THE SYMBOLIC ELEMENT

Your group's symbolic element is **FIRE**, which represents energy, transformation, and passion. In the context of the **United Nations Sustainable Development Goals (UN SDGs)**, Fire can symbolise transition and technological advancements and renewable energy sources aimed at addressing environmental challenges.

This worksheet addresses the following UN SDGs within the Transportation industry:

- **Goals 3** Ensure healthy lives and promote well-being for all at all ages.
- **Goals 7** Ensure access to affordable, reliable, sustainable and modern energy for all.
- **Goals 11** Make cities and human settlements inclusive, safe, resilient and sustainable.
- **Goals 17** Revitalize the global partnership for sustainable development.

THE TRANSPORTATION INDUSTRY

In the transportation industry, technologies such as Artificial Intelligence (AI), Robotics, Internet of Things (IoT), Big Data, and VR, can be used to provide efficiency, safety, and sustainability in the transportation sector.

AI	Robotics	Internet of Things

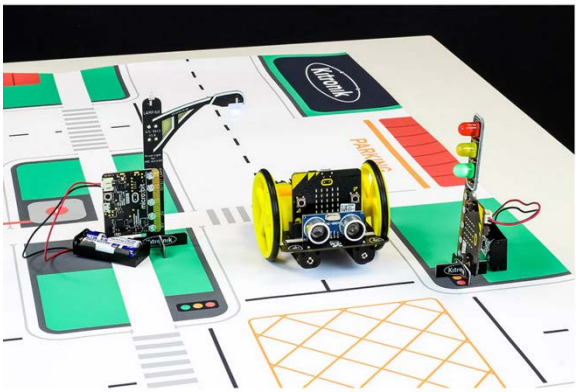
EXTENDED READING:
Artificial Intelligence (AI): AI optimises traffic light timings to reduce congestion. Example: Adaptive traffic signals in London improve traffic flow.

Robotics: Robots deliver packages efficiently. Example: Starship Technologies' delivery robots autonomously navigate sidewalks to deliver goods in cities.

Internet of Things (IoT): IoT devices track vehicle health and location. Example: UPS uses IoT sensors for real-time fleet management and maintenance alerts.

THE ARTIFICIAL INTELLIGENCE (AI) TECHNOLOGY

- AI technology can be used to conserve energy on our streets.
- AI technology can be used to enforce law, order, and to provide safety.



THE MISSION: TO CONSERVE ENERGY ON THE STREETS

Question: What is the need for streetlights?
Please write down your answer below.

Answer:

Question: When do streetlights turn on and off?
Please write down your answer below.

Answer:

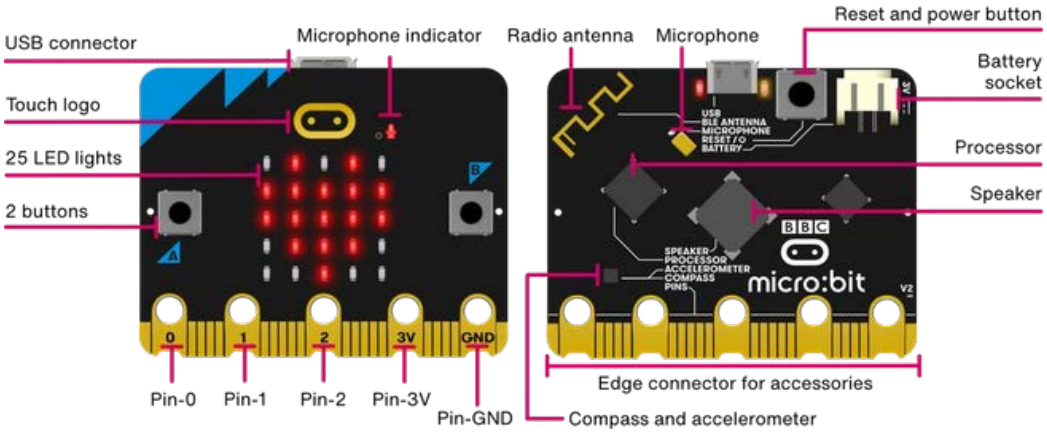
Question: How do they tell when it's light and dark?
Please write down your answer below:

Answer:

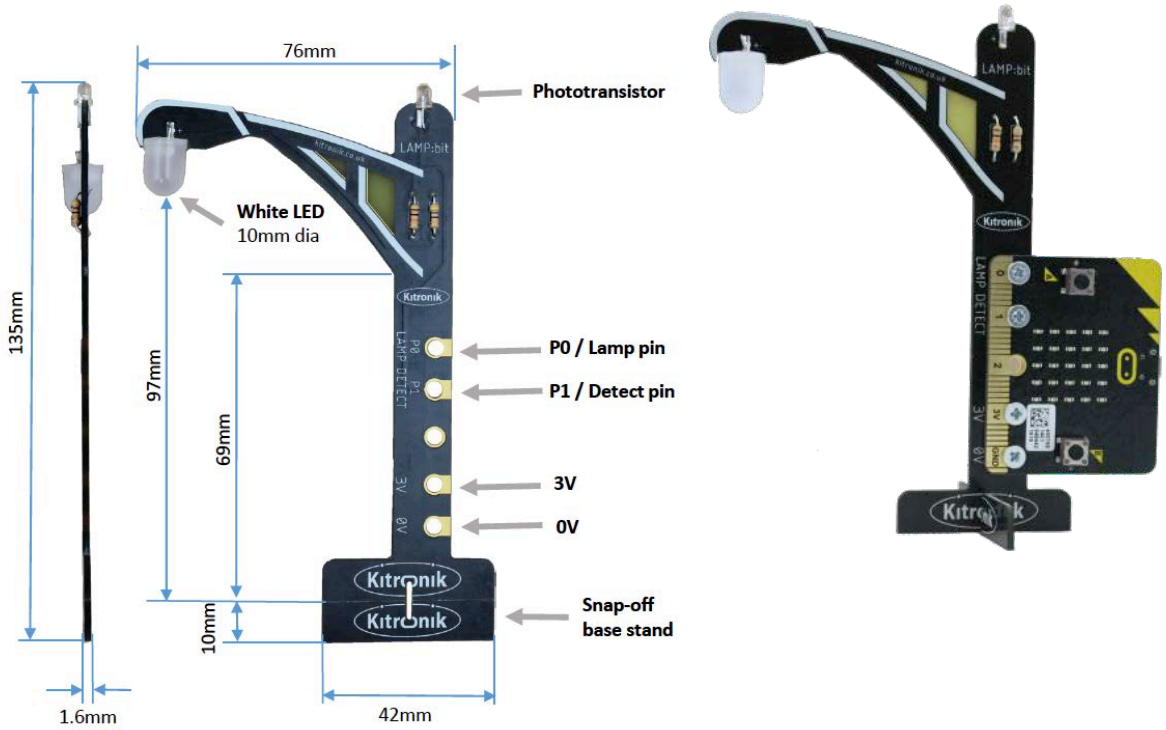
STAGE ONE: USING AI TO CONSERVE ENERGY IN OUR STREET

We will use a simple form of AI called a finite state machine (FSM) to program a streetlight component within a traffic transportation system. For that, we will need:

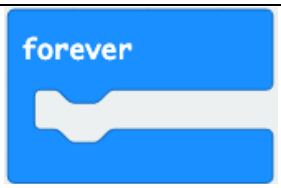
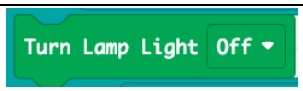
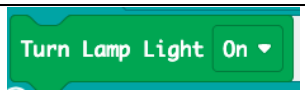
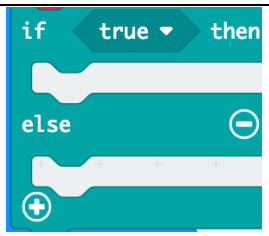
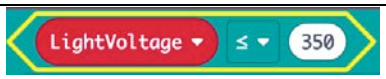
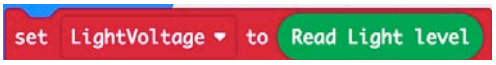
1. A BBC micro:bit: A pocket-sized computer (see the picture below for more details).



2. A LAMP:bit: A streetlight component that is equipped with a phototransistor that detects the changes in the light levels. When the phototransistor is illuminated with light, it then conducts and the pin P1 is pulled up towards 3V. When dark, the phototransistor does not conduct and P1 is pulled down towards 0V with a resistor (see the picture below for more details).



3. Below we have some coding building blocks for for which, if you put them together in the right order, you can construct a finite state machine (a simple AI system) that turns the light in the LAMP:bit on and off based on the phototransistor input, which is used to tell when it is light and dark.

What do you think each block of the code listed below does?	Using the code blocks in the left side of this table, write down in this column the correct order of the blocks to turns the light in the LAMP:bit on and off based on the phototransistor input.
(1) 	
(2) 	
(3) 	
(4) 	
(5) 	
(6) 	Solution

4. Let's program the LAMP:bit with the code you wrote down as your solution for the previous task. To do that, please follow these four steps:

   Step 1: Go to https://makecode.microbit.org/S36233-09650-46417-19780

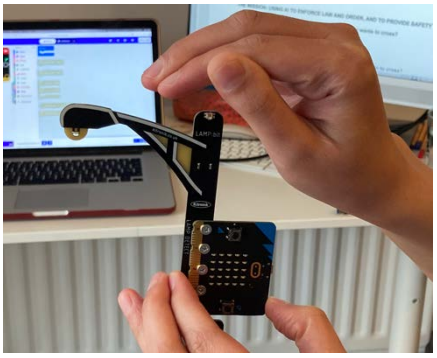
Step 2: Click on the **Edit** button

Step 3: That will open new window, in this window order the blocks in the screen according to your solution for the previous task

Step 4: Once done, download your project and copy/install it into the BBC micro:bit attached to the LAMP:bit

Question: What does the Lamp: bit do when you cover the phototransistor sensor with your hand (see the picture)?
Please write down your answer below:

Answer:



THE MISSION: USING AI TO ENFORCE LAW AND ORDER, AND TO PROVIDE SAFETY

Question: How do traffic lights know when a pedestrian wants to cross?
Please write down you answer below:

Answer:

Question: What icon/symbol is used to let pedestrians know when to cross?
Please write down you answer below:

Answer:

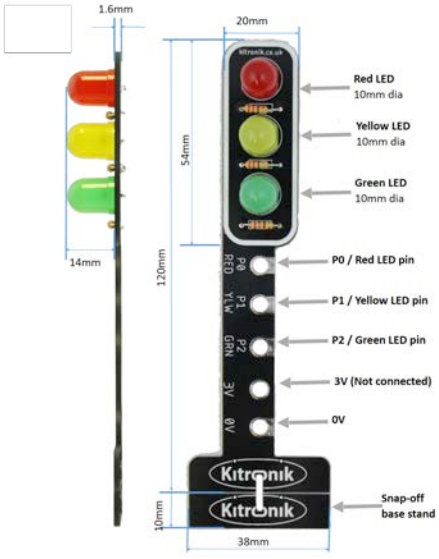
Question: At what point in the traffic light cycle does the pedestrian green man appear?
Please write down you answer below:

Answer:

STAGE TWO: USING AI TO ACHIEVE ORDER AND TO PROVIDE SAFETY

We will use a simple form of AI called a Finite State Machine (FSM) to program a traffic light component within a traffic transportation system. For that, we will need:

1. A BBC micro:bit: A pocket-sized computer.
2. A STOP:bit: A traffic light component that has three 10mm LEDs (1 Red, 1 Yellow, 1 Green). Each of these LEDs is driven by one of the BBC micro:bit pins. The table to the right gives the connections between the LEDs and the pins (see the picture below for more details).



Pinout	
P0	Red LED
P1	Yellow LED
P2	Green LED

3. Below we have the coding building blocks that can programme the STOP:bit to works in a certain way. On the right side, write down what the code shown below does.

What does the code shown on the left side do?

Solution

4. Let's program the STOP:bit with the code above. To do that, please follow these four steps:

   Step 1: Go to https://makecode.microbit.org/S49230-79156-82369-20409

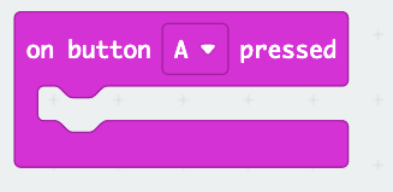
   Step 2: Click on the **Edit** button

   Step 3: Download your project and copy/install it into the BBC micro:bit attached to the STOP:bit

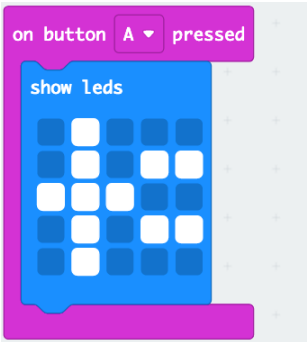
   Step 4: Does your intended solution match what you see when you demonstrate it on the STOP:bit? If not what are you seeing on the STOP:bit?

5. The current traffic light does not know when a pedestrian wants to cross. To solve this issue, we can ask an arriving pedestrian to press the button A on the BBC micro:bit. Then, when the micro:bit executes its program and reaches a certain part of the code, it will check if there are any button presses (also known as “interrupts”) to deal with before carrying on.

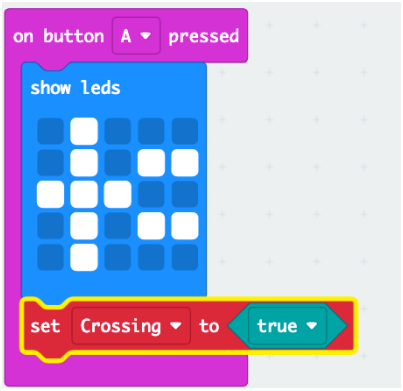
Step 1: Modify the code above to allow a pedestrian to press the button A using the **on button A pressed** command. From the **Input** menu, drag and drop **on button A pressed** command.



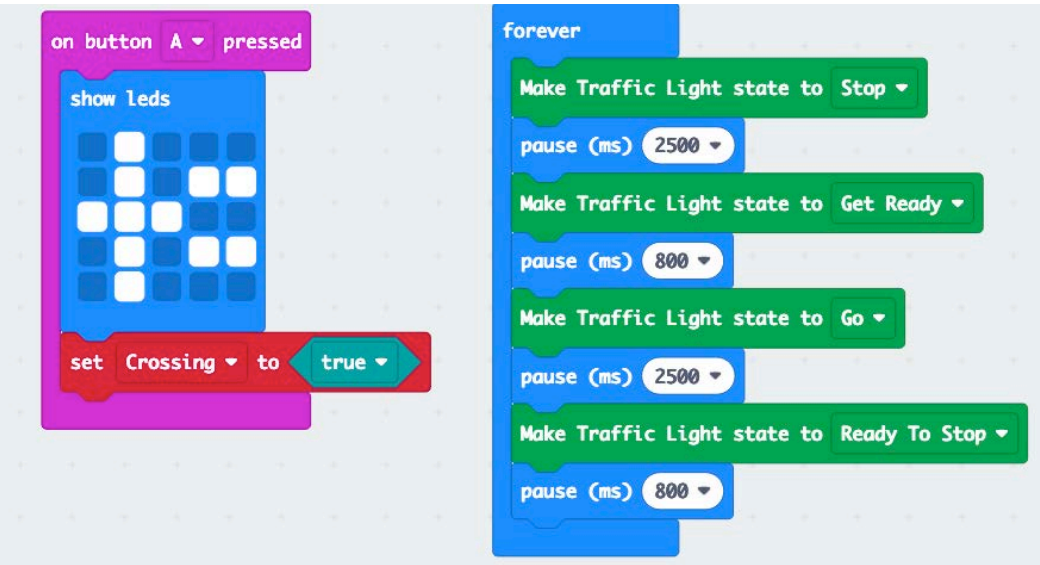
Step 2: Insert a **show leds** command to show a standing-man-icon on the display of the BBC micro:bit.



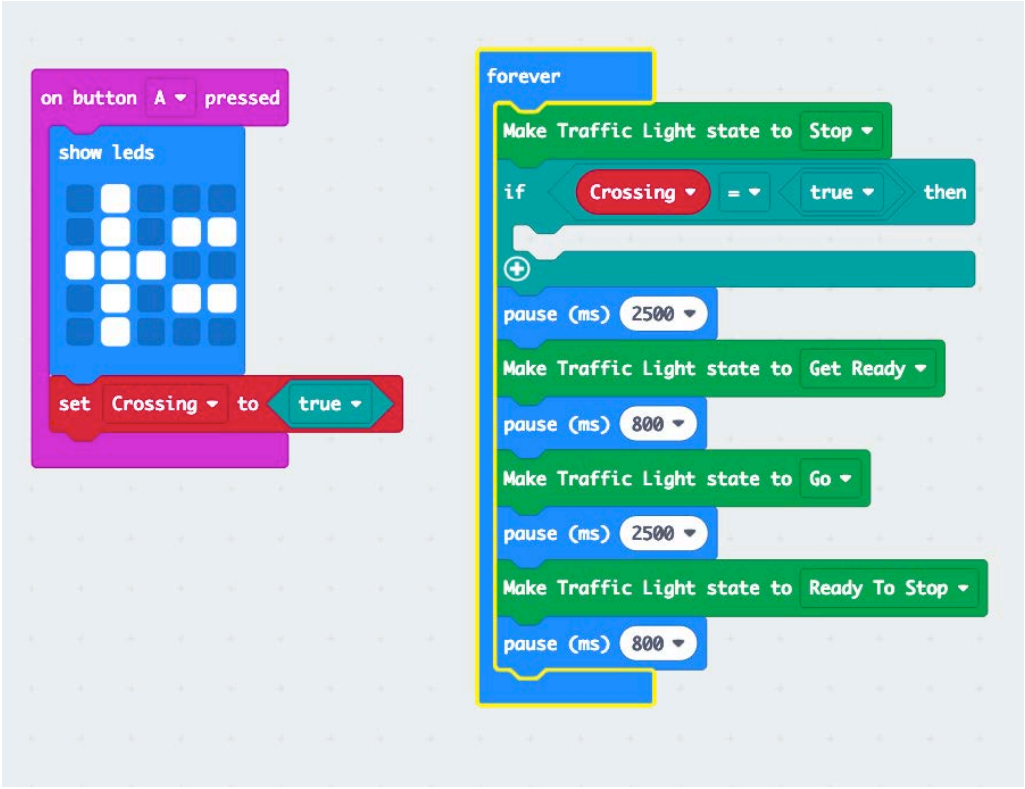
Step 3: Create a variable named “**Crossing**”, and set the “**Crossing**” variable to **true**, when a pedestrian presses the A button on the BBC micro:bit. You can create variable from the **Variables** menu.



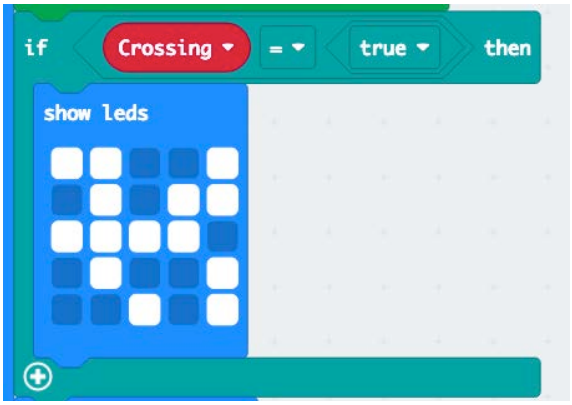
Step 4: So far, the system displays a pedestrian wanting to cross, but the traffic light does not “know” yet that a pedestrian wants to cross.



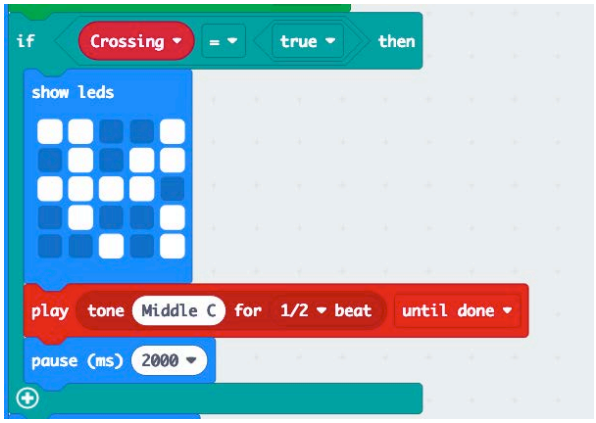
Step 5: To solve this issue, an interrupt is required. An interrupt is a way for the system to know when an action needs to take place. When the software reaches a certain part of the code, it will check if there are any interrupts to deal with before carrying on. This can be done using an **if** statement. We will insert an **if** statement after the **Make Traffic Light state to Stop** command (see below). This **if** statement checks if the **Crossing** variable is set to true.



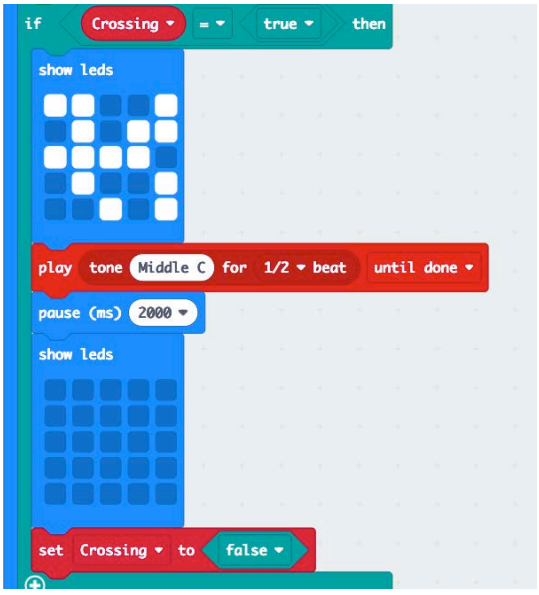
Step 6: When the **Crossing** variable is set to true, inside the if statement insert a **show leds** command and create a walking man icon on the BBC micro: bit display.



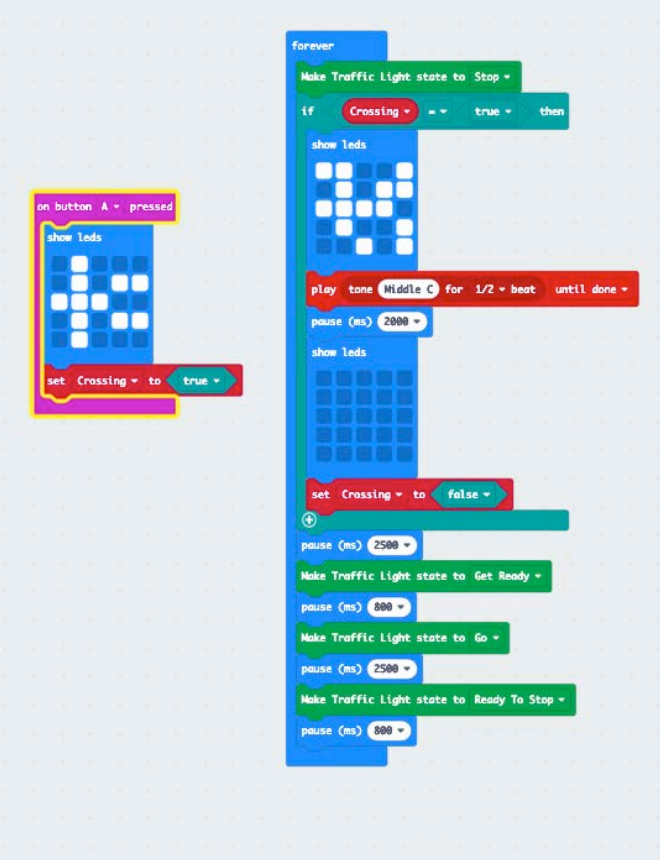
Step 7: Then, add **play tone Middle C for ½ beat until done** command, and **pause for 2s** to allow the pedestrian some time to cross.

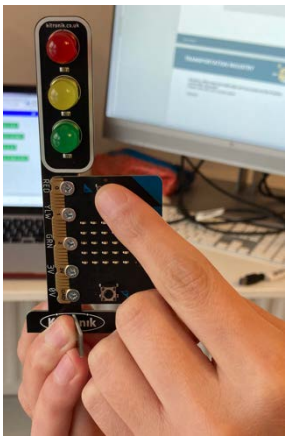


Step 8: After that, clear the BBC micro:bit display and set the **Crossing** variable to false.



Step 8: Now, you are set to download your project on the BBC micro:bit.





Question: What does the traffic light do if you press on the A button on the BBC micro:bit?
Please write down your answer below:

Answer: