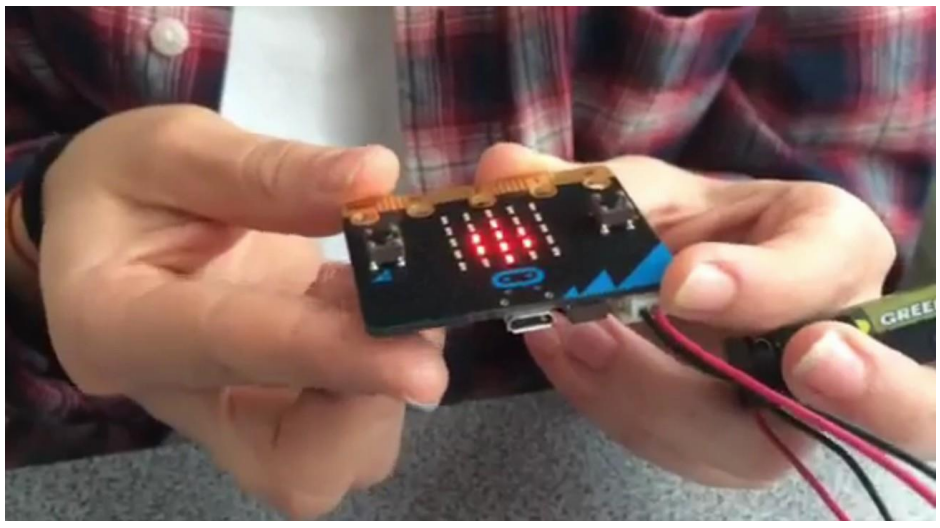
MOTION SENSOR

(AKCCELEROMETERS)



In this lesson you will get acquainted with the accelerometer – a sensor that will tell you how do you move with the micro:bit and which direction.

Material requirements:
BBC micro:bit, USB cable, battery for micro:bit, computer with an access to Internet

We are going to work in the online environment makecode.microbit.org

WHAT IS AN ACCELEROMETER?

An accelerometer is a sensor that measures acceleration. It is quite widespread – you can find it in cars, mobile phones and pedometers. It is often combined with another sensor – a gyroscope – a tilt sensor. It measures in which direction and how much the micro:bit is tilted. Because these two sensors (accelerometer and gyroscope) are mostly combined into one component (you will find it on the back of the micro:bit), so for simplicity we will both call them together "accelerometer ".

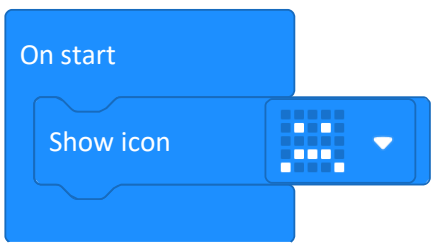
WHERE IS THE ACCELEROMETER USED?

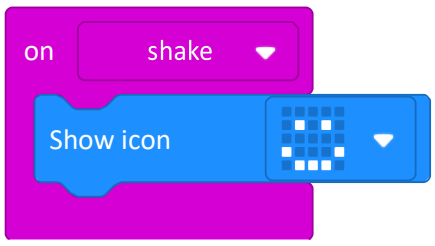
- The mobile phone/ tablet uses a tilt sensor to rotate the screen.
- Airbags in cars use an accelerometer to detect the crash when the car decelerates sharply (the opposite of acceleration - deceleration).
- The pedometer uses an accelerometer to detect the number of steps.

Shake sensing

Sensing the micro:bit to shake is similar to a button press. Just use the `when shake` from category `Input`. Try to program a simple program that will dispaly a sad smiley at the beginning and a happy smiley when mickro:bit is shaking.

First try the program in the simulator and only then upload it to the micro:bit. But how to simulate shaking in the simulator? We can do this in two ways. In the first way, we click on the white circle marked SHAKE, which was automatically added to the upper right side of the micro:bit in the simulator. The second way is to quickly move the mouse over the micro:bit a few times.





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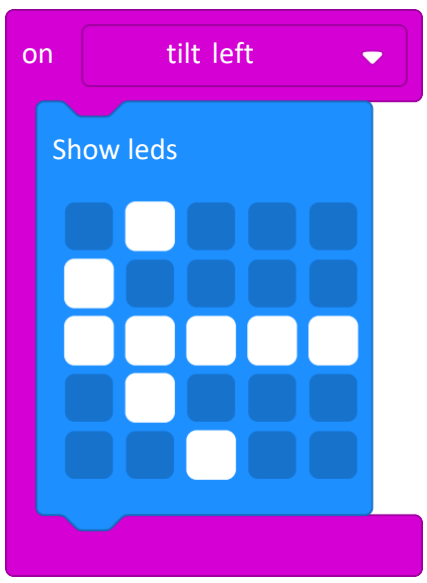
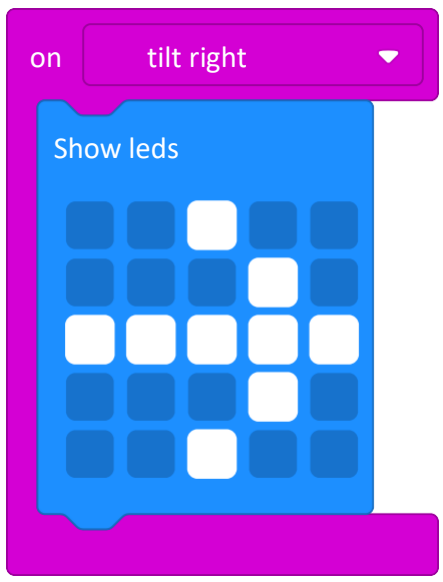
Tilt left and right

In addition to shaking, the micro:bit can also read a lot of other positions with the accelerometer, such as tilting to the right and tilting to the left. Again, we will use the command `when shake` from the `Input` category, but this time we will click on the `shake` and change it. Try programming the micro:bit to display a left arrow when tilted to the left and an arrow to the right when tilted to the right.





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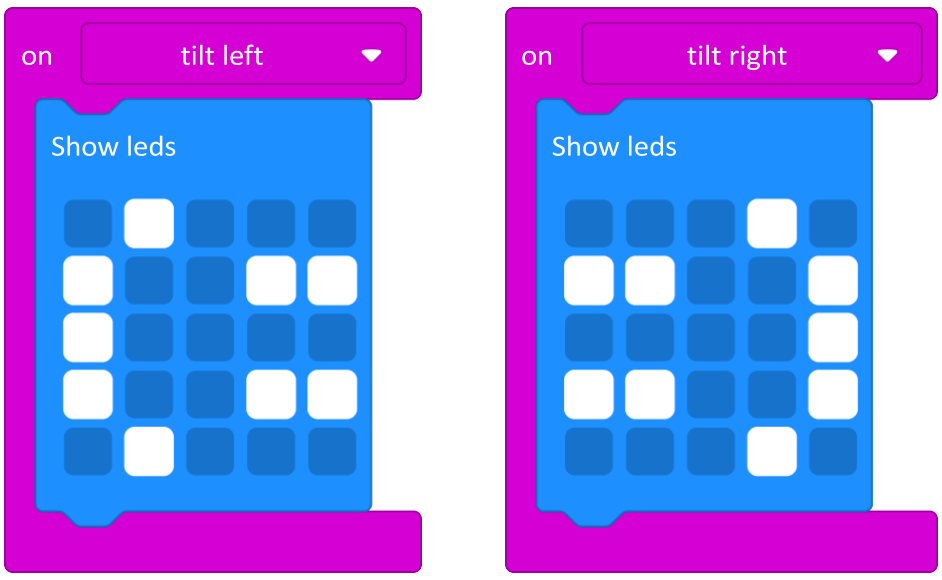
Rotate smiley – like on a mobile

Mobile phones also have built-in tilt sensors and use them, for example, to know which side to turn the screen to when we rotate the mobile phone. We will now program the same thing on the micro:bit – we will display a smiley face, which will rotate with the micro:bit so that it is never upside down (analogous to rotating the screen on smartphones).

First, we program the first part of the program – tilting the smiley to the right and to the left. All we need to do is change a little bit the program from the previous step.



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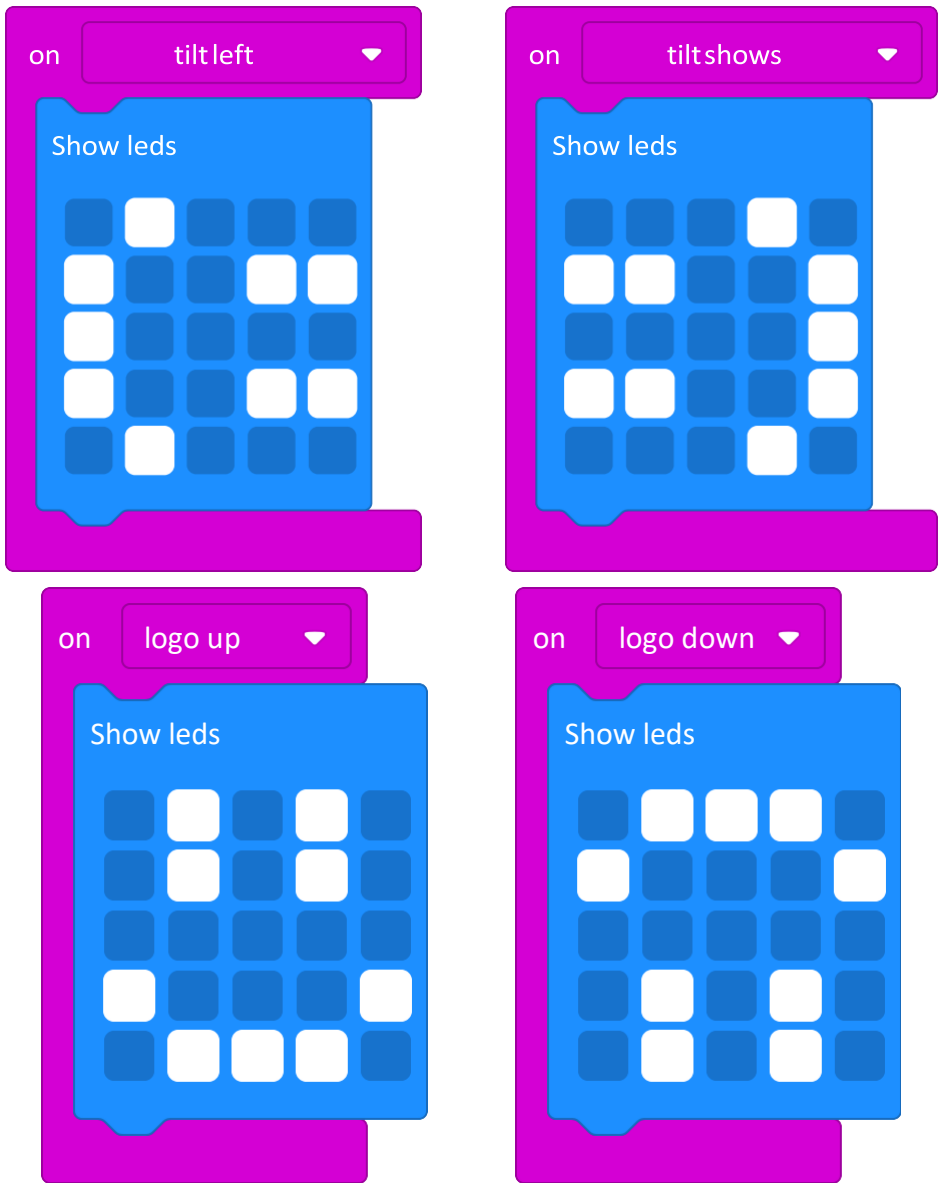
We will upload the program to the micro:bit and try out.

The whole program

If the display of the first two smileys works properly, we will add 2 remaining images – when we have a micro:bit perpendicular to the table and when we have it upside down. We do this with commands `logo up` and `logo down`. In this case, the logo means a small " face" with two eyes above the micro:bit display.

Here is the whole program:



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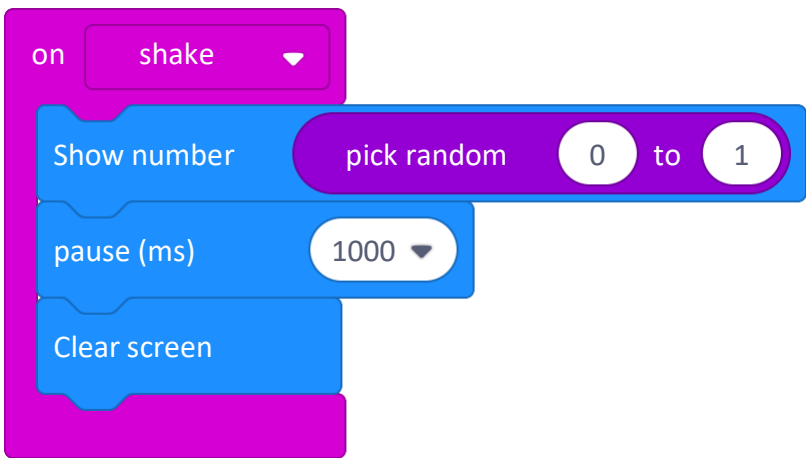
Random numbers – Tossing a coin

Making decisions is difficult and sometimes we toss a coin. But what if we do not have a coin with us? We can use micro:bit. It can randomly generate numbers, which we can then display on the screen.

Random numbers in micro:bit are obtained by the command `pick random 0 to 10` from the category `Math`. Since we want to create a digital coin, instead of numbers from `0 to 10`, we will only generate numbers from `0 do 1`. Zero will mean no and one will mean yes.



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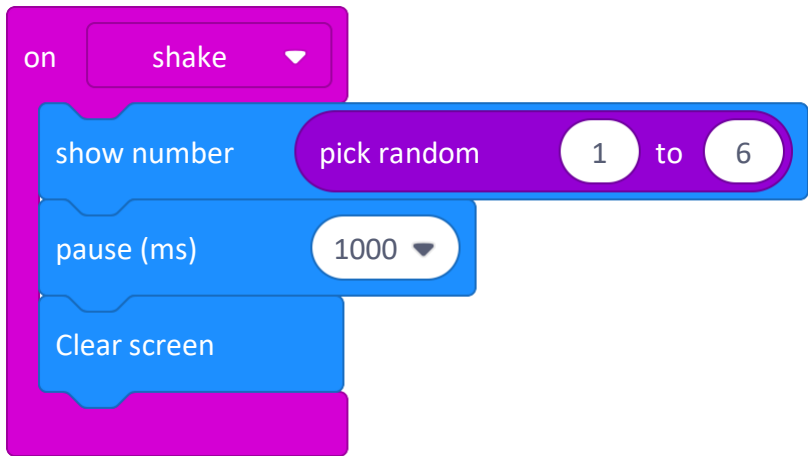
The number only needs to be displayed when shaken. To display, we will use the command `show number` from the `Input` category. It is important to use the command `show number` and not `show string`, as these are two different commands.

To display the value for only one second, we use the command `pause (ms)` and `Clear screen`.

Random numbers – Digital cube

What should we do in a situation if we want to play the game Don't be angry, man but after opening the box, we will find out that there is no cube in the package? We don t have to be hopeless, we take a micro:bit out of our pocket to turn it into a digital cube and after a while we can play.

Try to program the micro:bit to display a random number from 1 to 6 (like a cube) when shaken. The number is deleted after 1 second. The program will be remarkably similar to the previous task.



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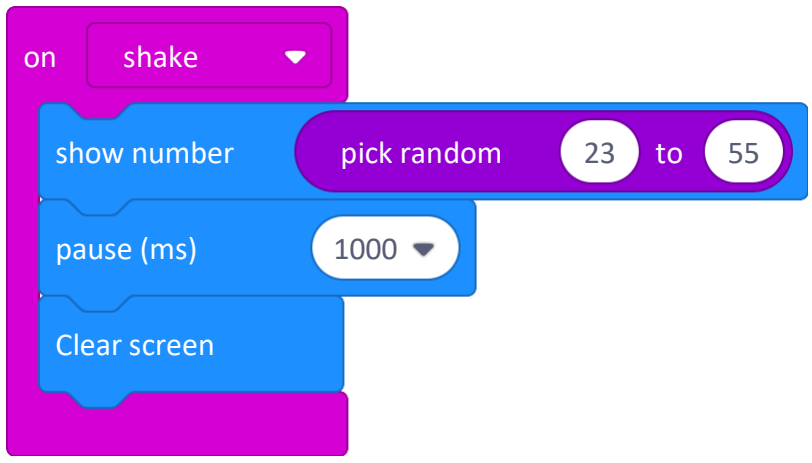
Random numbers – number generator

The last program we will do in this lesson is a random number generator. This can be useful for us, for example, in the lottery. However, the rules of our lottery are such that only numbers from 23 to 55 (55 is also included) are drawn. Try programming the micro:bit to always show you a random number from 23 to 55 (including 55) when shaken and to display it for only one second. Then the screen clears and you can shake the micro:bit again.



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LESSON SUMMARY

In this lesson, we learned to use an internal accelerometer and acceleration sensor (gyroscope). At the same time, we tried to generate random numbers and use them to create a digital coin, cube or random number generator.

FINAL QUESTIONS

- What is the difference between an accelerometer and a gyroscope?
- Where are the accelerometer and gyroscope located on the micro:bit?
- What command do we use to generate random numbers in the MakeCode environment?
- Where are acceleration and tilt sensors used everywhere in everyday life?