CEC Continuing Education Center

DesignNews

Exploring Smart AI Lens with the Micro:bit

DAY 5: Prototyping an Object Detection Machine

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Dr. Don Wilcher

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https://www.linkedin.com/in/dr-don-wilcher-ed-d-mseit-ee-ceta-2735151/

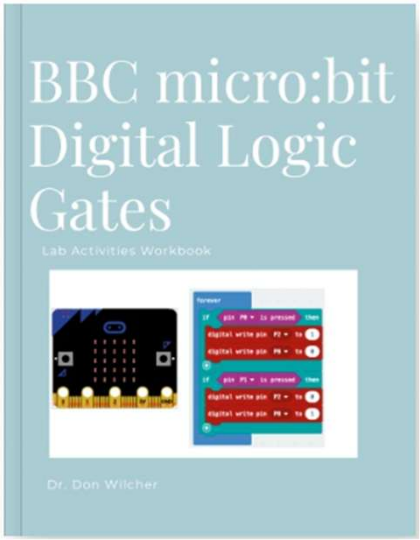
Patreon Page:
https://www.patreon.com/c/DrDon683

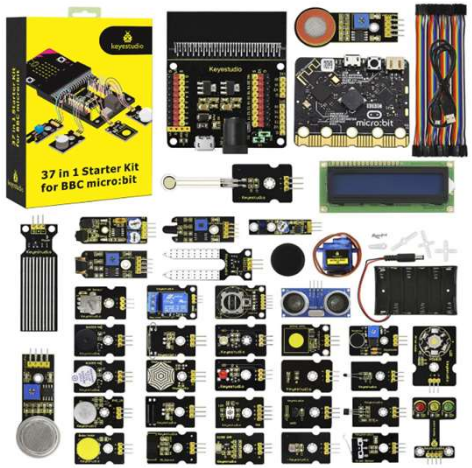
Course Kit and Materials

Micro:bit Version 2

Smart-AI Lens

BBC Micro:bit Digital Logic Gates Lab Activities Workbook





Keyestudio 37-In-1 Sensor Starter Kit

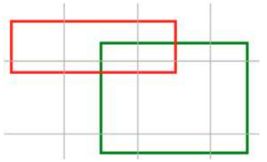
Research Perspective

"A single neural network predicts bounding boxes and class probabilities, directly from full images in one evaluation[1]."

Agenda:

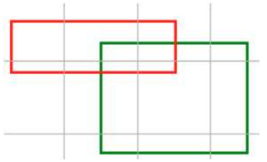
- What Is ABB Wizard Easy?
- Object Sorting Robot Prototype
- Testing a Servo Motor using Blockly Code
- Lab: Build an Object Sorting Robot Prototype

What Is ABB Wizard Easy?



- Wizard Easy Programming is a graphical programming tool that empowers users, be they first-time robot users or professionals, to:
  a) program collaborative and industrial robots easily, quickly, and efficiently in a wide range of applications.
  b) Add Wizard Easy Programming blocks by dragging and dropping them, or by pushing a button.
  c) Press play to run your program.
  d) It's that simple.

What Is ABB Wizard Easy?. . .



- Wizard Easy Programming comes with a set of standard pre-installed blocks, from:
  - a) robot movements
  - b) messages
  - c) signal instructions.
- For situations where highly specialized blocks are required, experts can easily create custom blocks with the Skill Creator.

Question 1

Which statement is correct?

a) Wizard Easy Programming is a high-level language for cobots.

b) Wizard Easy Programming is a high-level language for the micro:bit.

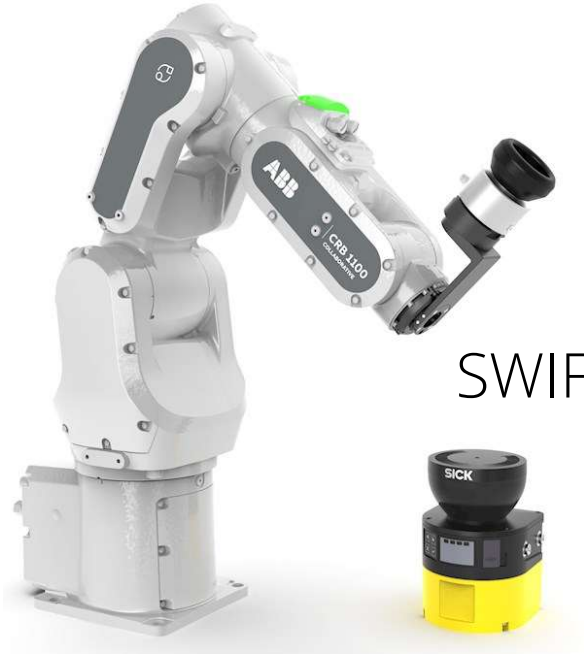
c) Wizard Easy Programming is a graphical programming tool that empowers users to program cobots.

d) none of the above

What Is ABB Wizard Easy?. . .

Single Arm YuMi

GoFa



SWIFTI

ABB Wizard Easy software compatible ABB Cobots

Image: ABB

What Is ABB Wizard Easy?. . .

Double Arm YuMi

Image: ABB

ABB Wizard Easy software compatible ABB Cobots

What Is ABB Wizard Easy?. . .

ABB Wizard Easy software allows ease in programming robots!

Image: ABB

What Is ABB Wizard Easy?. . .

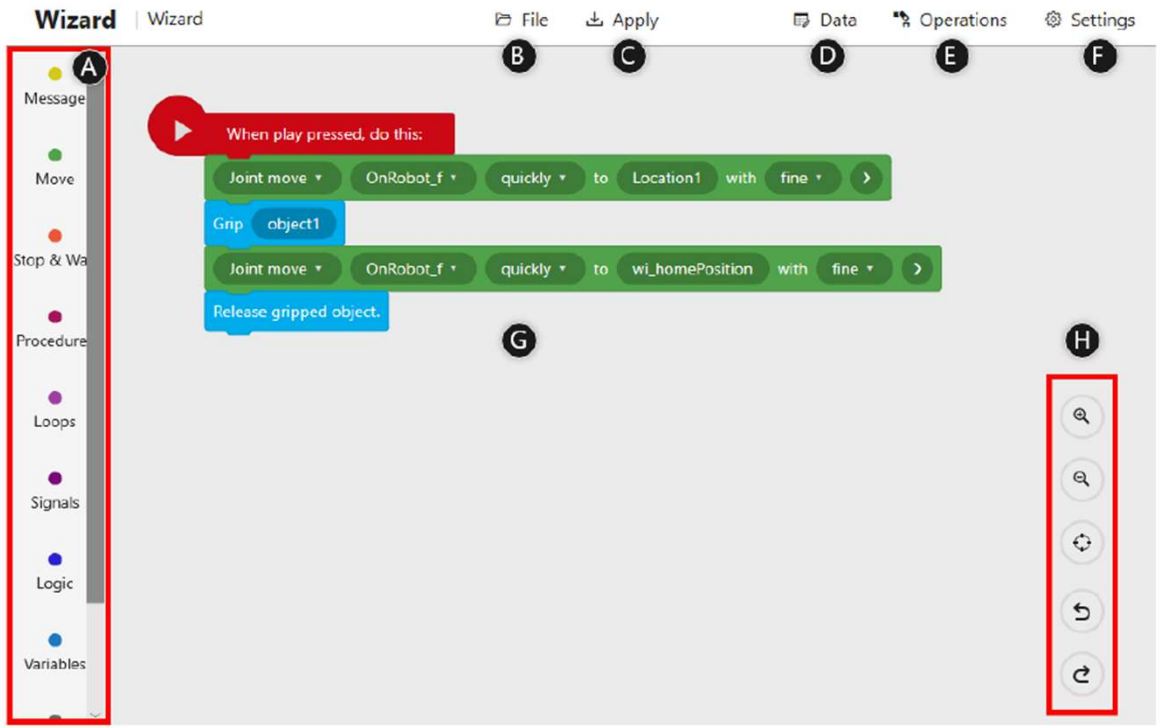


Image: ABB

ABB Wizard Easy User Interface

What Is ABB Wizard Easy?. . .

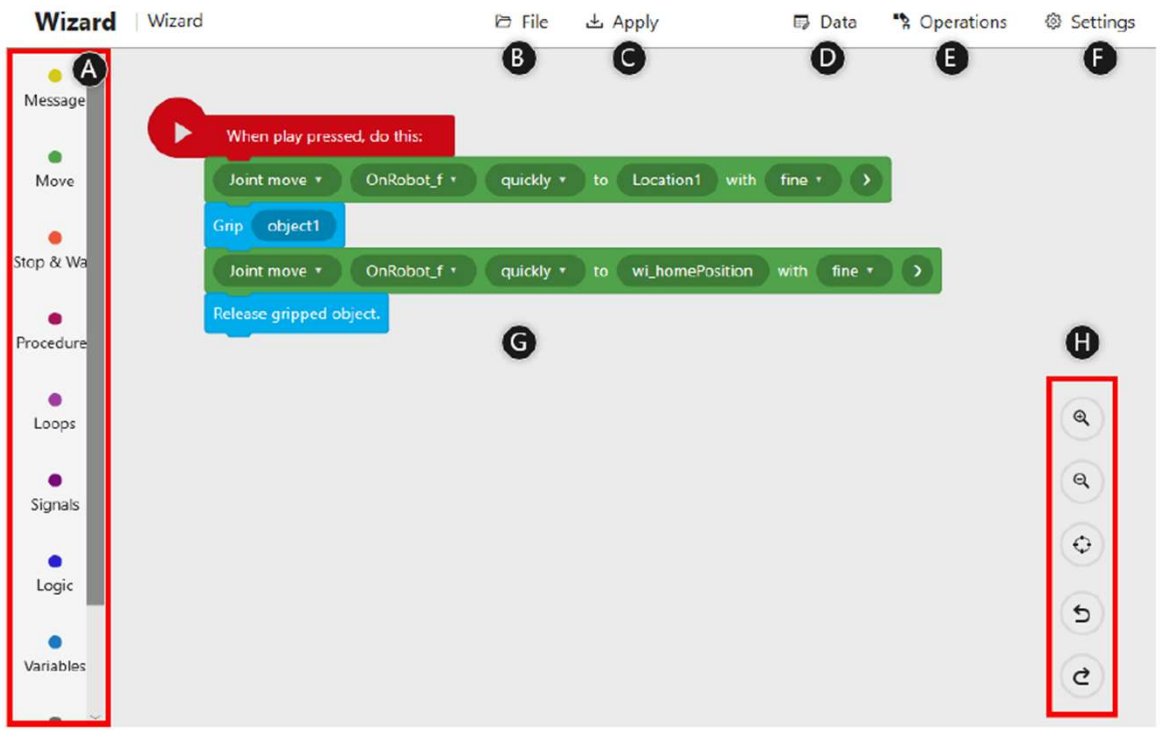


Image: ABB

ABB Wizard Easy User Interface

What Is ABB Wizard Easy?. . .

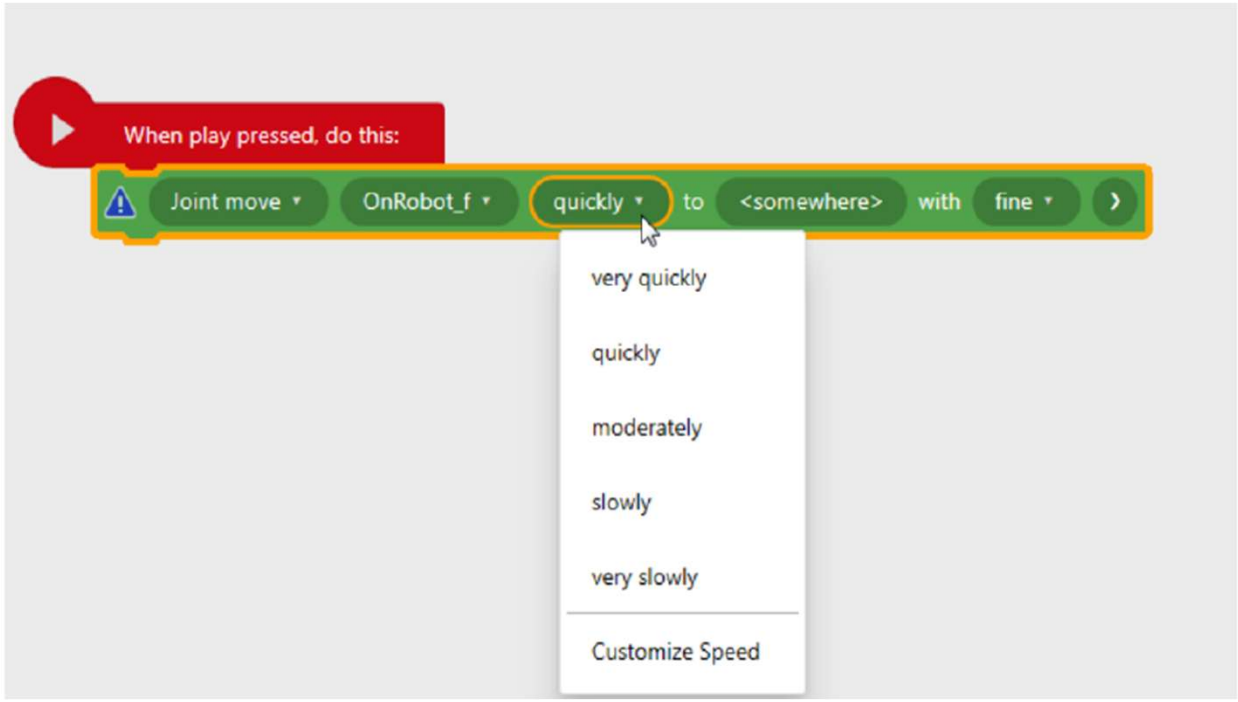


Image: ABB

Example of a Programming Block

What Is ABB Wizard Easy?. . .

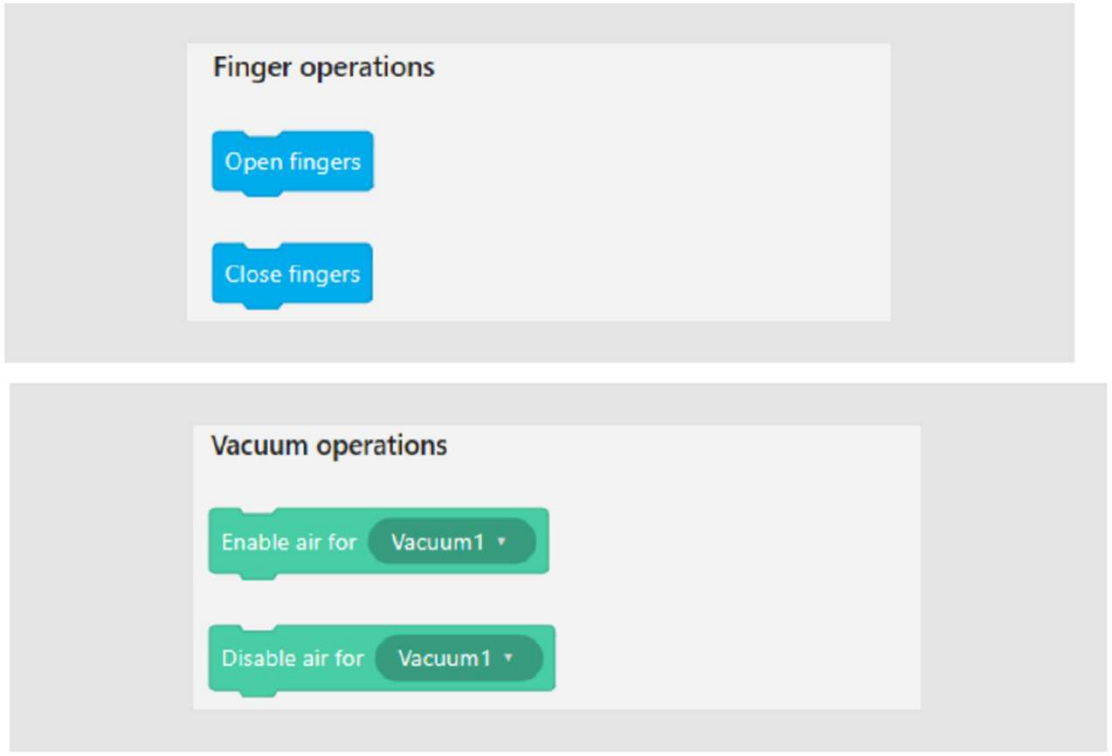


Image: ABB

Example of Programming Blocks

Question 2

What format is Wizard Easy Programming based on?

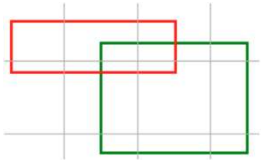
a) C++
b) Typescript
c) Blockly Code
d) none of the above

What Is ABB Wizard Easy?. . .

ABB's Wizard Easy Programming supports **all ABB cobots** as long as they are powered by the **OmniCore** controller, plus a growing set of six-axis industrial robots with OmniCore.

OmniCore Controller with Teach Pendant

Object Sorting Robot Prototype



The Object Sorting Robot Prototype project demonstrates AI + physical prototyping very clearly.

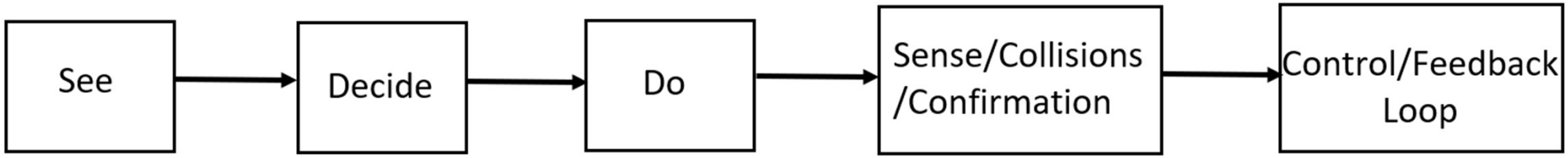
System Overview

The robot will:

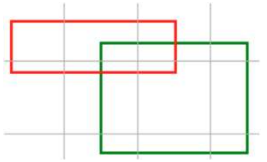
1. See objects using the Smart AI-Lens (camera module).
2. Decide what to do based on AI recognition (e.g., detect color, shape, or a specific object).
3. Do the sorting action using a servo motor to direct the object into the correct bin.
4. Sense collisions/confirmation with the Crash Sensor, ensuring the object is in place before sorting.
5. Control/feedback loop is managed by the micro:bit, which acts as the central controller.

Object Sorting Robot Prototype. . .

System Overview: Block Diagram



Object Sorting Robot Prototype. . .



System Overview: Block Diagram. . .

Roles of Each Component

a) micro:bit (Controller & Brain)

i. Acts as the central **decision unit**.

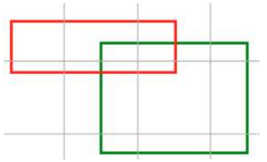
ii. Receives classification results from the **Smart AI-Lens** via serial or I²C communication.

iii. Reads input from the **Crash Sensor** to know when an object has arrived in the sorting area.

iv. Sends control signals (PWM) to the **servo motor** to rotate it toward the correct bin.

v. Provides user feedback (e.g., LEDs display a check mark for “recognized,” or an “X” for “unrecognized”).

Object Sorting Robot Prototype. . .



System Overview: Block Diagram. . .

b) Crash Sensor (Trigger Sensor)

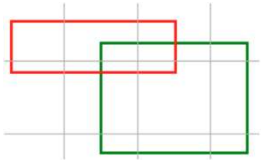
i. Detects when an object has rolled into or touched the sorting platform.

ii. Acts as a signal to the micro:bit to activate the AI-Lens for recognition.

iii. Ensures the system doesn't try to sort until an object is in position.

iv. Could also act as a safety stop if objects jam in the sorting area.

Object Sorting Robot Prototype. . .



System Overview: Block Diagram. . .

c) Smart AI-Lens (AI Vision Sensor)

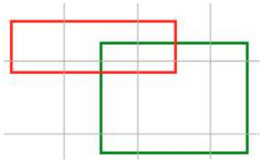
i. Provides the **computer vision capability**.

ii. Configurable in **Learn Mode** (train it to recognize different objects — for example, red vs. blue blocks, or round vs. square).

iii. Sends classification results to the micro:bit (e.g., “Object = Red,” “Object = Blue”).

iv. Works at the **edge** — no cloud connection required, making it an **edge-AI device**.

Object Sorting Robot Prototype. . .



System Overview: Block Diagram. . .

d) Servo Motor (Sorter Arm or Gate)

i. Physically moves to direct the object into the **correct bin**.

ii. For example:

- If the AI-Lens detects a “Red Block,” the servo rotates to 0°.
- If it detects a “Blue Block,” the servo rotates to 90°.
- If it detects an “Unknown Object,” it rotates to 180° (reject bin).

iii. Controlled directly from the micro:bit’s PWM pins.

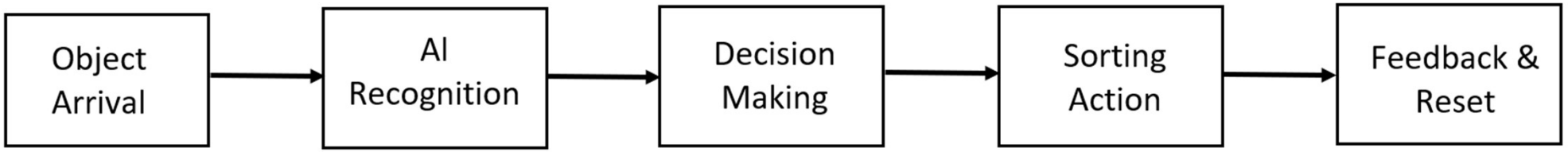
Question 3

Which component aligns with the Controller & Brain?

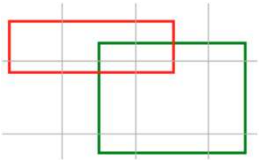
a) Smart AI-Lens
b) AI Recognition
c) Crash Sensor
d) micro:bit

Object Sorting Robot Prototype. . .

Workflow of the Object Sorting Robot Prototype



Object Sorting Robot Prototype. . .



Workflow of the Object Sorting Robot Prototype

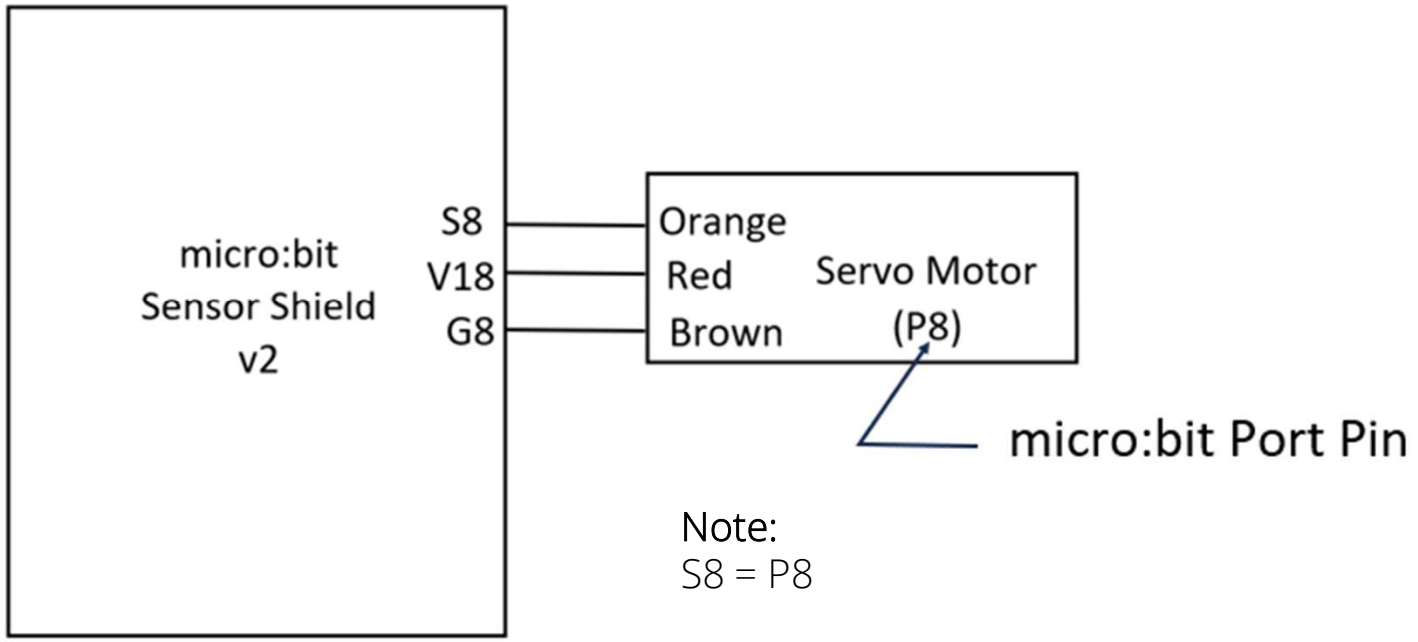
1. **Object Arrival**
   - The object rolls onto a platform.
   - The **Crash Sensor** is pressed → sends signal to micro:bit.
2. **AI Recognition**
   - The micro:bit tells the **Smart AI-Lens** to capture and recognize the object.
   - The AI-Lens returns classification data (e.g., Object = Red).
3. **Decision Making**
   - Micro:bit interprets the classification result.
   - Maps result to an **action rule** (e.g., "Red → Bin A, Blue → Bin B").
4. **Sorting Action**
   - The micro:bit sends a PWM signal to the **servo motor**.
   - Servo rotates to correct angle and directs the object into the bin.
5. **Feedback & Reset**
   - The micro:bit shows confirmation on its LED display.
   - Servo resets to a neutral position, waiting for the next object.

Testing a Servo Motor Using Blockly Code

The Sorting Action is a sub-element of the Object Sorting Robot Prototype. Testing a Servo Motor is quite simple when using a micro:bit, Blockly Code, and a servo motor.

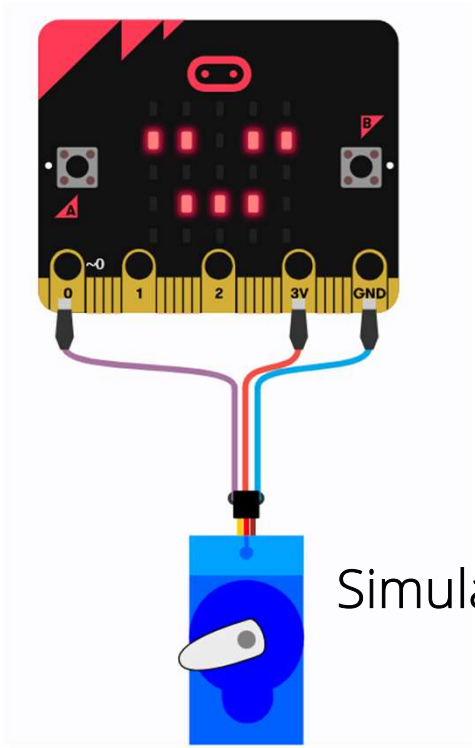
Concept Prototyping Block Diagram:

Hardware (HW)

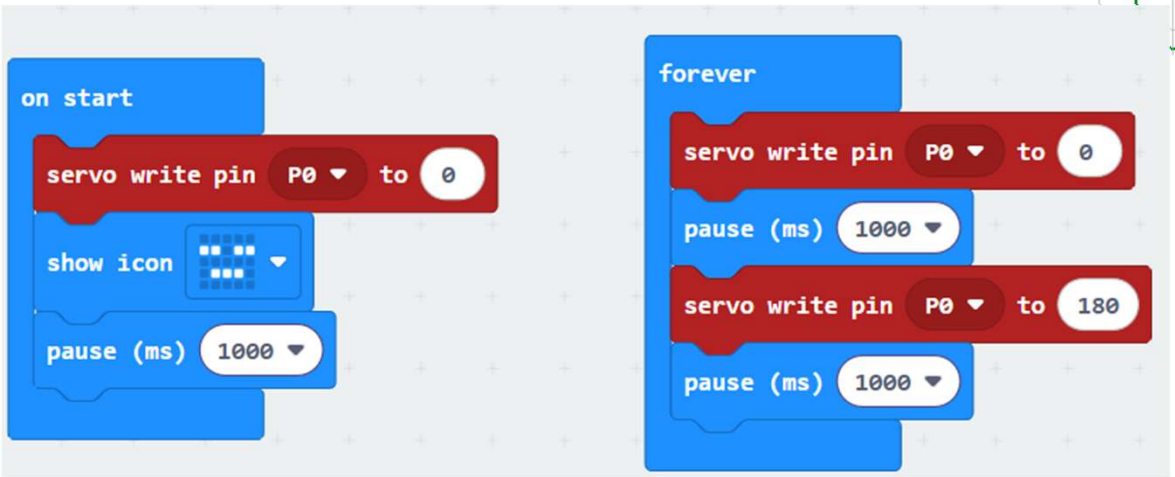


Note:
S8 = P8

Testing a Servo Motor Using Blockly Code. . .



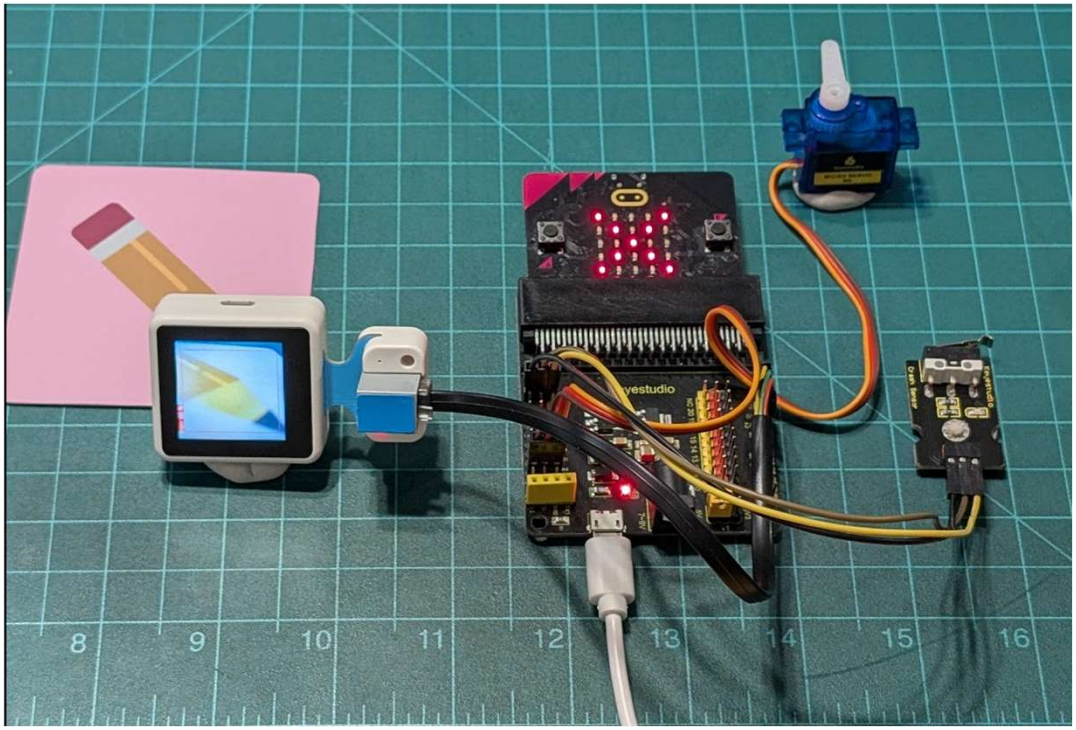
Simulated Servo Motor Controller



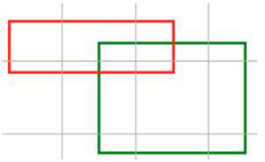
Concept Prototyping
Test Blockly Code:
Microsoft MakeCode

Software (SW)

Lab: Build an Object Sorting Robot Prototype



Lab: Build an Object Sorting Robot Prototype . . .

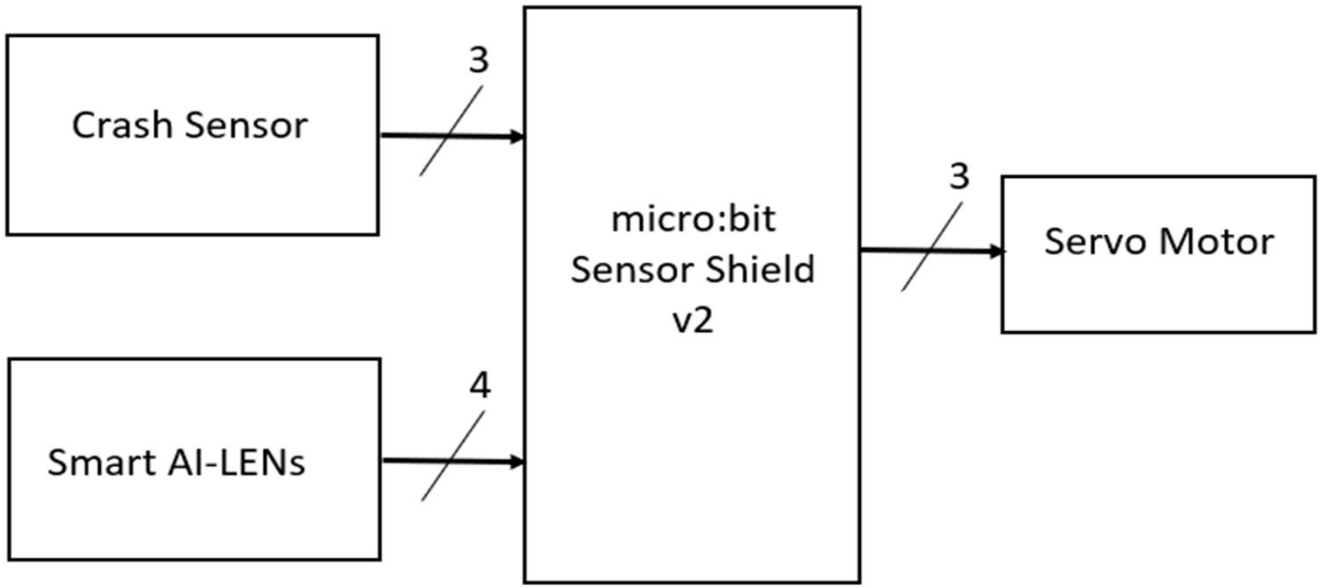


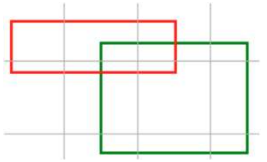
Participant Learning Objectives:

- Participants will learn to wire an Object Sorting Robot Prototype.
- Participants will learn how to use the Microsoft MakeCode Blockly Code for the Object Sorting Robot Prototype.
- Participants will learn to implement an object recognition event on recognizing an object using the Smart AI-Lens to Micro:bit Sensor Shield.

Lab: Build an Object Sorting Robot Prototype . . .

Concept Block Diagram for an Object Sorting Robot Prototype





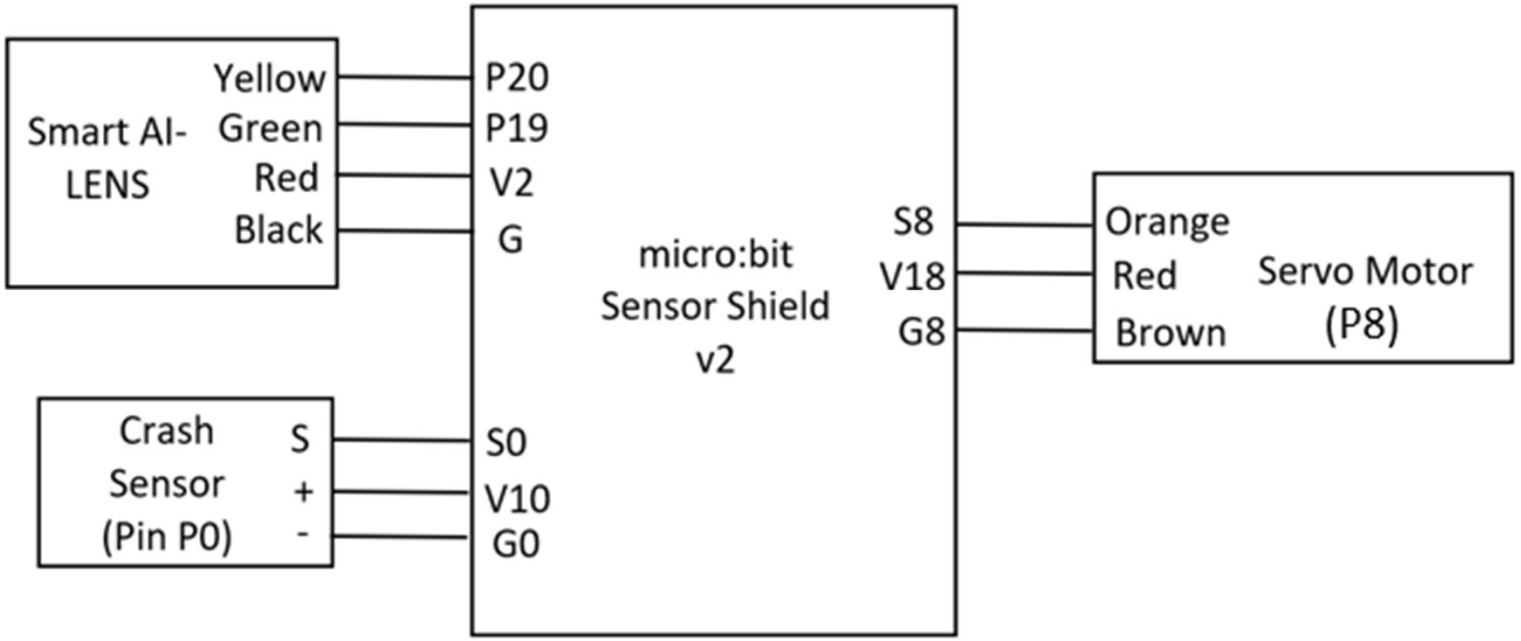
Lab: Build an Object Sorting Robot Prototype . . .

Operation

This project simulates the operation of an Object Sorting Robot. Upon the part being present (Crash Sensor pressed) and the Smart AI-Lens recognizing the object (pencil), a "check mark" is displayed on the micro:bit. The servo motor acts as an actuator that pushes the recognized object into the correct bin. If an object is not recognized or present, the micro:bit displays an "X“ and the servo motor is stopped or turned off.

Lab: Build an Object Sorting Robot Prototype . . .

Electrical Wiring Diagram



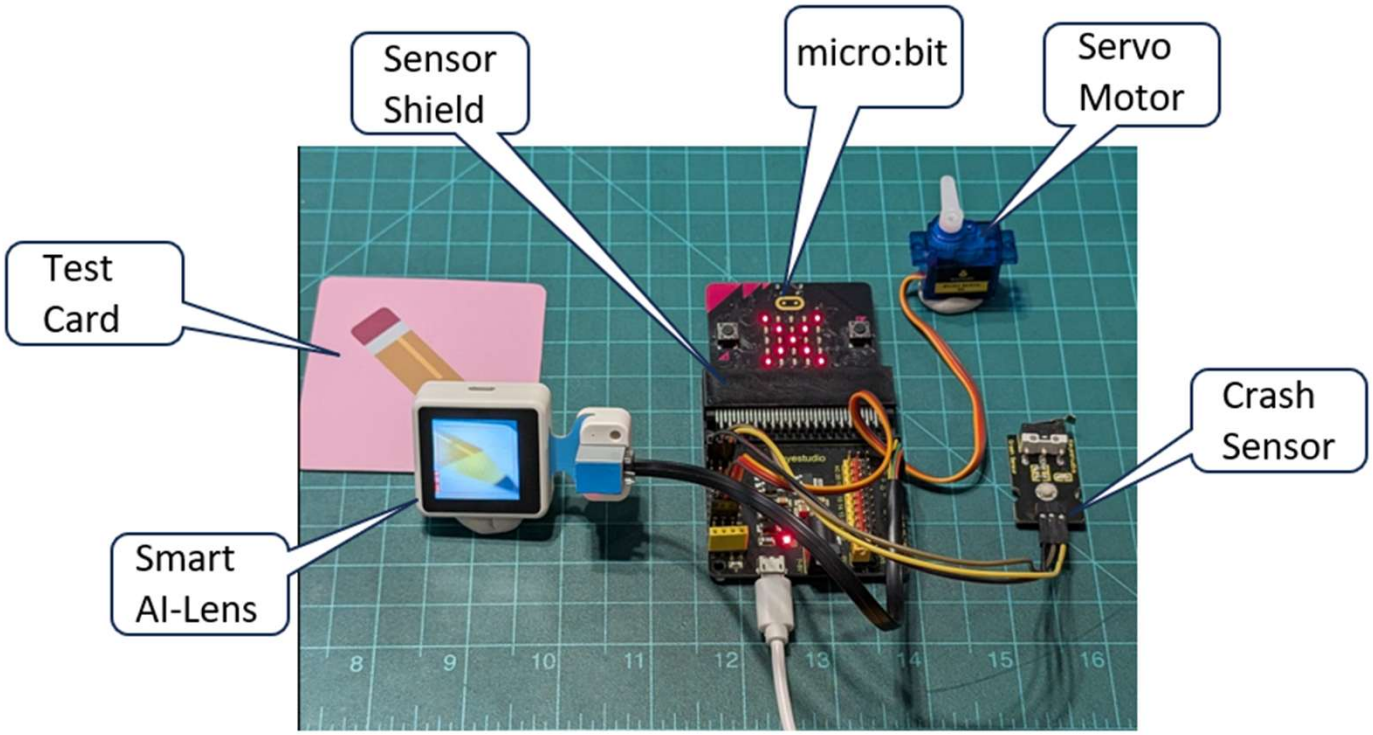
Question 4

What port pin is the Servo Motor wired to?

a) P0
b) P19
c) P8
d) none of the above

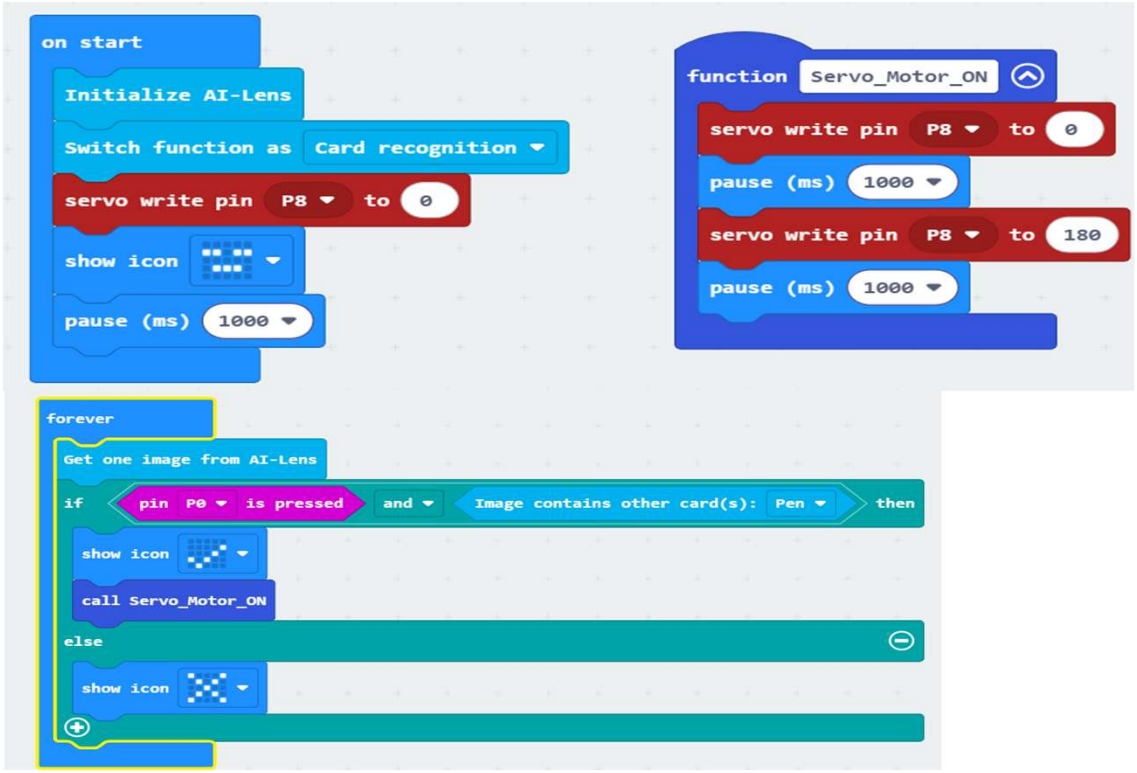
Lab: Build an Object Sorting Robot Prototype . . .

Completely Wired Object Sorting Robot Prototype



Lab: Build an Object Sorting Robot Prototype . . .

Object Sorting Robot Prototype Blockly Code

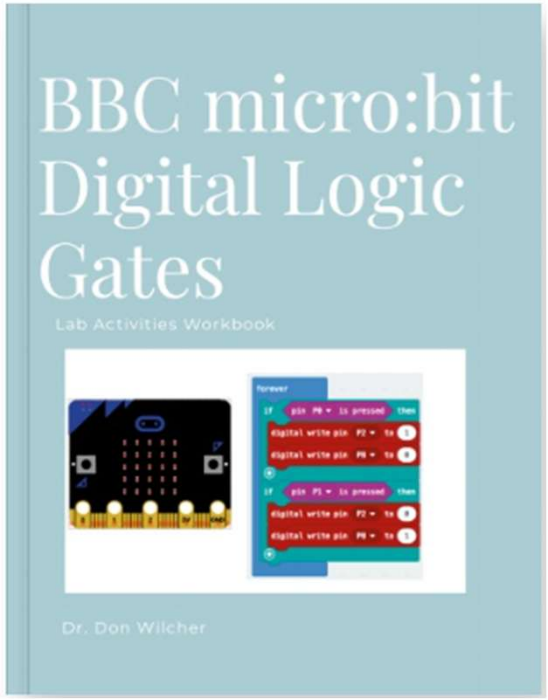


Lab: Build an Object Sorting Robot Prototype . . .

BBC Micro:bit Digital Logic Gate Lab Activities Workbook Challenge

Modify the Object Sorting Robot Prototype code to perform a Start-Stop control function for the Servo Motor.

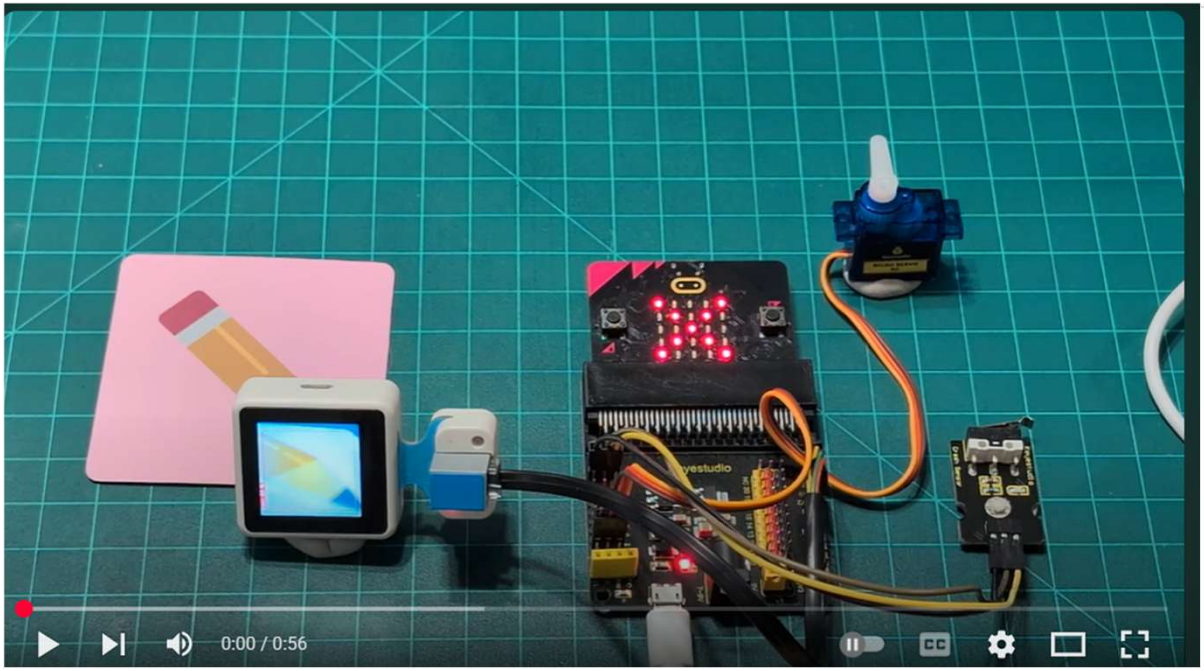
Pages 33-38 explain the Set-Reset (SR) Bistable Latch. In industrial controls, such a circuit is used to operate AC motors and manufacturing processes.



Lab: Build an Object Sorting Robot Prototype . . .

Assembled and Functionally Object-Sorting Robot Prototype

Watch the Video Clip!



https://www.youtube.com/watch?v=sn8hwm6W4Ds

Question 5

Which function block name is correct?

a) Servo_Motor_ON
b) Servo_Motor_OFF
c) Servo_Motor_ONE
d) none of the above

Thank you for attending

Please consider the resources below:

[1] J. Redmon, S. Divvala, R. Girshick, and A. Farhadi, “You only look once: Unified, real-time object detection,” *arXiv*:1506.02640 [cs.CV], Jun. 2016. [Online]. Available: https://arxiv.org/abs/1506.02640
[2] [1] D. Wilcher, “Designs News September 25 webinar code,” GitHub repository, Sep. 2025. [Online]. Available: https://github.com/DWilcher/DesignNews-WebinarCode/blob/main/September_25_Webinar_Code.zip

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