PEOPLE COUNTER
EXPLORING VARIABLES

In this lesson, you will create a useful tool – a people counter. They use them, for example, at festivals, events, or discos, so that the organizers know how many people they can let go inside.

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

We are going to work in an online environment make.code.microbit.org.


MANUAL PEOPLE COUNTER

The manual counter is often used at festivals, events and discos to help organizers know exactly how many people are inside and not to let go too many people in at once. In practice, it looks like every time a security guard lets in one person, he increases the number on the counter and when someone comes out, he decreases the number. He always knows exactly how many people he has inside. Such the conter could also be used, for example, at school during the school academy.
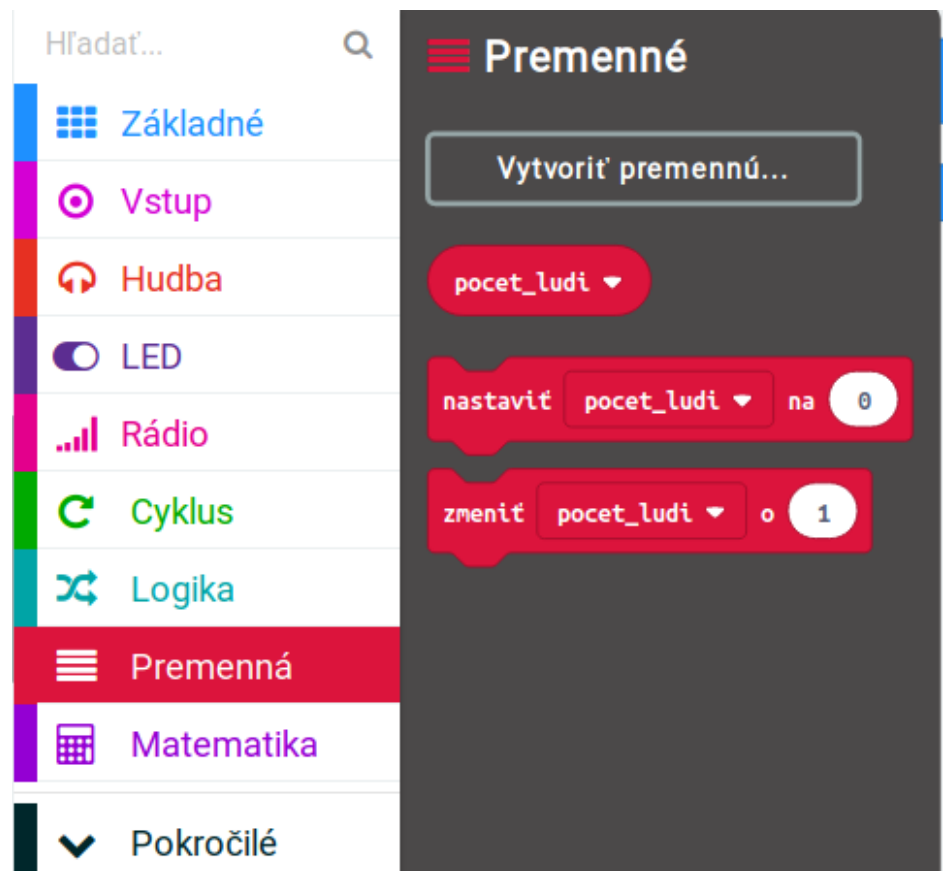

VARIABLES

During the event, the number of people changes, sometimes people come (the number increases) and then leave (the number decreases). We have to remember this number on a micro:bit somehow. We can do this with variables. The variable can be presented as a box in which we store any information – in our case, the number of people. We can increase or decrease the number of people stored in a variable at any time, depending on how people enter and exit.

We set this variable to zero at the beginning of our program, as we assume that we start counting when no participant is inside.
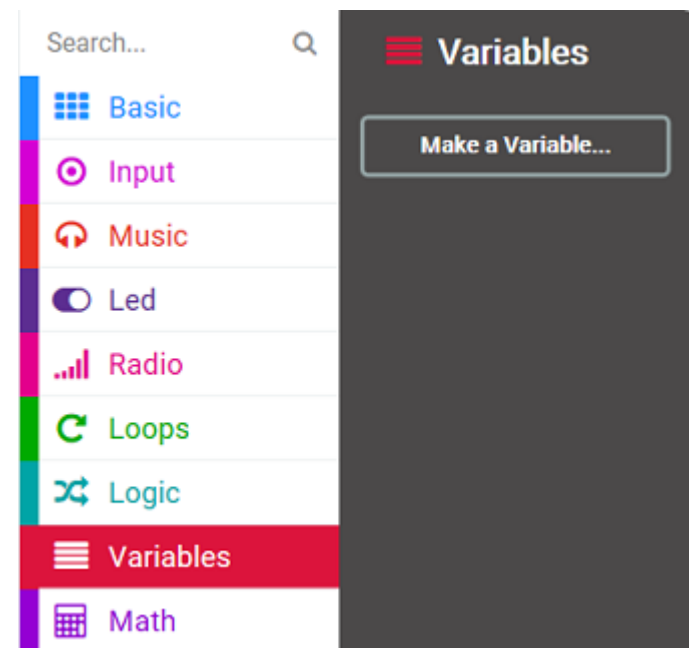
Variables (Premenné) have their own category in the MakeCode environment called Premenná (Variables). Through this category, it is possible to create one or more variables and name them as you wish. For our counter, click on the Vytvoriť premennú (make a variable) button and then enter the name of the new variable, for example *„pocet_ludi" (number_of_people)*. After creating it, we will see 3 blocks:

- Round block *„pocet_ludi" (number of people)*, which represents the variable itself. We will use it, for example, when we want to print a number in a variable on the screen.

- Command to set a variable to a given number.

- Command to change the number – the value of the variable, - thanks to which we can add and subtract from variable.

SETTING THE COUNTER TO ZERO AND DISPLAYING THE NUMBER OF PEOPLE

In the previous step, we created a variable, but there is nothing in it yet. We want our variable to start at the number 0, so we call use the command set pocet_ludi to 0. We insert the command into the command on start because we want to set the counter to zero only once.

*Edit and download: http://makecode.microbit.org/_7MpJjyDX0Kv4*
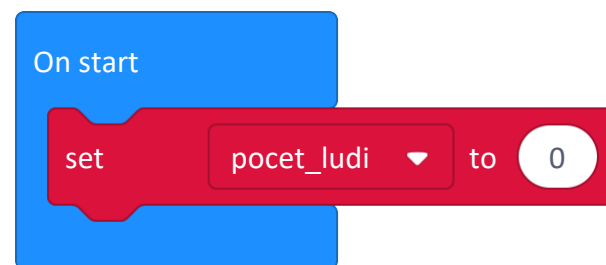
Then we add a micro:bit option to display the current number of people (currently there are zero people). We can do this in different ways, but let's say we want to show the number of people by shaking. So, we will use the command on shake, in which we insert the command show number (attention, it is important to use the command show number and not show string). All you have to do is insert our variable (you will find the red oval block pocet_ludi in the section called Variables, but only if we created such a variable first).

Try the program on a micro:bit or in a simulator – it should always show you the number zero when shaken.

INCOMMING AND OUTGOING PEOPLE

We have almost programmed the counter – we need to program the micro:bit so that it adds one person when you press button A and subtracts one person when you press button B. To do this, use the command set pocet_ludi by 1. If we have created several variables, it is necessary to select the correct variable to add/ subtract by clicking in the small white arrow. We do the countdown analogously, but we change not by 1, but by -1.

Now our counter should work at full capacity. We start at zero, use the buttons to add and subtract people, and when we want to display the current number of people, we simply shake the micro:bit. First test the code in the simulator and then upload it to your BBC micro:bit.

Edit and download: http://makecode.microbit.org/_bWD7MDg3AeXU
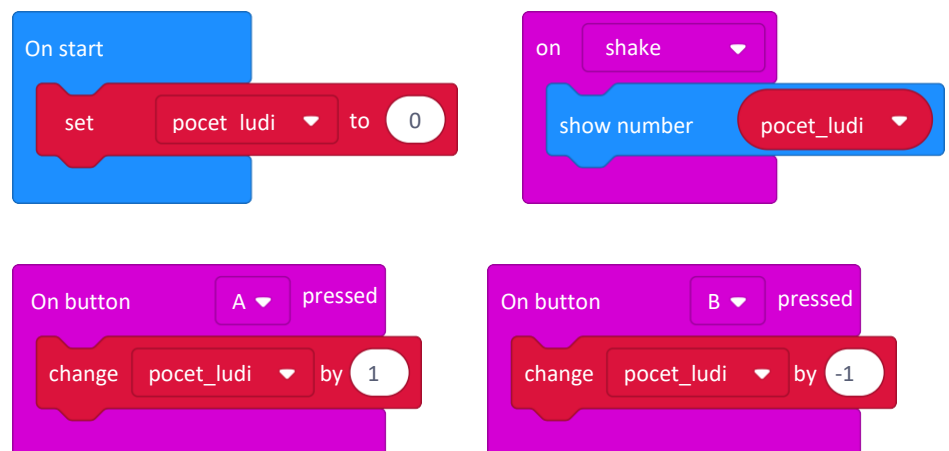
If the micro:bit does not show the current number of people correctly, try shaking it.

COUNTER RESET

How do we reset the counter? Just press the RESET button. Since the micro:bit starts the code again when RESET is pressed, the command on start set pocet_ludi on 0 also can reset a counter.

EVEN BETTER COUNTER

You can improve the counter in various ways, for example:

- After shaking, it displays the number of people for only 1 second, the clears the screen.
- Each time you add/ subtract, a new number of people is also displayed on the screen.

Does the micro:bit remember the value of the variable?

We already know the pressing the RESET button sets the variable to 0. But does the micro:bit remember variable when we disconnect it and reconnect it to the battery/ USB cable? The answer is no, and it is not due to a command on start. BBC micro:bit does not remember any variables after turning on and off. This is because the Micro:bit stores variables in RAM. This is a special memory that is always deleted when turned off. So when we turn on micro:bit again, the variables are empty and micro:bit has to set new values for them. But then why doesn't the code itself, which we load into the micro:bit, is also deleted? Because it is stored in FLASH memory that remains unchanged even when turned off and on. This allows the micro:bit to remember what we have programmed into it.

Classic computers work on a similar principle – they also have RAM memory, in which they store data that is deleted when the computer is turned off. Instead of FLASH memory, however, they use hard disks (HDD).

Infinite counter

Using variables, you can also create an infinite counter on the micro:bit – a program that will display numbers from one to infinity on the micro:bit. Try to write and test such a program on micro:bit. Always pause 1000 ms between number displays.
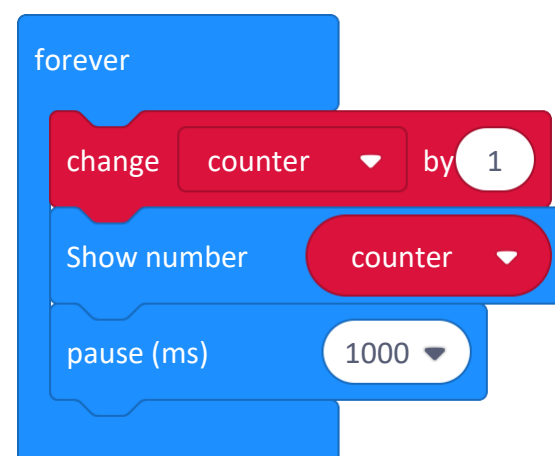
Edit and download: http://makecode.microbit.org/_ajW7rhai62q4

LESSON SUMMARY

In this chapter, we learned how to use variables and use them to create people counter from a micro:bit. But variables have a much greater use than just people counters – variables are one of the most basic concepts in programming and you will definitely still use them. In addition to the number of people, you can store almost anything in it – text, number, more numbers, pictures, etc.