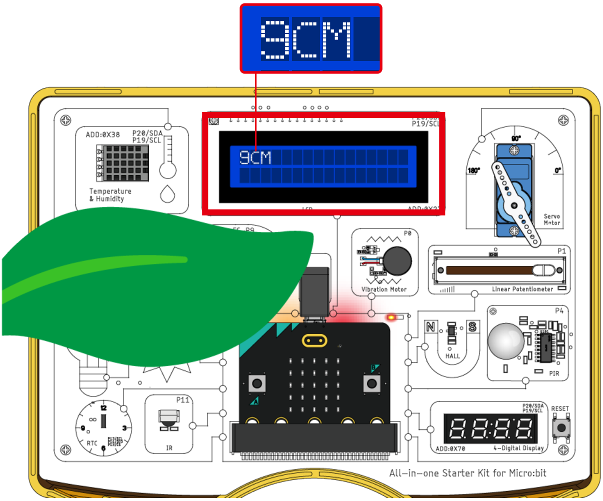


After Operation:
After starting the lesson and running the program, the LCD screen will continuously update the distance values measured by the ultrasonic sensor.



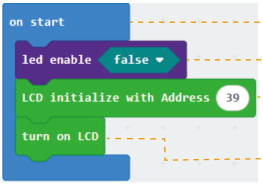
As a flat object moves in front of the ultrasonic module, the distance displayed on the screen will change dynamically.



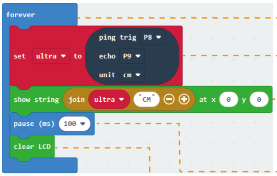


After running the program, you will see the distance data measured by the ultrasonic sensor continuously refreshing on the LCD screen. As the flat surface in front of the ultrasonic module moves, the measured distance values will also change accordingly. If this does not happen, please check whether the program is running correctly.

Code Explanation



- When the Micro:bit starts
- Set the onboard LED to OFF
- On the development board, the LCD’s address is 0x27 in hexadecimal, which corresponds to 39 in decimal.
- Turn on the LCD



- Forever Loop
- Initialize the pins for the ultrasonic sensor and store its measured values in the variable "ultra"
- Display the value of the variable "ultra" on the LCD at the first row and first column
- Wait 100 milliseconds
- Clear the LCD display

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

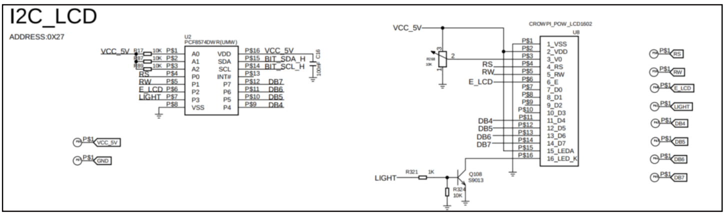
Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

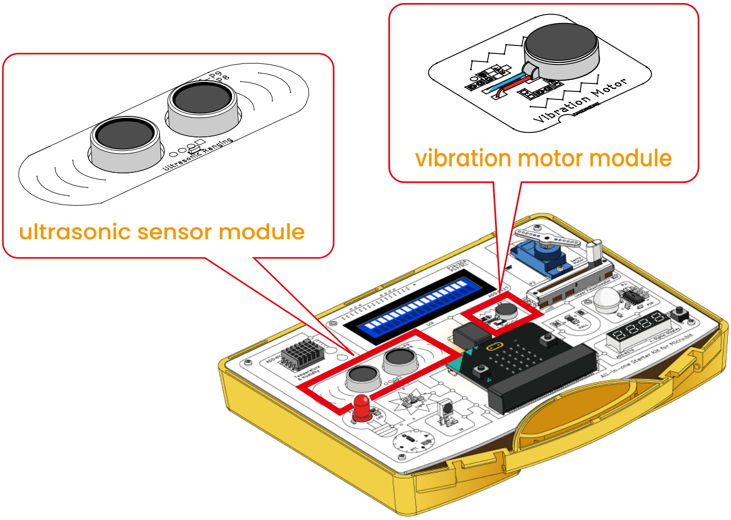


Lesson 7 - Obstacle Close Range Alarm

Introduction

In this lesson, we will delve deeper into the ultrasonic sensor module and learn how to integrate it with other modules. We will use the distance data obtained from the ultrasonic module to control the on/off state of the vibration motor module. In this way, we can achieve the effect of ultrasonic obstacle avoidance.

Hardware Required



Working Principle of Ultrasonic Distance Sensor

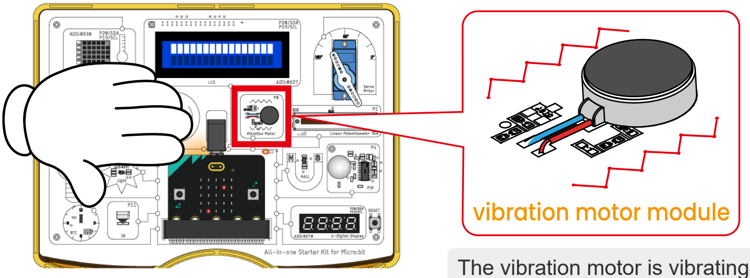
The ultrasonic sensor measures distance by emitting high-frequency sound waves (typically 40 kHz) and detecting the reflected echo. The transmitter emits an ultrasonic pulse, which reflects off an object and is detected by the receiver. The microcontroller (MCU) calculates the time-of-flight (ToF) between transmission and reception. Based on the speed of sound (~343 m/s at 25 °C), the distance can be calculated. Temperature compensation can be applied to improve accuracy. Ultrasonic sensors are suitable for short-range, non-contact distance detection. They are resistant to light interference but can be affected by soft materials.

Working Principle of Vibration Motor

The vibration motor generates mechanical oscillations via electromagnetic actuation or eccentric rotors. DC current through the coil creates alternating magnetic fields to drive permanent magnets/eccentric masses, converting electrical energy to vibration. Frequency is controlled by PWM signals, while amplitude depends on rotor eccentricity/current. Built-in shock sensors provide real-time feedback, featuring 3-5V operation and <10ms response time.

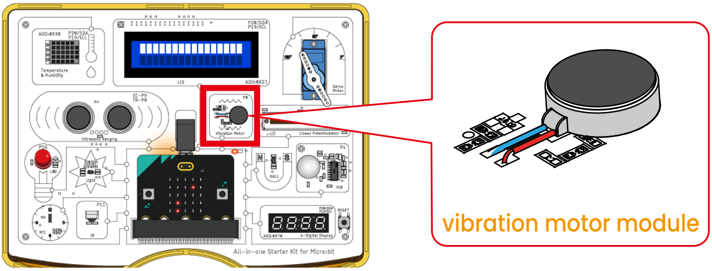
Operation Effect Diagram

Simulating an approaching obstacle:
Slowly move your hand or an object closer to the ultrasonic module (distance < 30 cm). The vibration motor should activate, indicating the presence of an obstacle.



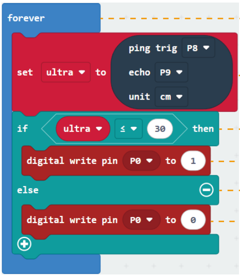
The vibration motor is vibrating

Simulating a receding obstacle:
Move the object away (distance ≥ 30 cm). The vibration motor should stop vibrating, indicating that the area is clear and safe.



After running the program, you will observe that as the distance measured by the ultrasonic module changes, the vibration motor activates when the distance is less than 30 centimeters, indicating the presence of an obstacle. When the distance is 30 centimeters or more, the vibration motor turns off, signaling that the path is clear and no obstacles are detected. If the system does not behave as expected, please ensure that the program is running correctly.

Code Explanation



Forever Loop

Configure the pins for the ultrasonic sensor and store its measured values in the variable "ultra".

If "ultra" is less than or equal to 30

Start vibration module

If not less than or equal to 30

Stop vibration module

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

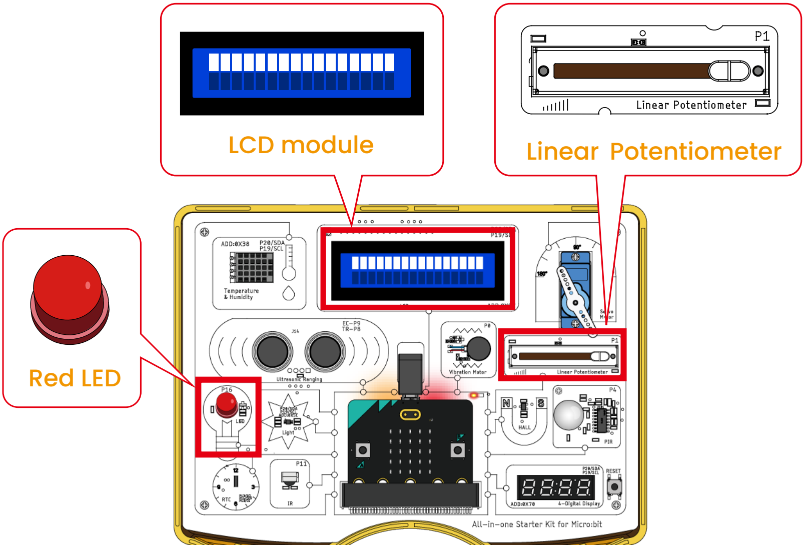
For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

Lesson 8 - Brightness Display

Introduction

In this lesson, we will learn how to adjust the brightness of an LED using a slide potentiometer and divide the brightness into 10 distinct levels. By reading the voltage output from the slide potentiometer, you will obtain real-time changes in its resistance value and map these to corresponding brightness levels, thereby achieving linear brightness adjustment and graded display of the LED.

Hardware Required



Working Principle of LED

An LED (Light Emitting Diode) operates via carrier recombination in a semiconductor PN junction. Under forward bias, electrons and holes recombine in the depletion region, releasing energy as photons. The emission wavelength is determined by the material's bandgap (e.g., GaAs for IR, GaP for red/green, InGaN for blue/white). Drive circuits must limit current (typically 5-20mA) to prevent thermal damage. LEDs feature high efficiency, long lifespan, and fast response, widely used in displays and lighting.

Working Principle of Linear Potentiometer

A linear potentiometer varies resistance through a wiper's linear movement along a resistive track. The resistive track, typically made of carbon film, conductive plastic or metal film, features uniform resistance distribution. The wiper divides the resistive element into two sections, creating an adjustable voltage divider. This design enables precise resistance adjustment, widely used in volume control, position sensing and instrument calibration applications.

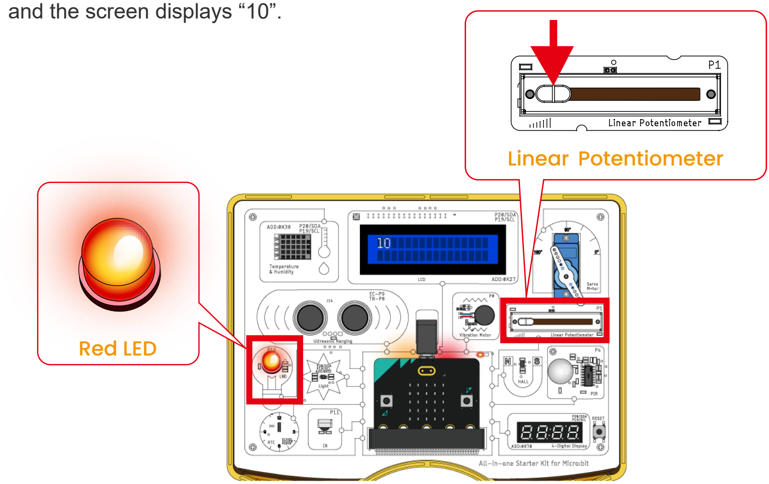
Working Principle of Button Control

Button switch control relies on mechanical contacts for circuit switching. In default state, the open contacts maintain high-level signal via pull-up resistor; when pressed, closed contacts create conduction path pulling the signal line low. For reliable operation, hardware debouncing (e.g. RC low-pass filter) or software algorithms (delayed sampling) must be implemented to eliminate false triggers from contact bounce. Design considerations include contact material, on-resistance and mechanical endurance parameters.

Operation Effect Diagram

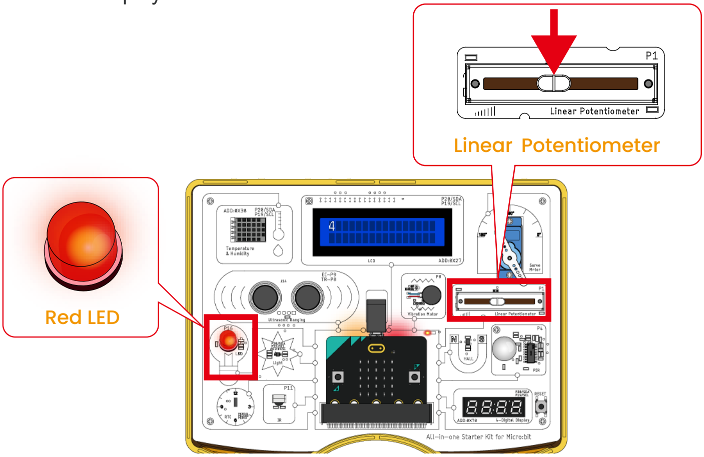
Slide the linear potentiometer and observe the changes in the LED brightness as well as the brightness level displayed on the screen.

1.Adjust to 10 (Brightest):
Slide the potentiometer to the far left end, observe the LED reaching its brightest state, and the screen displays “10”.



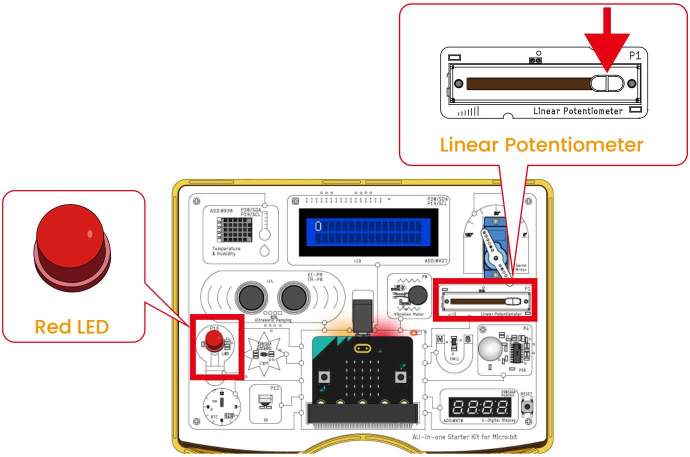
2. Adjust to 4:

Slide the potentiometer to the middle position, observe the LED at medium brightness, and the screen displays “4”.



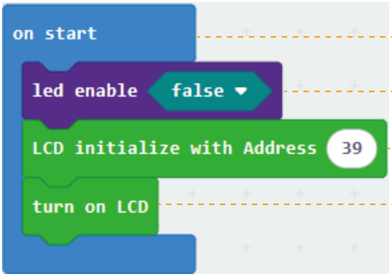
3. Adjust to 0 (Darkest):

Slide the potentiometer to the far right end, observe the LED turning off, and the screen displays “0”.



After running the program, you will see that by sliding the potentiometer left or right, you can adjust the brightness level of the light from 0 to 10.

Code Explanation

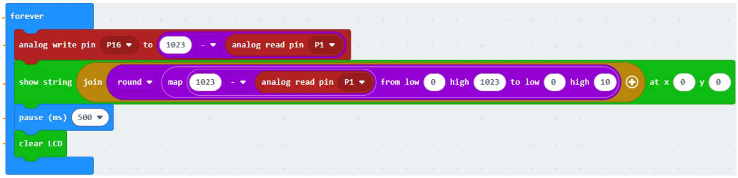


When the Micro:bit starts

Set the onboard LED to OFF

On the development board, the LCD's address is 0x27 in hexadecimal, which corresponds to 39 in decimal.

Turn on the LCD



Forever Loop

The sliding rheostat outputs an analog value between 0 and 1023. A higher resistance means the LED will be dimmer. So we need to write:1023 - the value from the sliding rheostat.

Since the values we get are analog and range from 0 to 1023, we need to map them to a range of 0 to 10 and display the result as an integer on the LCD screen.

Wait 500 milliseconds

Clear LCD

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

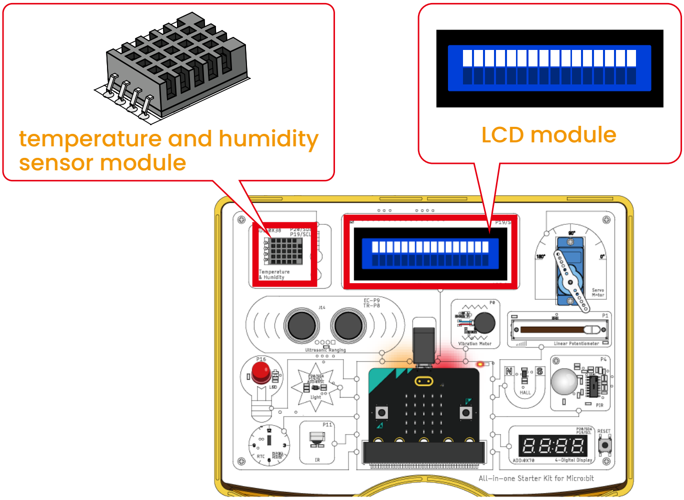
For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

Lesson 9 - Temperature&Humidity Detecting System

Introduction

In this lesson, we will llearn how to use a temperature and humidity sensor module, master the methods for collecting temperature and humidity data, and implement real-time data reading and display through programming. You will also learn how to dynamically update sensor data on the screen and understand the interaction logic between data acquisition and visual display.

Hardware Required



Working Principle of Temperature and Humidity Sensors

Temperature and humidity sensors detect environmental parameters through sensitive elements. Temperature measurement is typically based on thermistors or semiconductor materials whose resistance or voltage changes with temperature. Humidity is usually measured using capacitive or resistive sensing elements, where the dielectric constant or resistance varies with the ambient humidity. An integrated signal conditioning circuit within the sensor converts the analog signals into digital outputs, which can then be read and processed by the main control unit.

Working Principle of LCD Display

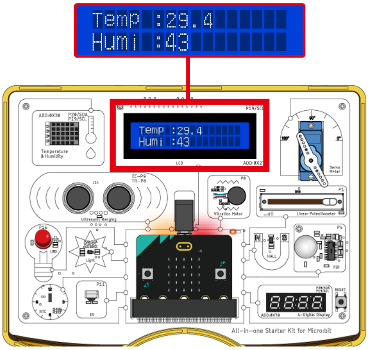
An LCD (Liquid Crystal Display) modulates light by controlling the alignment of liquid crystal molecules. The LC layer is sandwiched between polarizers: without voltage, molecules allow light transmission; when electrified, they rotate to block light by altering polarization. Each pixel is independently controlled by a TFT (Thin-Film Transistor), adjusting voltage to change LC orientation for grayscale or color display.

Operation Effect Diagram

After starting the program, the system will continuously collect data from the temperature and humidity sensor and display it on the screen in real time.

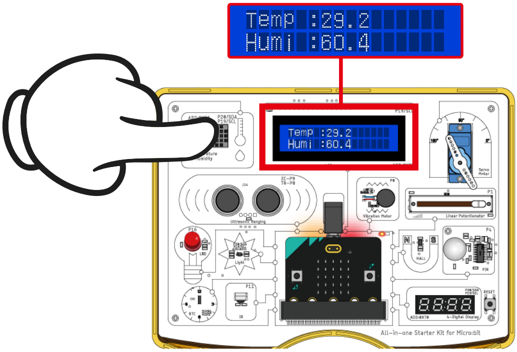
1.Normal Environment:

In a normal room temperature environment, observe the temperature and humidity data displayed on the screen.



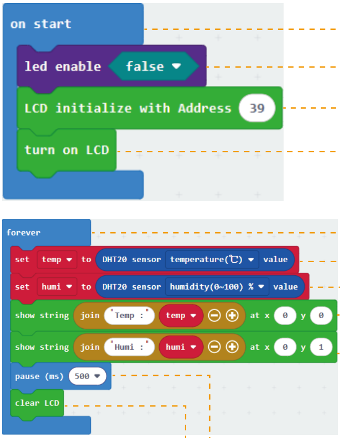
2.Touch the Sensor (to slightly heat the temperature and humidity sensor):

Gently place your finger on the surface of the DHT20 temperature and humidity sensor to generate slight heat, and observe the changes in the temperature and humidity data displayed on the screen.



After running the program, you will see the temperature and humidity data obtained from the temperature and humidity sensor displayed on the screen.

Code Explanation



- When the Micro:bit starts
- Set the onboard LED to OFF
- On the development board, the LCD's address is 0x27 in hexadecimal, which corresponds to 39 in decimal.
- Turn on the LCD
- Forever Loop
- Get the temperature value from the DHT20 sensor and store it in the variable "temp"
- Get the humidity value from the DHT20 sensor and store it in the variable "humi"
- Display the value of the variable "temp" on the LCD
- Display the value of the variable "humi" on the LCD
- Wait 500 milliseconds
- Clear LCD

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

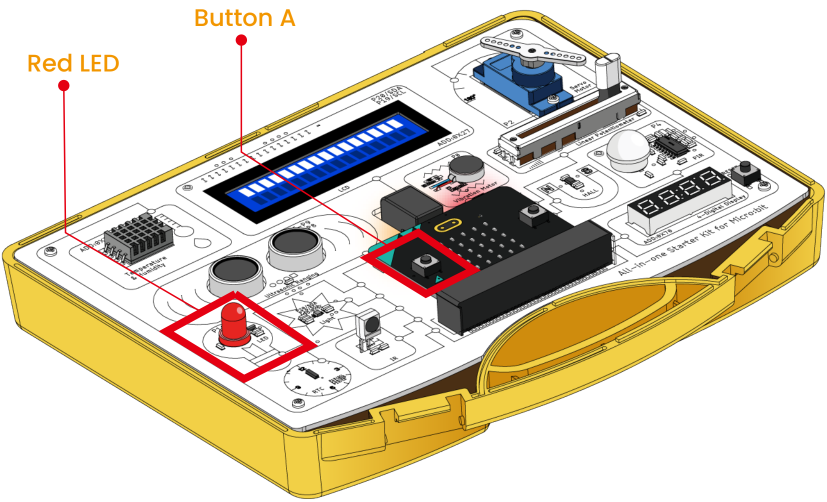
For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

Lesson 10 - Servo Control

Introduction

In this lesson, we will learn how to control a servo motor module by configuring PWM control signals to achieve oscillating motion within the 0 to 180-degree range. During the course execution, the servo will follow a predefined logic to perform periodic movement, rotating from 0 degrees to 180 degrees and then reversing back to 0 degrees.

Hardware Required

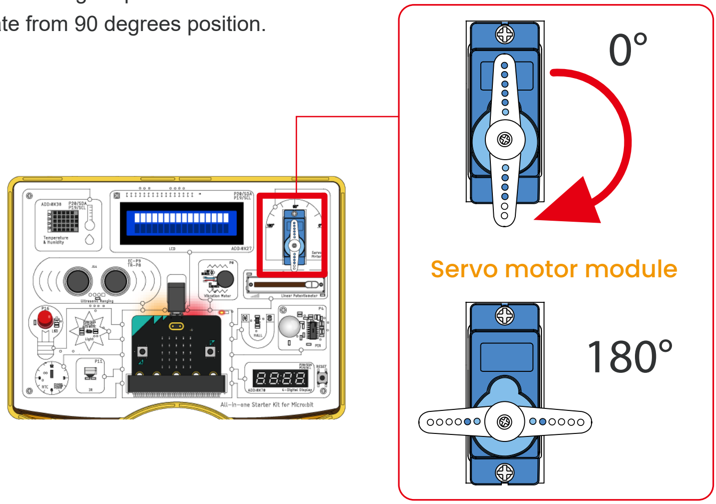


Working Principle of a Servo Motor

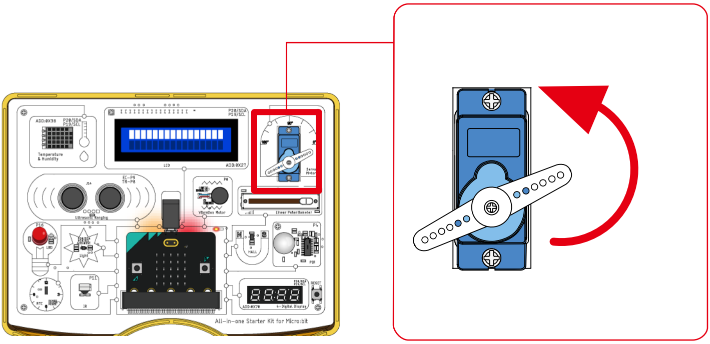
A servo motor achieves precise angular positioning through a closed-loop control system. The control circuit receives a PWM signal and decodes the pulse width to determine the target position. The motor drives a gear set to rotate, while a built-in potentiometer continuously feeds back the current angle to a comparator. If there is any deviation, the circuit adjusts the motor’s rotation direction until the error is eliminated. A typical servo motor operates within a rotation range of 0° to 180°, offering high torque and fast response characteristics.

Operation Effect Diagram

Forward Rotation: After the program starts, the servo will slowly rotate from 0 degrees to the 180-degree position.
Rrotate from 90 degrees position.

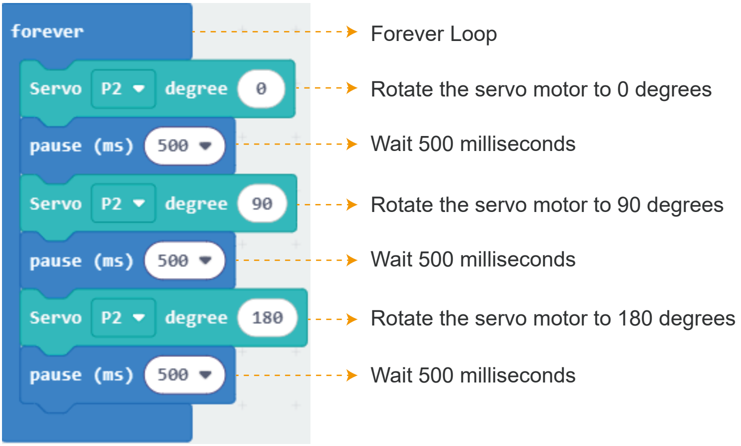


Reverse Rotation: Once it reaches 180 degrees, the servo will automatically rotate in the reverse direction, returning to the 0-degree position, forming a continuous oscillating loop.



After running the program, you will see the servo rotate from 0 degrees to 180 degrees, and then from 180 degrees back to 0 degrees. If this process does not occur, please check whether the firmware has been correctly flashed and whether the hardware connections are correct.

Code Explanation



Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

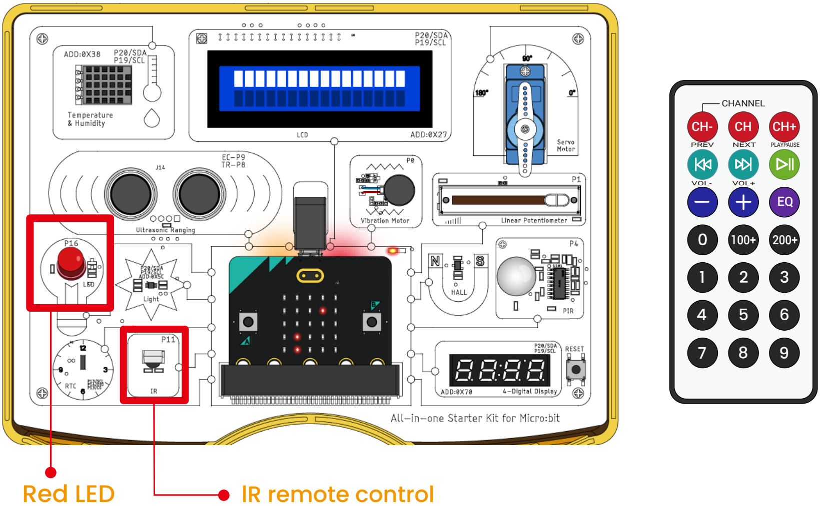
For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

Lesson 11 - IR Control LED

Introduction

In this lesson, we will learn how to use an infrared remote control to achieve diversified control of an LED, including turning it on, making it flash, and turning it off. You will understand the principles of infrared signal reception and decoding, and learn how to integrate this with program logic to enable effective interaction between the IR remote and the LED driver. By the end of this lesson, you will not only be able to implement basic IR remote control functions, but also be well-prepared to expand into multi-device control and intelligent lighting system applications.

Hardware Required



Working Principle of an Infrared Remote Sensor

An infrared remote sensor enables control by receiving infrared signals. The transmitter encodes control commands into infrared light signals modulated at a specific frequency. Once the sensor receives the signal, it demodulates and decodes it back into a control command, which is then executed by the microcontroller to perform the corresponding operation.

Working Principle of LED

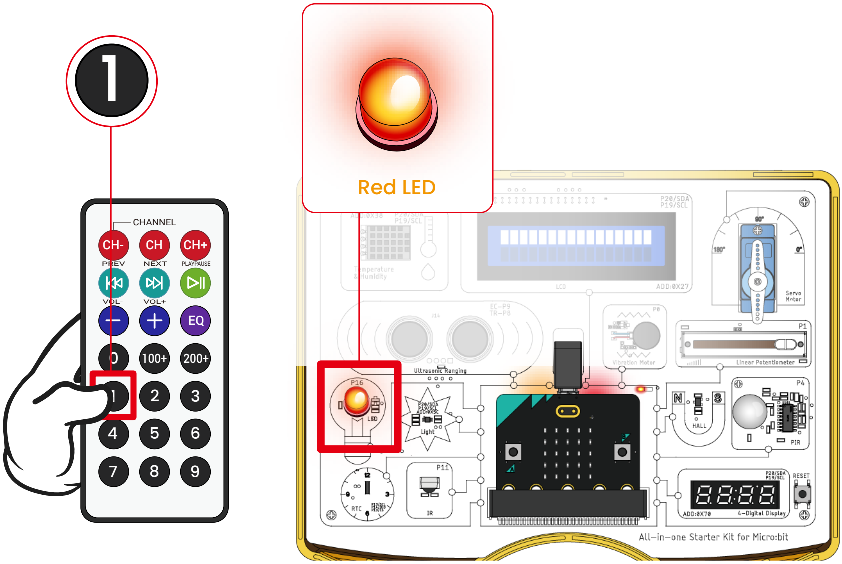
An LED (Light Emitting Diode) operates via carrier recombination in a semiconductor PN junction. Under forward bias, electrons and holes recombine in the depletion region, releasing energy as photons. The emission wavelength is determined by the material's bandgap (e.g., GaAs for IR, GaP for red/green, InGaN for blue/white). Drive circuits must limit current (typically 5-20mA) to prevent thermal damage. LEDs feature high efficiency, long lifespan, and fast response, widely used in displays and lighting.

Working Principle of an Infrared Remote Control

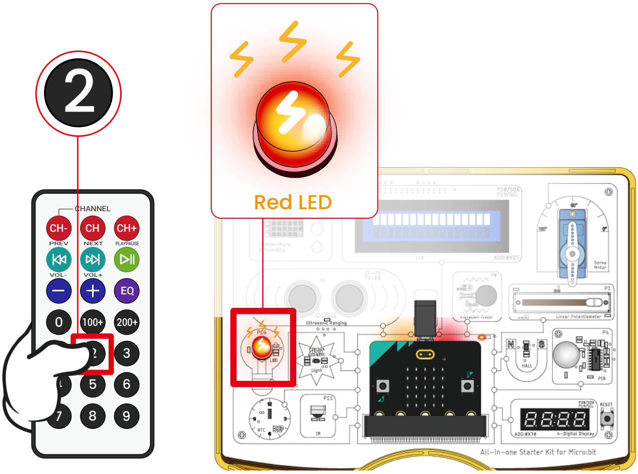
An infrared remote control sends commands through button inputs. The microcontroller inside the remote encodes the command and modulates it into an infrared signal, which is then transmitted via the infrared emitting diode. On the receiving end, an infrared sensor detects the signal, demodulates it, and decodes the original command to drive the target device and execute the corresponding operation.

Operation Effect Diagram

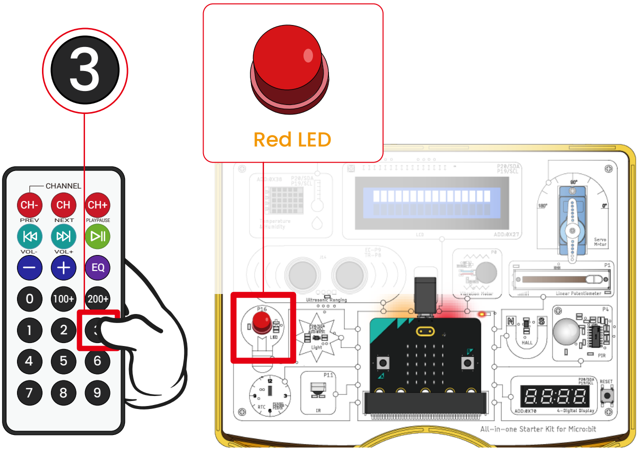
When you press the "1" button on the remote control, the red LED lights up.



When you press the "2" key on the remote control, the red LED flashes.



When you press the "3" button on the remote control, the red LED light goes off



After running the program, you will observe the following:

When you press the "1" button on the remote control, the red LED lights up.

When you press the "2" key on the remote control, the red LED flashes.

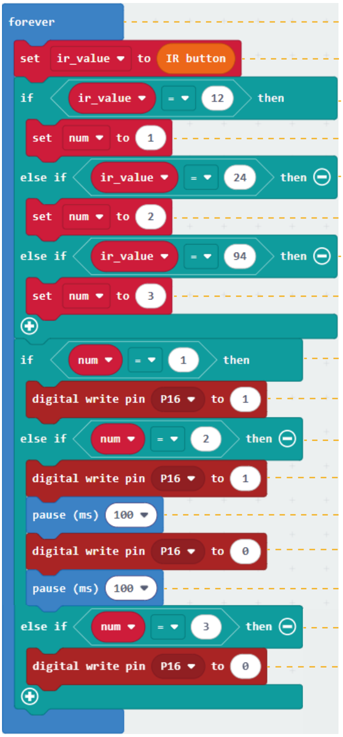
When you press the "3" button on the remote control, the red LED light goes off

Code Explanation

When the Micro:bit starts

Initialize the infrared (IR) sensor by connecting it to pin P11.

Create a variable named num and set its initial value to 3.



Forever Loop

Store the value received from the IR sensor in the variable "ir_value"

If the returned value equals 12

Set the value of the variable "num" to 1

If the returned value equals 24

Set the value of the variable "num" to 2

If the returned value equals 94

Set the value of the variable "num" to 3

If the variable "num" equals 1

The LED lights up when the P16 pin is high

If the variable "num" equals 2

The LED lights up when the P16 pin is high

Wait 100 milliseconds

The LED light is off when pin 16 is low

Wait 100 milliseconds

If the variable "num" equals 3

The LED light is off when pin 16 is low

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

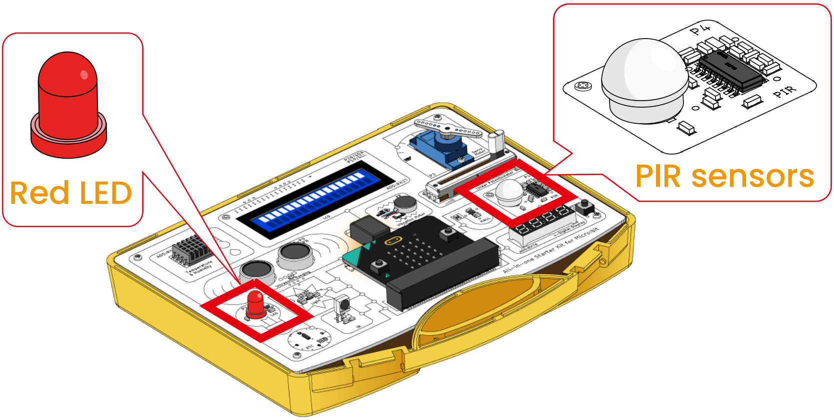
https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Lesson 12 - PIR Control Light

Introduction

In this lesson, we will use PIR sensors, which can detect infrared radiation from humans or animals. When a person or animal enters the detection range, the PIR sensor will send a signal to detect motion. PIR sensors are widely used in applications such as automatic lighting control, security alarms, and more.

Hardware Required



Working Principle of an Infrared Remote Sensor

An LED (Light Emitting Diode) operates via carrier recombination in a semiconductor PN junction. Under forward bias, electrons and holes recombine in the depletion region, releasing energy as photons. The emission wavelength is determined by the material's bandgap (e.g., GaAs for IR, GaP for red/green, InGaN for blue/white). Drive circuits must limit current (typically 5-20mA) to prevent thermal damage. LEDs feature high efficiency, long lifespan, and fast response, widely used in displays and lighting.

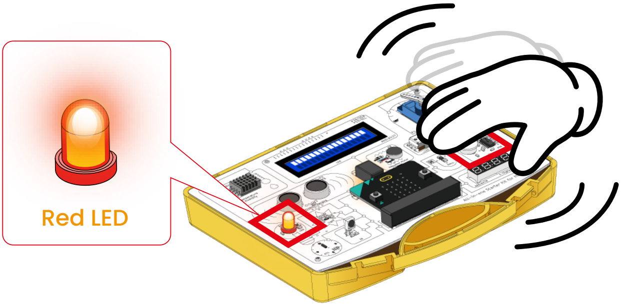
Working Principle of LED

The PIR (Passive Infrared) sensor detects human-emitted IR waves (8-14μm) using pyroelectric materials. Moving heat sources create differential signals on dual sensing elements, amplified by FET and processed by comparators to trigger output. Fresnel lenses focus IR radiation and define detection zones, featuring 5-10m range at 3.3-5V with low power consumption, ideal for security and automation.

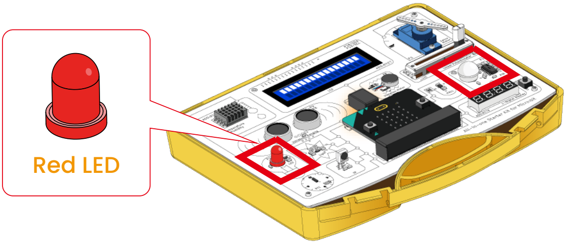
Operation Effect Diagram

After the course begins, you will observe the following phenomena:

1. When a person moves within the detection range of the PIR (Passive Infrared) motion sensor (such as waving or walking), the LED light will turn on for 5 seconds.

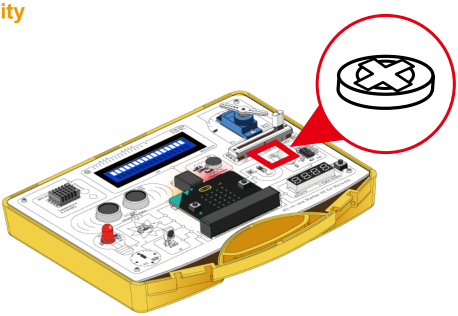


2. If no motion is detected, the LED will remain off.

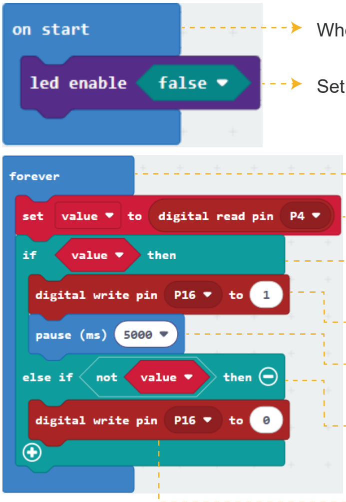


After running the program, you will see: the LED illuminates for 5 seconds when motion, such as waving or walking, is detected within the range of the PIR motion sensor. If no motion is detected, the LED remains off.

Adjusting the screw at the top-left corner of the PIR sensor to increase or decrease its sensitivity



Code Explanation



When the Micro:bit starts

Set the onboard LED to OFF

Forever Loop

Read the value from the PIR sensor connected to digital port P4 and store it in the variable "value"

If the variable "value" is true, that means it's equal to 1

LED lights on

Wait 5000 milliseconds

If the variable "value" is false, that means it's equal to 0

LED lights off

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

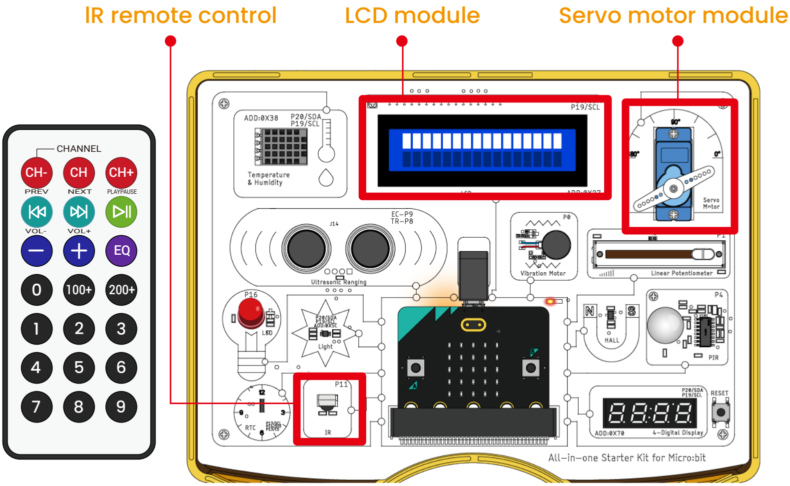
For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

Lesson 13 - Servo Angle Control

Introduction

In this lesson, we will use an infrared remote control to operate a servo motor.By pressing different buttons on the remote, we can adjust the servo angle, and the current angle will be displayed on the LCD screen in real time.You will learn how to decode infrared signals, map button inputs to specific servo positions (such as 0°, 90°, and 180°), and provide visual feedback through the LCD interface.This lesson will help you understand the collaborative interaction between input devices (IR remote control), processing logic (microcontroller), and output devices (servo movement and LCD display).

Hardware Required



Working Principle of a Servo Motor

A servo motor achieves precise angular positioning through a closed-loop control system. The control circuit receives a PWM signal and decodes the pulse width to determine the target position. The motor drives a gear set to rotate, while a built-in potentiometer continuously feeds back the current angle to a comparator. If there is any deviation, the circuit adjusts the motor's rotation direction until the error is eliminated. A typical servo motor operates within a rotation range of 0° to 180°, offering high torque and fast response characteristics.

Working Principle of LCD Display

An LCD (Liquid Crystal Display) modulates light by controlling the alignment of liquid crystal molecules. The LC layer is sandwiched between polarizers: without voltage, molecules allow light transmission; when electrified, they rotate to block light by altering polarization. Each pixel is independently controlled by a TFT (Thin-Film Transistor), adjusting voltage to change LC orientation for grayscale or color display.

Working Principle of an Infrared Remote Sensor

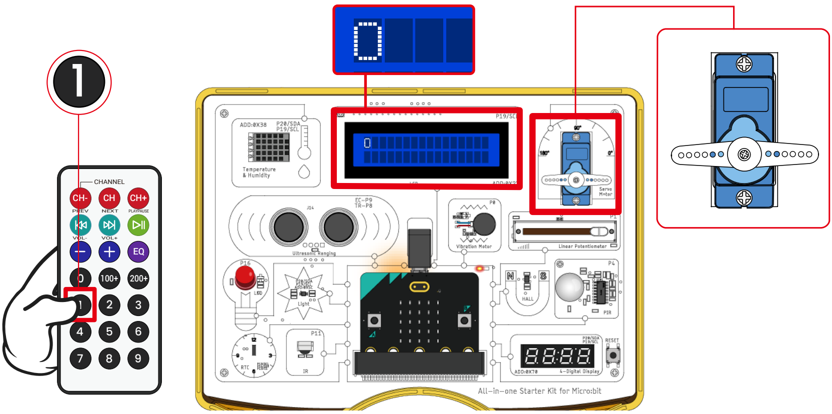
An infrared remote sensor enables control by receiving infrared signals. The transmitter encodes control commands into infrared light signals modulated at a specific frequency. Once the sensor receives the signal, it demodulates and decodes it back into a control command, which is then executed by the microcontroller to perform the corresponding operation.

Working Principle of an Infrared Remote Control

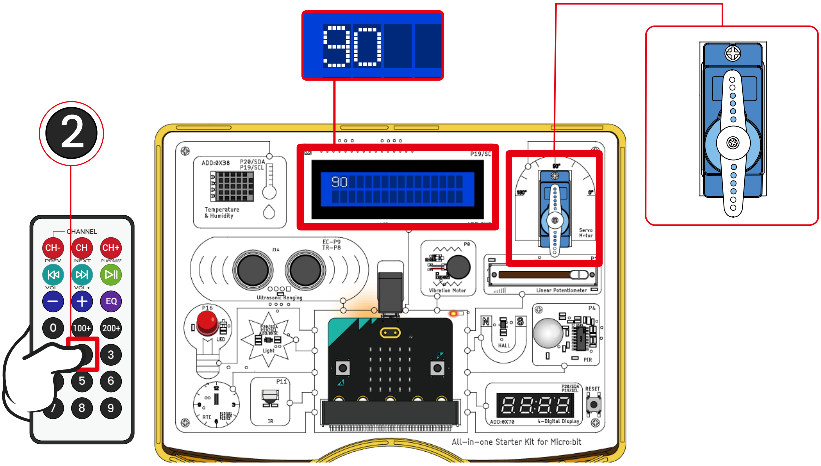
An infrared remote control sends commands through button inputs. The microcontroller inside the remote encodes the command and modulates it into an infrared signal, which is then transmitted via the infrared emitting diode. On the receiving end, an infrared sensor detects the signal, demodulates it, and decodes the original command to drive the target device and execute the corresponding operation.

Operation Effect Diagram

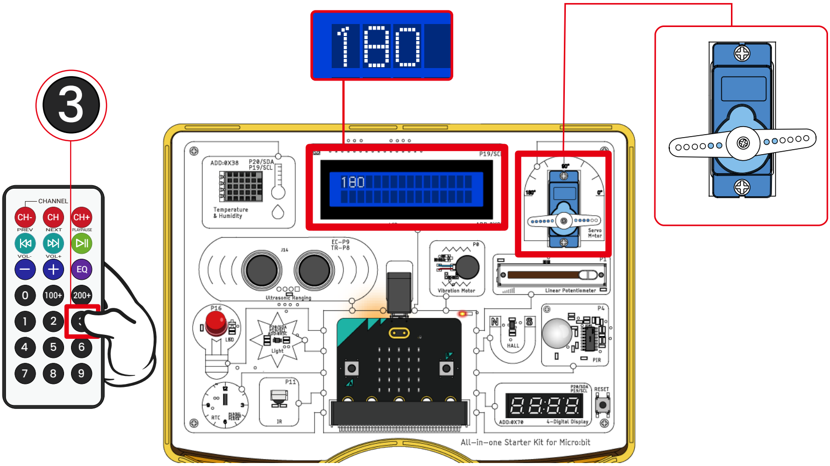
1.When button 1 is pressed, the servo rotates to 0 degrees. The LCD screen displays: 0



2.When button 2 is pressed, the servo rotates to 90 degrees. The LCD screen displays: 90

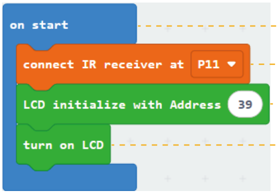


3.When button 3 is pressed, the servo rotates to 180 degrees. The LCD screen displays: 180.



After running the program, you will see the servo is controlled by a remote. When button 1 is pressed, it rotates to 0 degrees; button 2 sets it to 90 degrees, and button 3 to 180 degrees. After each press, the current angle is displayed on the LCD screen.

Code Explanation

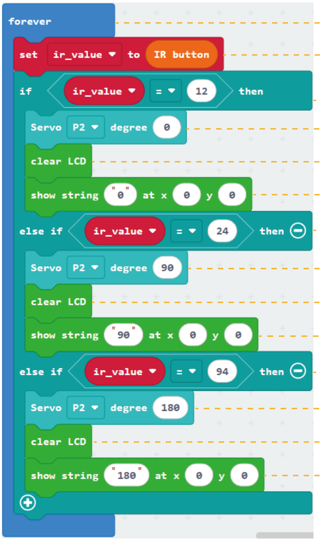


When the Micro:bit starts

Set pin P11 as the input for the IR receiver

On the development board, the LCD's address is 0x27 in hexadecimal, which corresponds to 39 in decimal.

Turn on the LCD



Forever Loop

Assign the value returned by the IR sensor to the variable "ir_value"

If the returned value is 12

Set the steering angle to 0

Clear LCD display

Display "0" at the first row, first column of the LCD

If the returned value is 24

Set the steering angle to 90

Clear LCD display

Display "90" at the first row, first column of the LCD

If the returned value is 94

Set the steering angle to 180

Clear LCD display

Display "180" at the first row, first column of the LCD

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

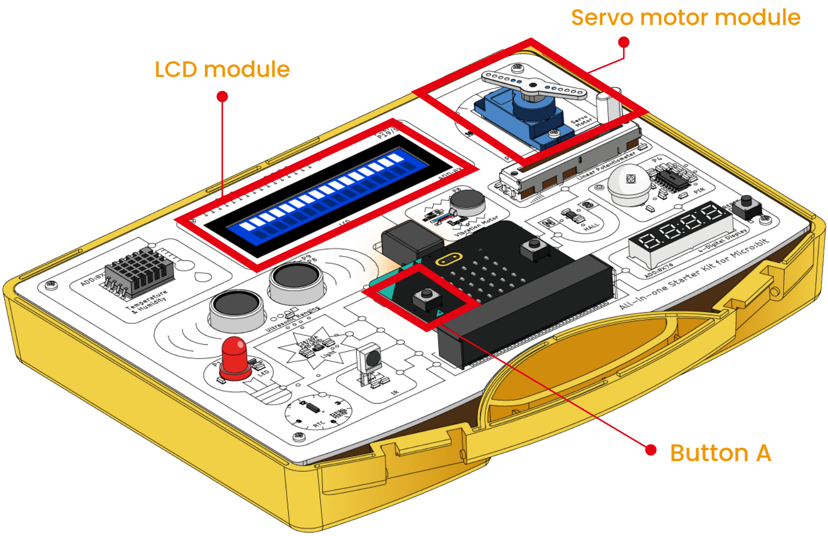
For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

Lesson 14 - Polite Automatic Door

Introduction

In this lesson, you will learn how to open a door by pressing a button and display a "Welcome" message on the LCD. You will also learn how to use a servo motor to simulate the opening and closing of the door, and how to clear the message automatically when the door is closed. This project helps you understand the interaction between button input, servo control, and real-time LCD display, laying the foundation for smart access control systems.

Hardware Required



Working Principle of a Servo Motor

A servo motor achieves precise angular positioning through a closed-loop control system. The control circuit receives a PWM signal and decodes the pulse width to determine the target position. The motor drives a gear set to rotate, while a built-in potentiometer continuously feeds back the current angle to a comparator. If there is any deviation, the circuit adjusts the motor's rotation direction until the error is eliminated. A typical servo motor operates within a rotation range of 0° to 180°, offering high torque and fast response characteristics.

Working Principle of LCD Display

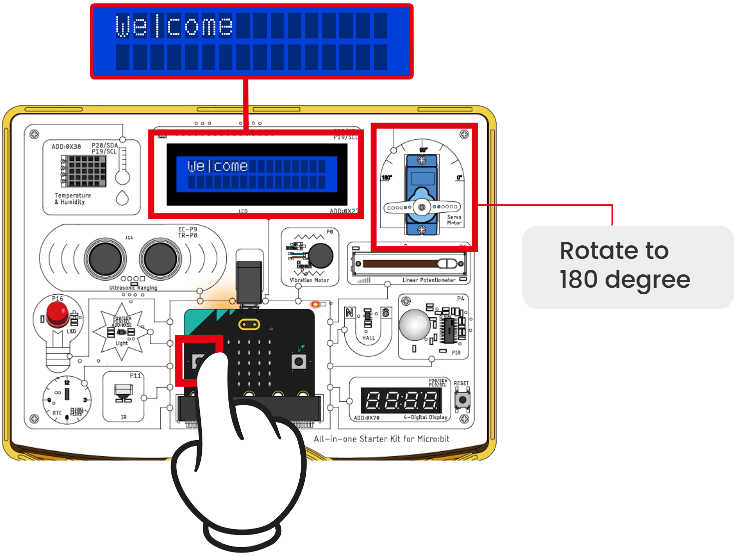
An LCD (Liquid Crystal Display) modulates light by controlling the alignment of liquid crystal molecules. The LC layer is sandwiched between polarizers: without voltage, molecules allow light transmission; when electrified, they rotate to block light by altering polarization. Each pixel is independently controlled by a TFT (Thin-Film Transistor), adjusting voltage to change LC orientation for grayscale or color display.

Working Principle of Button Control

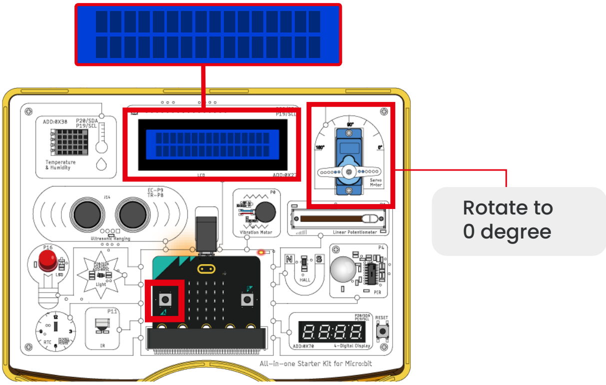
Button switch control relies on mechanical contacts for circuit switching. In default state, the open contacts maintain high-level signal via pull-up resistor; when pressed, closed contacts create conduction path pulling the signal line low. For reliable operation, hardware debouncing (e.g. RC low-pass filter) or software algorithms (delayed sampling) must be implemented to eliminate false triggers from contact bounce. Design considerations include contact material, on-resistance and mechanical endurance parameters.

Operation Effect Diagram

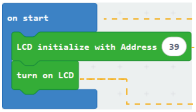
1.After uploading the program, press button A on the Microbit to rotate the servo to 180 degrees (open the door) and display a "Welcome" message on the LCD.



2.Release the button to rotate the servo back to 0 degrees (close the door) and clear the message from the LCD.



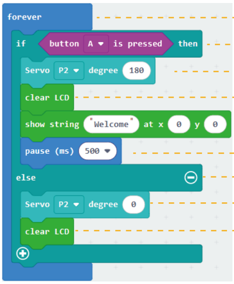
Code Explanation



When the Micro:bit starts

On the development board, the LCD's address is 0x27 in hexadecimal, which corresponds to 39 in decimal.

Turn on the LCD



Forever Loop

When the A button on the Micro:bit is pressed

Set the steering angle to 180

Clear LCD display

Display "Welcome" at the first row, first column of the LCD

Wait 500 milliseconds

When the A button on the Micro:bit is released

Set the steering angle to 0

Clear LCD display

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

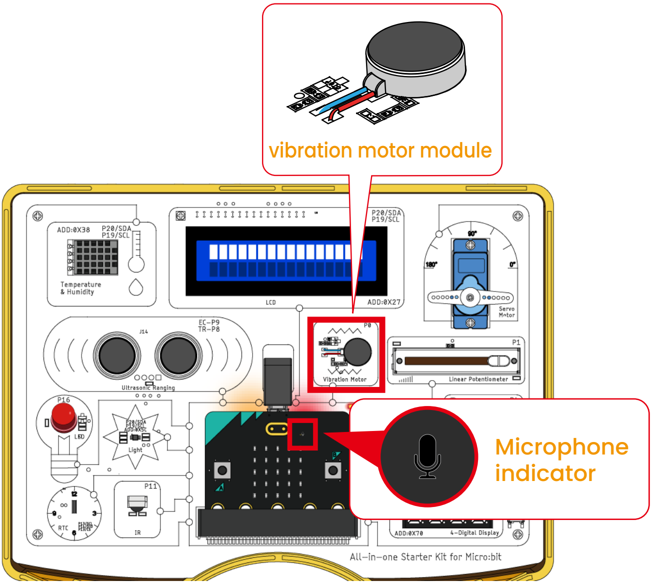
For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

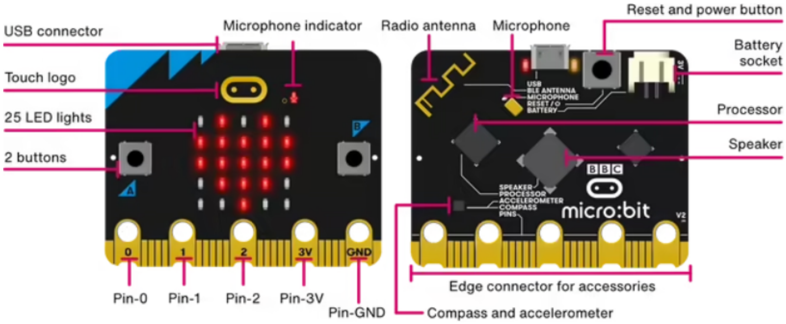
Lesson 15 - Sound Reminder

Introduction

In this lesson, we will explore advanced operations of the Microbit's microphone. We will use the built-in sound sensor to detect the ambient noise levels in the current environment. You will learn how to read sound intensity data, set threshold values for different noise levels, and trigger corresponding actions on the vibration motor based on the detected results.

Hardware Required





Working Principle of Sound Sensor

Sound sensors convert acoustic vibrations to electrical signals via piezoelectric effects or capacitance changes. Sound pressure deforms piezoelectric materials (generating charge) or alters capacitor plate spacing, producing microvolt-level AC signals. After amplification/filtering, an ADC digitizes the signal. Sensitivity depends on material properties and preamp gain, while frequency response is determined by mechanical resonance characteristics.

Working Principle of Vibration Motor

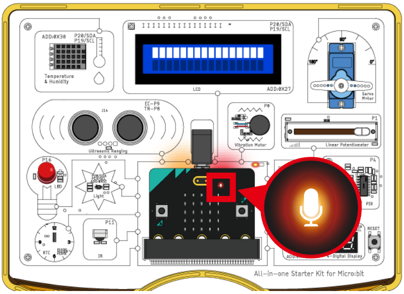
The vibration motor generates mechanical oscillations via electromagnetic actuation or eccentric rotors. DC current through the coil creates alternating magnetic fields to drive permanent magnets/eccentric masses, converting electrical energy to vibration. Frequency is controlled by PWM signals, while amplitude depends on rotor eccentricity/current. Built-in shock sensors provide real-time feedback, featuring 3-5V operation and <10ms response time.

Operation Effect Diagram

Vibration Alert Mechanism with Micro:bit Microphone Indicator

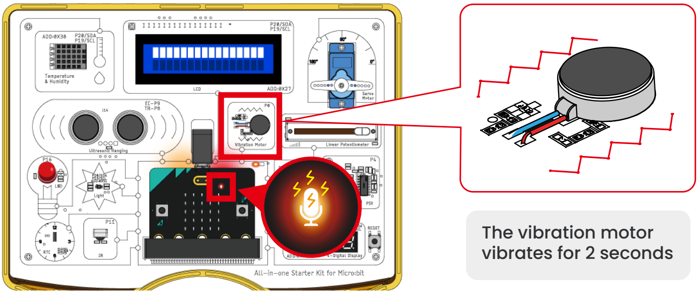
Initial State after Program Start:

Once the program is started, the microphone indicator LED on the micro:bit will remain steadily lit, indicating that the microphone is active and ready.

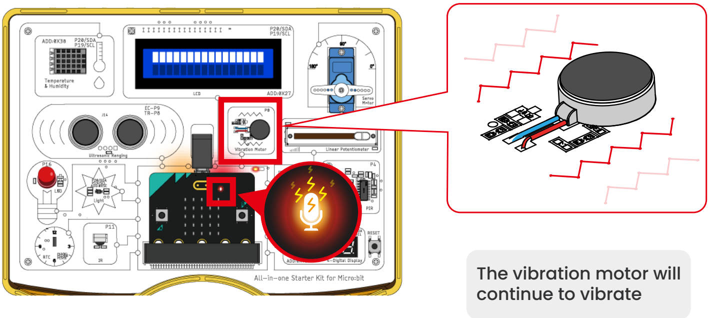


Vibration Alert Mechanism (Microphone LED blinks during alert):

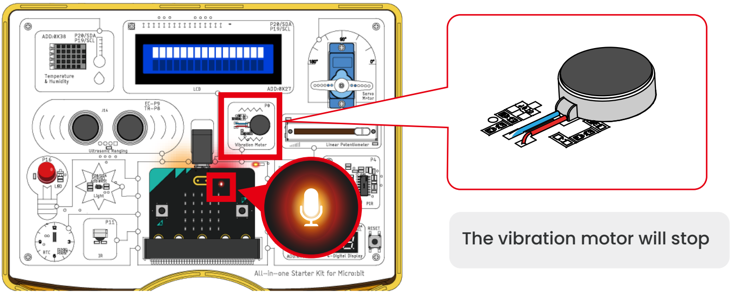
- **Trigger Condition 1:** When ambient noise is too loud or someone shouts directly into the microphone, the vibration motor will activate for 2 seconds to remind the user to lower the volume. During this time, the microphone indicator LED will blink.



- **Trigger Condition 2:** If the sound level remains consistently high, the vibration motor will continue vibrating, and the microphone indicator will keep blinking.



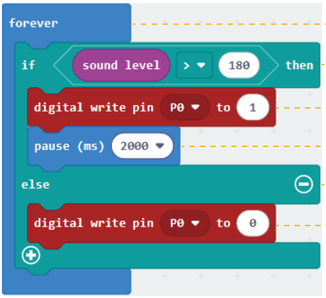
• **Stop Condition:** Once the noise level drops below the threshold, the vibration motor will stop immediately, and the microphone LED will return to a steady on state.



After running the program, you will observe that if the surrounding noise is too loud, or if you are shouting into the microphone, the device will vibrate for 2 seconds to remind you to lower your voice. If the sound level remains high, the vibration motor will continue to vibrate. Once the noise level drops, the vibration will stop.

Note: When the micro:bit is first powered on, the microphone may produce unusually high sound readings. To avoid false triggering, a threshold value of 180 is used to filter out these initial spikes.

Code Explanation



Forever Loop

If the sound sensor on the Micro:bit detects a value over 180, it means the surrounding noise is too loud

Start vibration module

Wait 2000 milliseconds

Else

Turn off vibration module

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

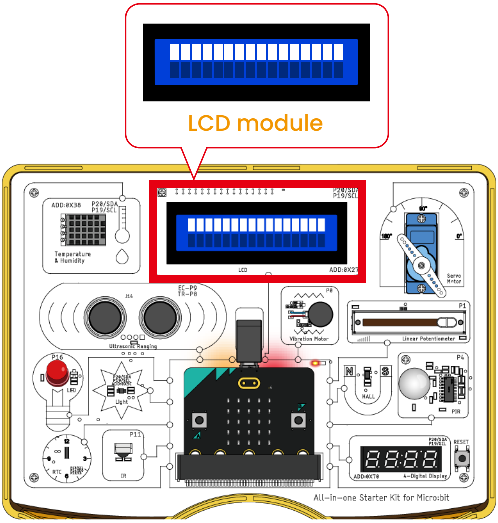
For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

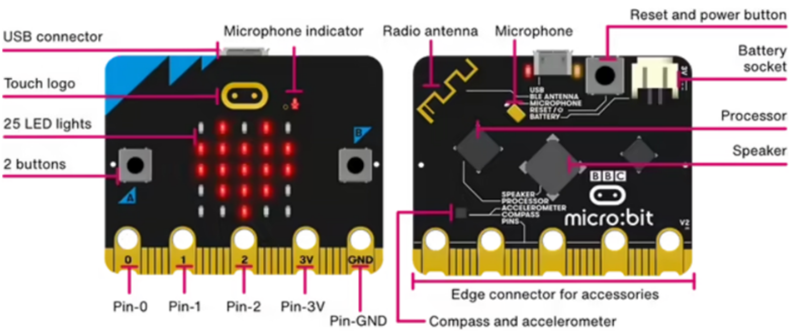
Lesson 16 - Calculation Of Acceleration

Introduction

In this lesson, we will learn how to use an accelerometer to read values along the X, Y, and Z axes. You will understand the basic principles of acceleration measurement, master the methods of data acquisition from the accelerometer, and learn how to process and display the sensor data. Through hands-on practice, you will be able to perceive the motion and orientation changes of the device.

Hardware Required





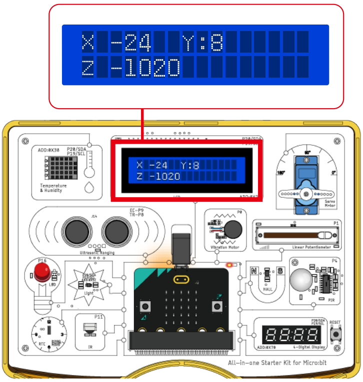
Working Principle of LCD Display

An LCD (Liquid Crystal Display) modulates light by controlling the alignment of liquid crystal molecules. The LC layer is sandwiched between polarizers: without voltage, molecules allow light transmission; when electrified, they rotate to block light by altering polarization. Each pixel is independently controlled by a TFT (Thin-Film Transistor), adjusting voltage to change LC orientation for grayscale or color display.

Working Principle of accelerometer Sensor

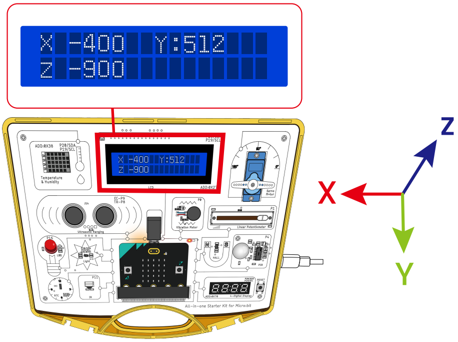
Accelerometers measure acceleration by detecting proof mass displacement caused by inertial force. MEMS types utilize silicon micromachined structures where mass movement alters capacitor plate spacing or piezoresistance, generating electrical signals. The ASIC circuit amplifies and digitizes these signals to output acceleration-proportional voltage/digital values. Tri-axis versions employ orthogonally arranged sensing units for 3D spatial measurement, widely used in orientation detection and motion analysis.

Operation Effect Diagram



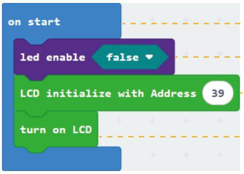
After running the program:
1.The LCD screen will display the accelerometer values for the X, Y, and Z axes.

2.When the accelerometer is moved quickly along a specific axis, the value for that axis will change accordingly.



After running the program, you will the LCD display the accelerometer values for the X, Y, and Z axes.When you move the accelerometer quickly along an axis, you'll notice that the value for that axis changes accordingly.

Code Explanation

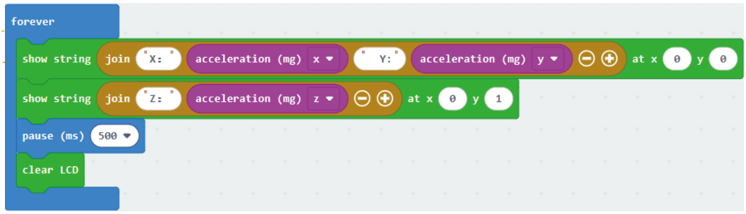


When the Micro:bit starts

Set the onboard LED to OFF

On the development board, the LCD's address is 0x27 in hexadecimal, which corresponds to 39 in decimal.

Turn on the LCD



Forever Loop

The x- and y-axis acceleration values are displayed in the first row and first column of the LCD display

The z-axis acceleration values are displayed in the second row and first column of the LCD display

Wait 500 milliseconds

Clear LCD display

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

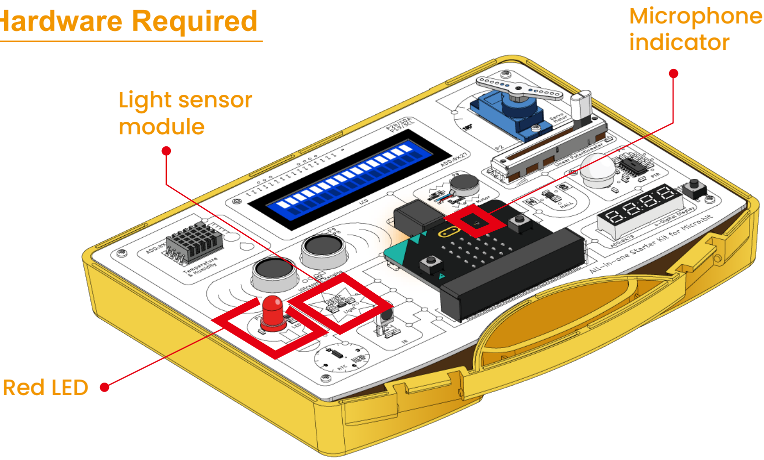
For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

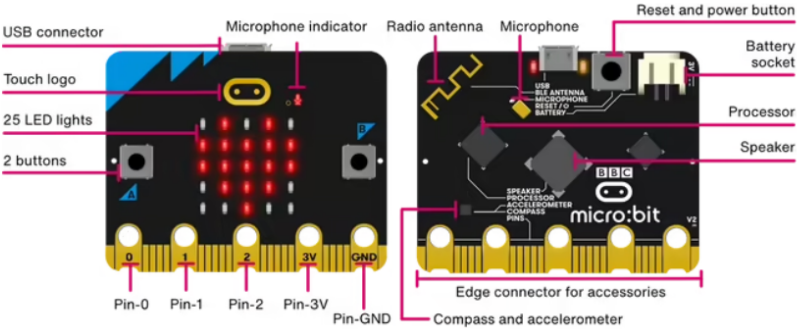
Lesson 17 - Smart Corridor Light

Introduction

In this lesson, we will learn how to integrate a sound sensor, light sensor, and LED to implement a smart corridor lighting system. By coordinating multiple sensors, the system can automatically control the LED based on ambient light and sound signals, simulating the intelligent lighting logic used in real-world scenarios.

Hardware Required





Working Principle of LED

An LED (Light Emitting Diode) operates via carrier recombination in a semiconductor PN junction. Under forward bias, electrons and holes recombine in the depletion region, releasing energy as photons. The emission wavelength is determined by the material's bandgap (e.g., GaAs for IR, GaP for red/green, InGaN for blue/white). Drive circuits must limit current (typically 5-20mA) to prevent thermal damage. LEDs feature high efficiency, long lifespan, and fast response, widely used in displays and lighting.

Working Principle of Light Sensor

A light sensor converts optical signals to electrical signals via photoelectric devices (e.g., photoresistor, photodiode, or phototransistor). Photons striking semiconductor materials generate electron-hole pairs, creating photocurrent. This current is processed by signal conditioning circuits (e.g., op-amp or ADC) to output electrical signals (voltage/digital values) proportional to light intensity, enabling precise ambient light detection.

Working Principle of the Sound Sensor

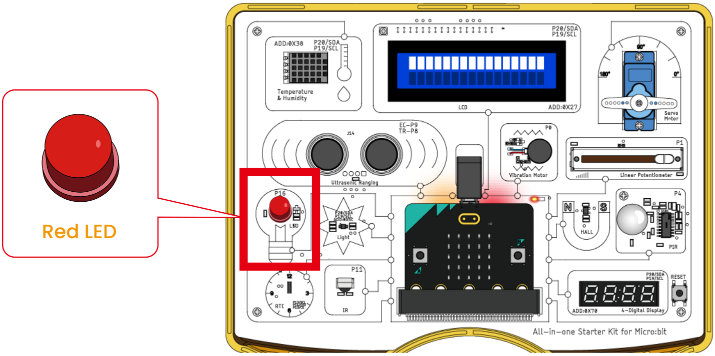
The sound sensor converts sound wave vibrations into electrical signals through a transducer element. An electret microphone generates signals based on capacitance changes between a diaphragm and a backplate, while piezoelectric types rely on voltage generated by the deformation of piezoelectric materials. The analog signal is then amplified, filtered, and converted into digital data via an ADC (Analog-to-Digital Converter). The sensor's sensitivity and frequency response depend on the diaphragm material and structural design, allowing it to detect sound pressure variations within specific frequency ranges.

Operation Effect Diagram

After starting the program, the smart corridor light operates according to the following logic:

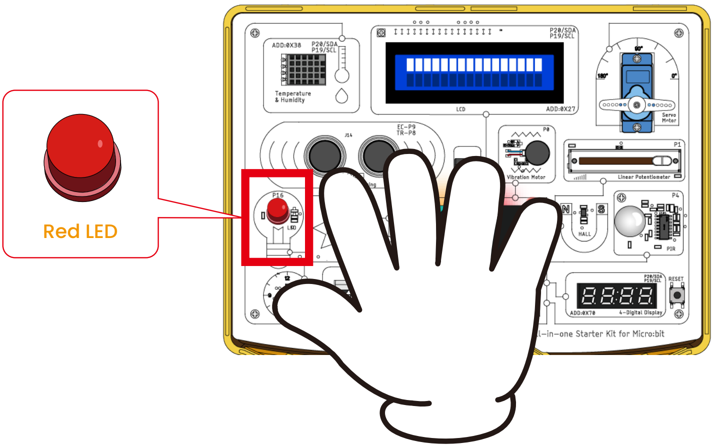
1. Bright Environment:

When natural light is sufficient, the LED remains off regardless of whether sound is detected or not.

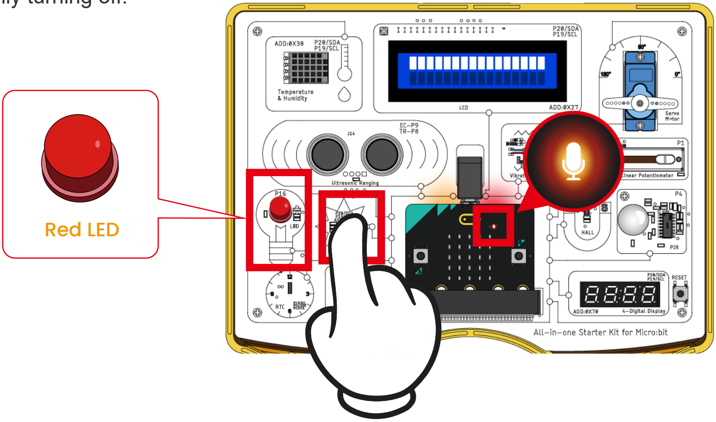


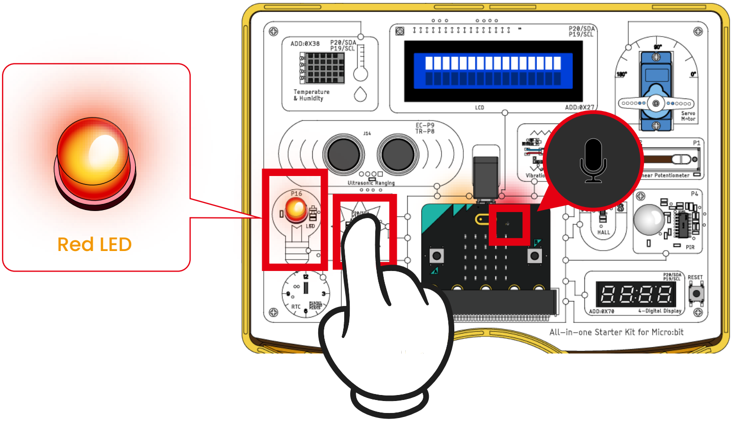
2. Dim Environment:

When the light sensor is covered by a hand (or a box), the LED remains off by default.



If sound is detected, the LED turns on and remains lit for 10 seconds before automatically turning off.

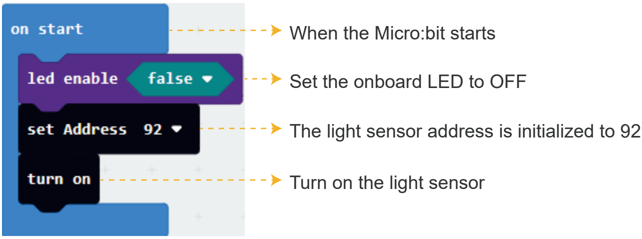


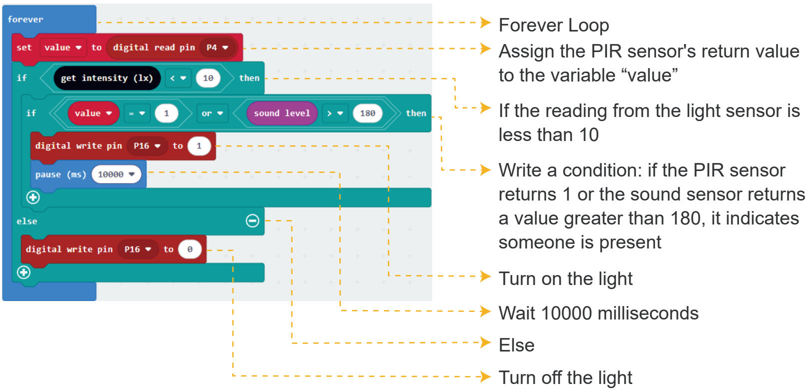


If the sound continues, the LED stays on continuously. Once the sound stops, the LED remains on for an additional 10 seconds and then turns off automatically.

After running the program, you will see that the LED responds intelligently based on ambient light and sound. When the surrounding light is very strong, the LED remains off regardless of any movement or noise. However, when the ambient light is dim—or if the light sensor is covered—the LED stays off by default. In this low-light condition, if movement or sound is detected, the LED will turn on for 10 seconds and then automatically turn off. If the movement or sound continues, the LED remains on. Once no further activity is detected, the LED stays on for another 10 seconds before switching off.

Code Explanation





Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

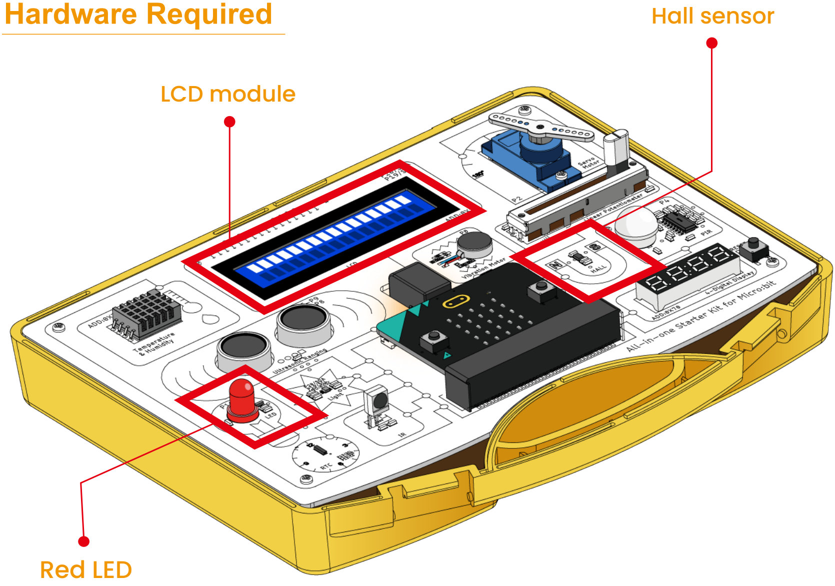
For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

Lesson 18 - Hall Counter

Introduction

In this lesson, we will learn the basic application of the Hall effect sensor. A magnet will be used to trigger the Hall sensor to perform a counting function, with the results displayed in real time on the TFT screen. This system is designed to detect changes in magnetic fields and is suitable for use in scenarios such as access control counting and object detection.

Hardware Required



Working Principle of LED

An LED (Light Emitting Diode) operates via carrier recombination in a semiconductor PN junction. Under forward bias, electrons and holes recombine in the depletion region, releasing energy as photons. The emission wavelength is determined by the material's bandgap (e.g., GaAs for IR, GaP for red/green, InGaN for blue/white). Drive circuits must limit current (typically 5-20mA) to prevent thermal damage. LEDs feature high efficiency, long lifespan, and fast response, widely used in displays and lighting.

Working Principle of Hall Sensor

Hall sensors operate on the Hall effect: when current flows through a semiconductor under perpendicular magnetic field, charge carriers deflect due to Lorentz force, generating a transverse potential difference (Hall voltage). This voltage is proportional to magnetic flux density and is amplified by signal conditioning circuits. Available as linear (analog output) or switch (digital output) types, widely used for position sensing and speed detection.

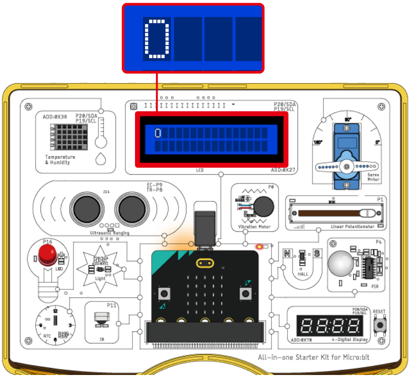
Working Principle of LCD Display

An LCD (Liquid Crystal Display) modulates light by controlling the alignment of liquid crystal molecules. The LC layer is sandwiched between polarizers: without voltage, molecules allow light transmission; when electrified, they rotate to block light by altering polarization. Each pixel is independently controlled by a TFT (Thin-Film Transistor), adjusting voltage to change LC orientation for grayscale or color display.

Operation Effect Diagram

1. Initial State:

After powering on, the screen displays 0, and the system enters a standby mode.

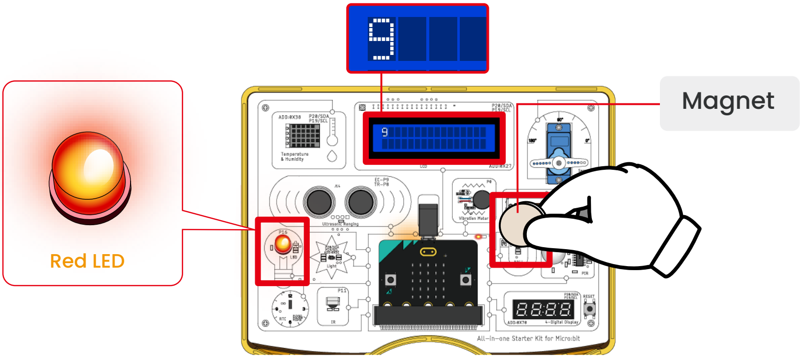


2. Counting Trigger:

a) When a magnet approaches the Hall sensor, the sensor detects the magnetic field change and outputs a high-level signal.

b) Upon receiving the signal, the development board causes the red LED to flash once (LED turns on and then off), while the count value increments by 1.

c) The TFT screen updates in real time to display “X” (where X is the current count).

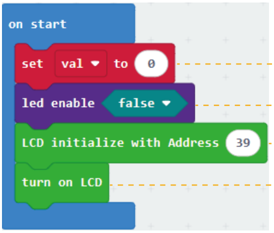


3. Repeat Counting Operation:

Each time the magnet is brought close to and then moved away from the sensor, the count accumulates following the above process (e.g., 1 → 2 → 3…), accompanied by LED flashing and display updates for each count.

After running the program, you will see the LCD display “0”. Each time a magnet approaches the Hall sensor, the red LED will turn on briefly, and the count displayed on the LCD will increase by 1. Repeating this process will continue to increment the count accordingly.

Code Explanation



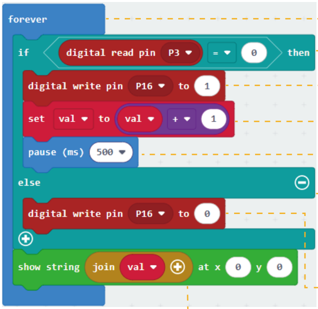
When the Micro:bit starts

The variable “val” is initialized to 0

Set the onboard LED to OFF

On the development board, the LCD’s address is 0x27 in hexadecimal, which corresponds to 39 in decimal.

Turn on the LCD



Forever Loop

If the Hall sensor returns a value of 0

When the Hall sensor reads 0, it indicates that a magnet is approaching, and the LED turns on

Add 1 to the variable “val”

The 500-millisecond delay is used to prevent the numbers from increasing too quickly

Else

The LED light is off when pin 16 is low

The current value of the variable “val” is displayed at row 0, column 0 on the LCD screen

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

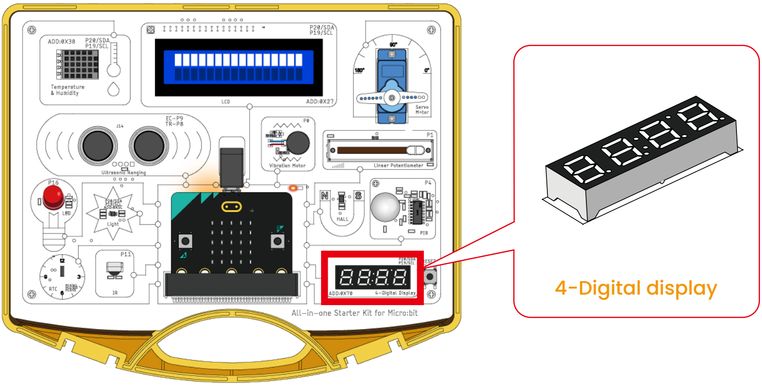
https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Lesson 19 - Show number on 4-Digital Display

Introduction

In this lesson, we will learn how to use a 4-digit seven-segment display. You will understand its working principle and how to programmatically control each individual digit. The course covers methods for displaying numbers, data refreshing techniques, and dynamic digit switching effects. By completing this lesson, you will master the basic operations of seven-segment displays, laying a solid foundation for implementing diverse applications such as counters, clocks, and countdown timers.

Hardware Required



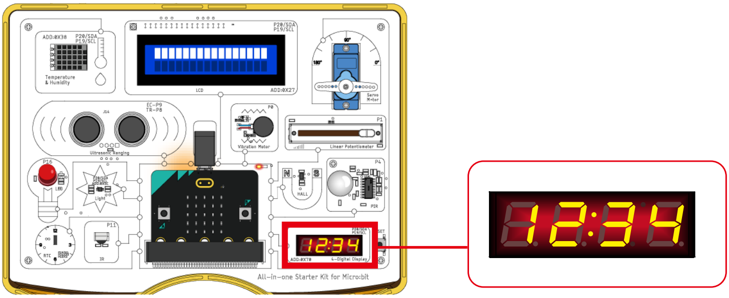
Working Principle of 4-Digital Display

The 4-digit display uses multiplexing technology: each digit consists of 7 LED segments. The controller sequentially activates common cathode/anode of each digit while sending corresponding segment patterns, leveraging persistence of vision to create "simultaneous" display. With >100Hz refresh rate to prevent flickering, only one digit lights up at any moment but cycles rapidly. Display content is controlled by segment/bit selection signals from driver IC, requiring current-limiting resistors.

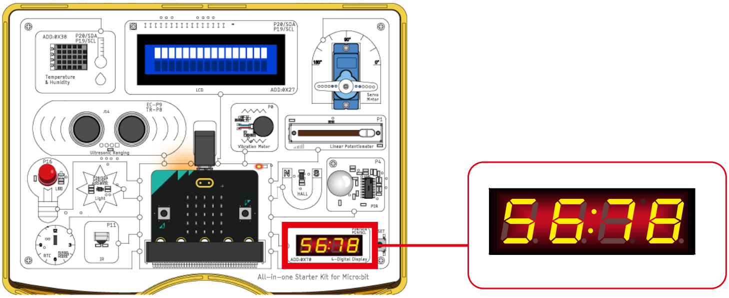
Operation Effect Diagram

After running the program:

The 4-digit seven-segment display will first show the numbers 1 to 4 in sequence.

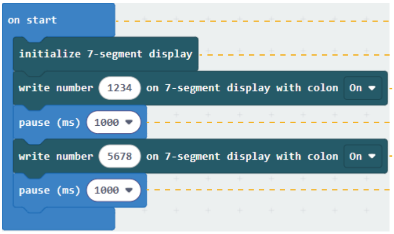


Then, the numbers 5 to 8 will be displayed sequentially, replacing the previous numbers.



After running the program, you will see the 4-digit seven-segment display show the numbers 1 to 4 in sequence. Then, the numbers 5 to 8 will be displayed one after another, replacing the previous digits.

Code Explanation



When the Micro:bit starts
Initialize the 7-segment display
Show '1234' on the Nixie display
Wait 1000 milliseconds
Show '5678' on the Nixie display
Wait 1000 milliseconds

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

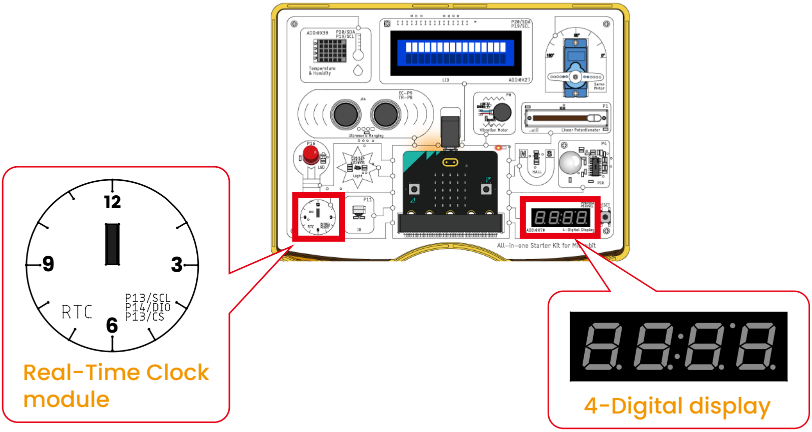
For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

Lesson 20 - Make an accurate clock

Introduction

In this lesson, we will learn how to use the RTC (Real-Time Clock) module to achieve accurate time management. You will understand how to initialize and configure the RTC, read the current time and date, and ensure continuous timekeeping even when the device is powered off. Additionally, we will demonstrate how to display the RTC time in real time on a 4-digit seven-segment display, including how to dynamically update the displayed content.

Hardware Required



Working Principle of 4-Digital Display

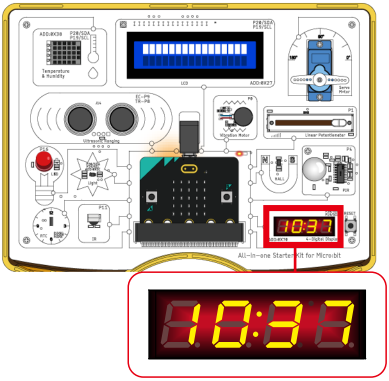
The 4-digit display uses multiplexing technology: each digit consists of 7 LED segments. The controller sequentially activates common cathode/anode of each digit while sending corresponding segment patterns, leveraging persistence of vision to create "simultaneous" display. With >100Hz refresh rate to prevent flickering, only one digit lights up at any moment but cycles rapidly. Display content is controlled by segment/bit selection signals from driver IC, requiring current-limiting resistors.

Working Principle of RTC

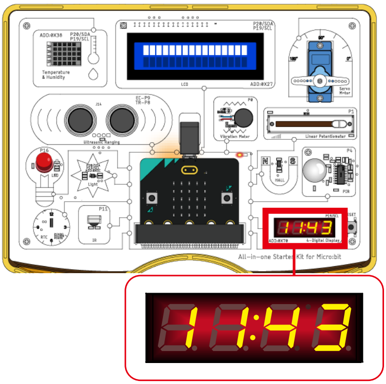
The RTC module generates reference clock signals via crystal oscillator, which are divided to drive timing circuits. Dedicated ICs contain time registers and communicate via serial interface. Backup battery maintains timing during power loss, while compensation circuits correct clock deviations. Time data is stored in specific format with automatic calendar adjustment.

Operation Effect Diagram

After running the program:
1.The system initializes and reads the current time and date (initial time: 10:37).

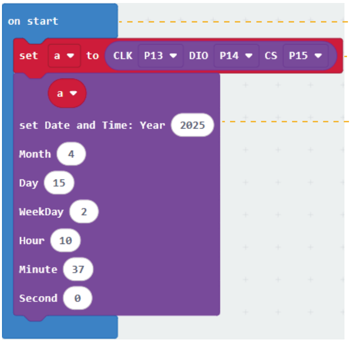


2.After calibration using the RTC, the real-time clock time is continuously displayed on the 4-digit seven-segment display.



After running the program, you will see that the time is calibrated using the RTC and then displayed on the 4-digit display. The display will continuously show the current time, updating in real time to reflect the accurate clock readings maintained by the RTC module.

Code Explanation



When the Micro:bit starts

Initialize the pin connected to the RTC

Initialize the real-time clock, which can be freely set here

Forever Loop

Initialize the 7 Nixie tube displays

Combine the hour and minute into a string and display it on the Nixie tube

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

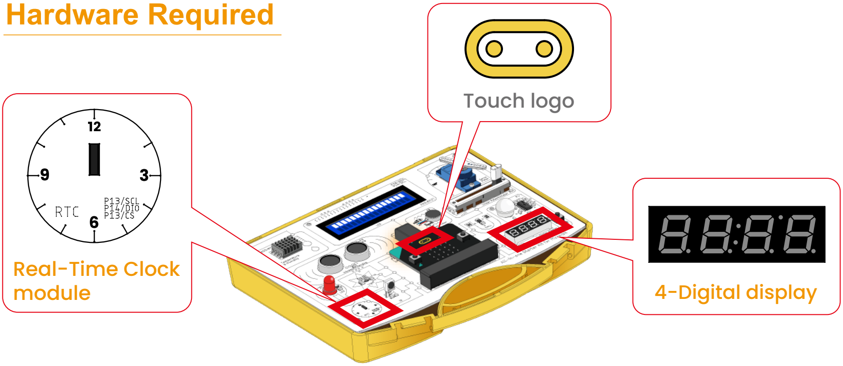
For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

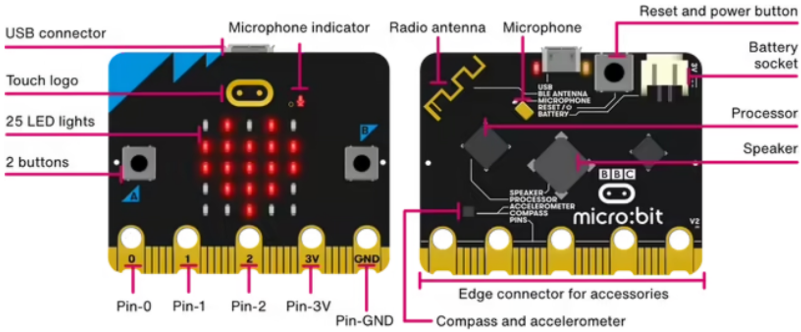
Lesson 21 - Alarm Clock

Introduction

In this lesson, we will combine the RTC clock, a 4-digit nixie tube, and the Microbit's onboard speaker and touch sensors to create an alarm clock.The alarm can be turned off using the touch sensors when it sounds.

Hardware Required





Working Principle of 4-Digital Display

The 4-digit display uses multiplexing technology: each digit consists of 7 LED segments. The controller sequentially activates common cathode/anode of each digit while sending corresponding segment patterns, leveraging persistence of vision to create "simultaneous" display. With >100Hz refresh rate to prevent flickering, only one digit lights up at any moment but cycles rapidly. Display content is controlled by segment/bit selection signals from driver IC, requiring current-limiting resistors.

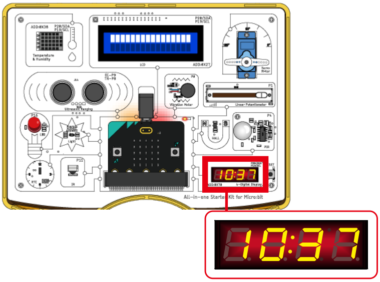
Working Principle of RTC

The RTC module generates reference clock signals via crystal oscillator, which are divided to drive timing circuits. Dedicated ICs contain time registers and communicate via serial interface. Backup battery maintains timing during power loss, while compensation circuits correct clock deviations. Time data is stored in specific format with automatic calendar adjustment.

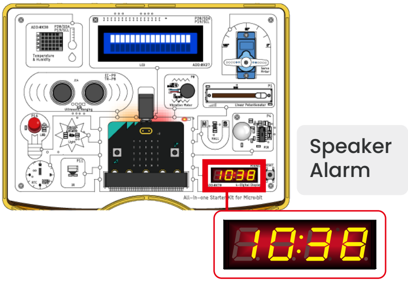
Operation Effect Diagram

After running the program:

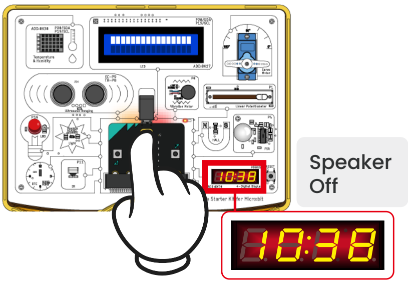
1. The system initializes, and the 4-digit display reads the current time and date (initial time: 10:37).



2. The alarm is set through the program. When the time reaches 10:38, the speaker will sound continuously for 2 minutes.

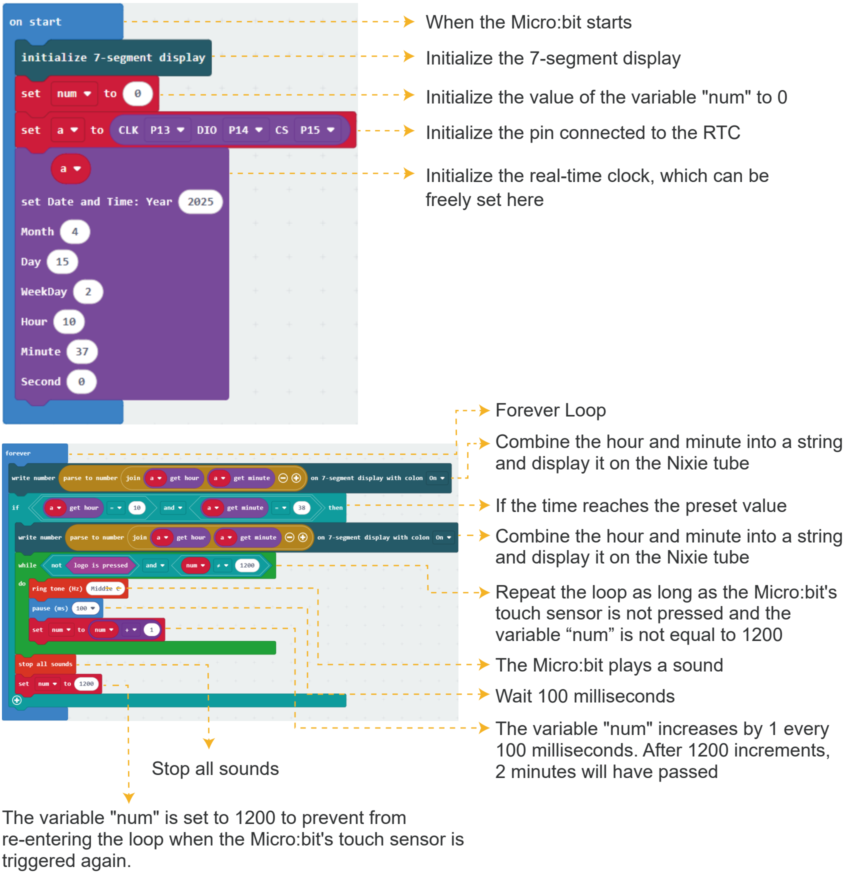


3.Touching the Micro:bit's touch-sensitive logo will turn off the speaker.



After running the program, you will see that the alarm clock is set through the program. When the set time is reached, the speaker will sound continuously for 2 minutes. If you press the touch sensor during this time, the speaker will turn off immediately, allowing you to silence the alarm manually.

Code Explanation



Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

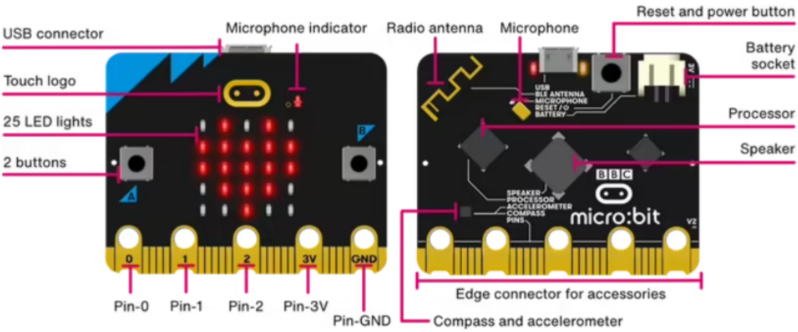
For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

Lesson 22 - Compass

Introduction

In this lesson, we will use the Microbit's onboard digital compass (magnetometer) to create a project that always points north. You will learn how to display directional feedback on the LED matrix. Through this project, you will gain a deeper understanding of how a digital compass works.

Hardware Required



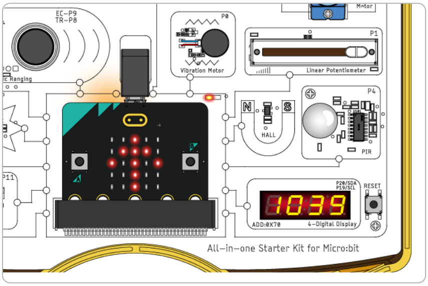
Working Principle of electronic Compass

Electronic compasses determine geomagnetic field direction using magnetoresistive or Hall effects. Orthogonal magnetic sensors (e.g. AMR or Hall elements) detect X/Y-axis field components. Signal conditioning circuits convert analog measurements to digital data, which undergoes tilt compensation and calibration to calculate azimuth relative to magnetic north. Digital heading data is output via standard interfaces.

Operation Effect Diagram

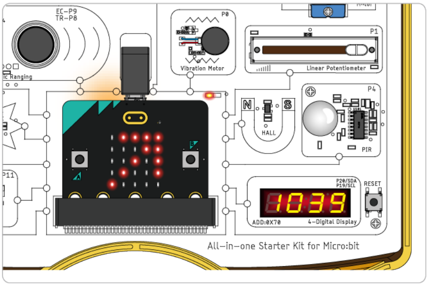
1. North (N)

Angle range: less than 23° or greater than or equal to 338°.
Indicates the true north direction. An upward arrow is displayed on the LED matrix, showing that the device is facing north（↑）.



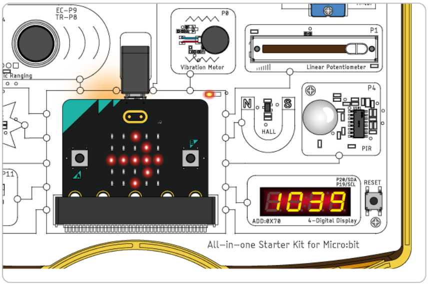
2Northeast (NE)

Angle range: 23° to 66°.
Located between north and east. The LED shows an arrow pointing up and to the right (↗).



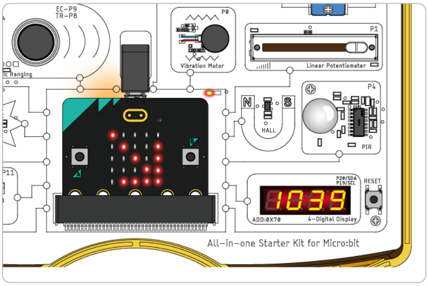
3East (E)

Angle range: 67° to 111°.
Indicates the true east direction. The LED displays a right-pointing arrow(→).

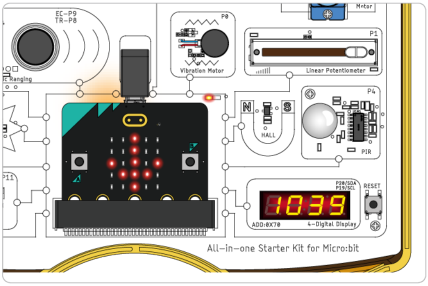


4Southeast (SE)

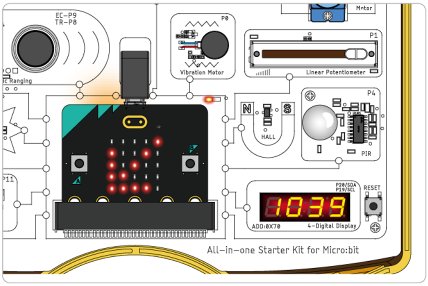
Angle range: 112° to 156°.
Located between east and south. The LED shows an arrow pointing down and to the right (↘).



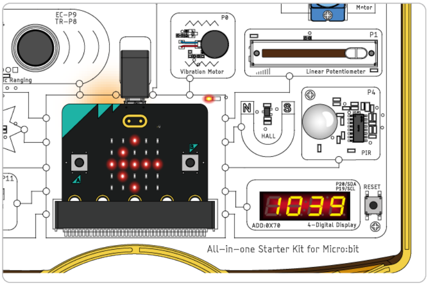
5South (S)
Angle range: 157° to 201°.
Indicates the true south direction. A downward arrow is displayed on the LED matrix (↓), showing the device is facing south.



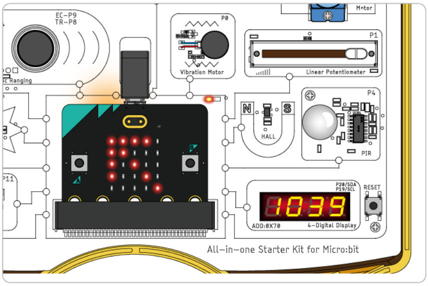
6Southwest (SW)
Angle range: 202° to 246°.
Located between south and west. The LED displays a down-left arrow (↙).



7West (W)
Angle range: 247° to 291°.
Indicates the true west direction. The LED shows a left-pointing arrow (←).



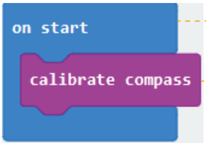
8. Northwest (NW)
Angle range: 292° to 337°.
Located between west and north. The LED displays an arrow pointing up and to the left (↖).



After running the program, you will see that the LED matrix indicates direction by displaying an arrow that always points north. The arrow updates in real time based on the Microbit's orientation. The pointing resolution is 45 degrees, corresponding to the following directions: ↑, ↗, →, ↘, ↓, ↙, ←, ↖.

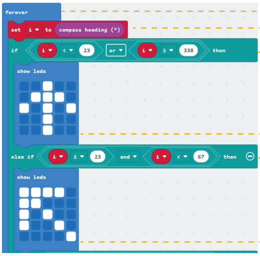
Note: After uploading the code, make sure to calibrate the compass by moving the red dot around the entire Micro:bit screen as prompted.

Code Explanation



When the Micro:bit starts

Calibrate the compass on the Micro:bit



Forever Loop

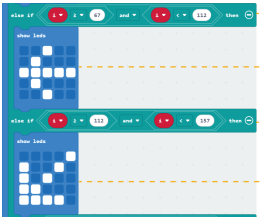
Store the compass heading from the Micro:bit in the variable 'i'

If the value of variable 'i' is less than 23 or greater than or equal to 338, then the direction is due north

If the direction is due north, pointing forward means pointing north

If the value of variable 'i' is between 23 and 67, the direction is northwest

If the direction is northwest, pointing northwest means pointing north

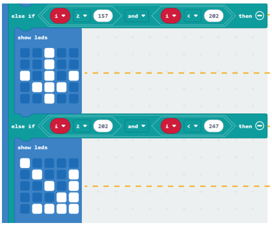


If the value of variable 'i' is between 67 and 112, the direction is due west

If the direction is due west, pointing due west means pointing north

If the value of variable 'i' is between 112 and 157, the direction is southwest

If the direction is southwest, pointing southwest means pointing north



If the value of variable 'i' is between 157 and 202, the direction is due south

If the direction is due south, pointing due south means pointing north.

If the value of variable 'i' is between 202 and 247, the direction is southeast

If the direction is southeast, pointing southeast means pointing north.

Click the link below to view the programming steps tutorial with detailed operation guidelines.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/all%20in%20one%20microbit%20mp4

Complete Code

Kindly click the link below to view the full code.

https://github.com/Elecrow-RD/All-in-one-Starter-Kit-for-Micro-bit/tree/master/example/code

Programming Steps

For detailed programming steps, you can refer to the programming process in the first lesson. (P2-7)

MAKE YOUR MAKING EASIER