

Perfect Pancakes

In this tutorial, you will build a game with your BBC micro:bit, where you flip a small frying pan to fry a virtual egg into a perfect pancake.



The BBC micro:bit is a great device for developing interactive games with, because it can sense movement and orientation using its built-in accelerometer sensor.

By attaching the BBC micro:bit to a physical object, you give that object a personality. This personality is communicated by the gestures and screen animations that you design, but also by the story that you tell when you are showing the game to your friends.

You can pick almost any inanimate object you like, and breathe life into it with your BBC micro:bit!

In this tutorial, you will attach your BBC micro:bit to a small frying pan, and play a game called "Perfect Pancakes".

To play this game, you watch an on-screen animation of a pancake cooking, and at the right time you have to flip the virtual egg into the air. The objective of the game is to flip the egg 5 times at the right time, without burning or dropping the virtual egg.

What makes this game fun, is the combination of movements and screen animations that you design for it.



Figure 1: The Perfect Pancakes, assembled

To develop this game on the BBC micro:bit, first you will learn some basics about how to sense the real world surrounding the BBC micro:bit, and how to display images on the screen. You will do this by performing some simple experiments.

What you will learn

In this tutorial, you will learn how to do the following:

- write simple code using the Blocks editor
- modify and write new code in the TouchDevelop editor
- test your programs both on the emulator, and on the real BBC micro:bit
- display images on the screen
- detect button presses
- respond to movement by using the accelerometer

In this tutorial, you are encouraged to experiment as much as possible, learning by exploring – please click/press on different things to find out what they do, read through the program listing to understand how it works, and use the online help at the top right of the screen (you can open the help in another browser window)

Steps

1. Experiment with a button
2. Experiment with animations
3. Experiment with the accelerometer
4. Play the game
5. Understanding how the game works
6. Reconfigure the game
7. Make the game your own

1. Experiment with a button

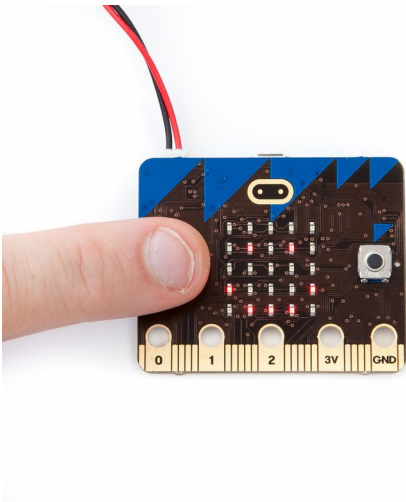


Figure 2: Pressing a button to display an image

Create a new script by clicking on CREATE CODE, then under the Microsoft Blocks Editor, click NEW PROJECT and choose a name.

Using the palette on the left, drag blocks onto the programming space to make your script look like the script on the right.

Now press the RUN button at the top of the page. You should see the BBC micro:bit emulator appear, and pressing on the A button will show a happy face, pressing on the B button will show a sad face.

In this tutorial step, you will write a small program that shows a happy face or a sad face, whenever you press the A or B buttons.

This will show you how to sense that a button has been pressed, and show an image on the screen, which you will need to understand the Perfect Pancakes game.

You will also learn how to test code in the emulator, and run your code on your real BBC micro:bit.

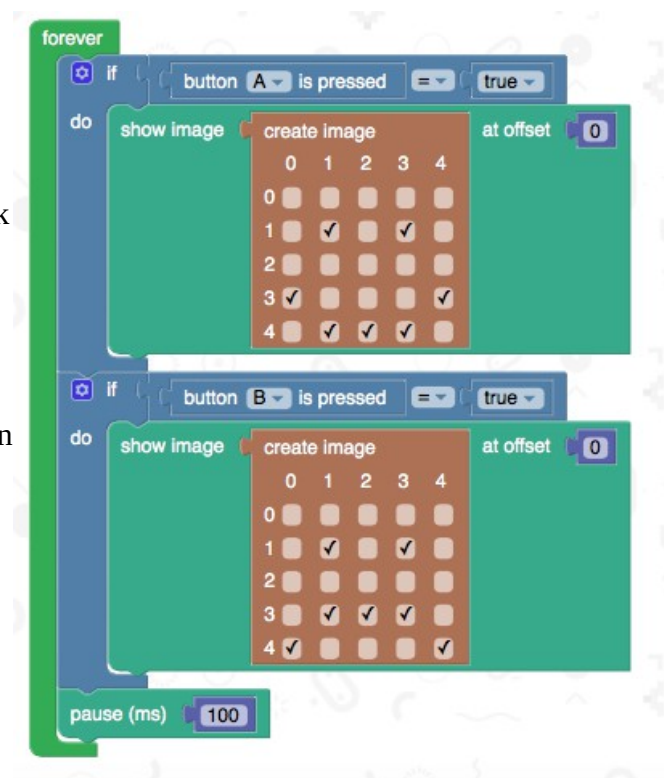


Figure 3: Code for sensing a button press

Once you have tested this on the emulator, the next step is to compile and run it on your real BBC micro:bit.

Press the COMPILE button and wait for the program to build and download onto your computer. Then in your downloads folder, find the new .hex file that has appeared, plug in your BBC micro:bit into the USB port of your computer, and drag the new .hex file onto the drive that has appeared called "MICROBIT".

When the programming has finished, the drive will automatically eject. Then press the system button on the back of the BBC micro:bit to run the program – test it still works by pressing the A and B buttons, and you should see your happy and sad face on the real screen.

2. Experiment with animations

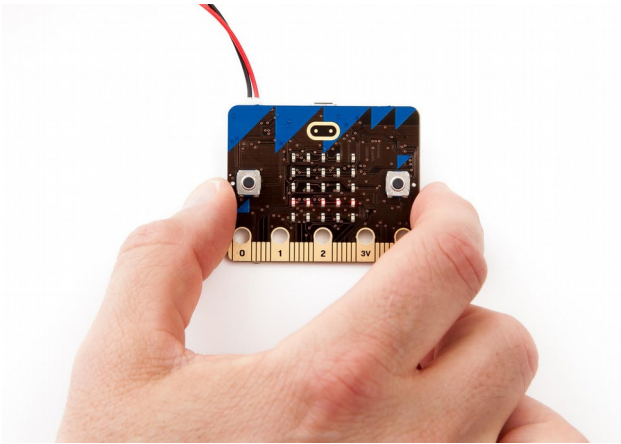


Figure 4: Floating a pancake

Create a new script by clicking on CREATE CODE, then under the Microsoft Blocks Editor, click NEW PROJECT and choose a name.

Using the palette on the left, drag blocks onto the programming space to make your script look like the program on the right.

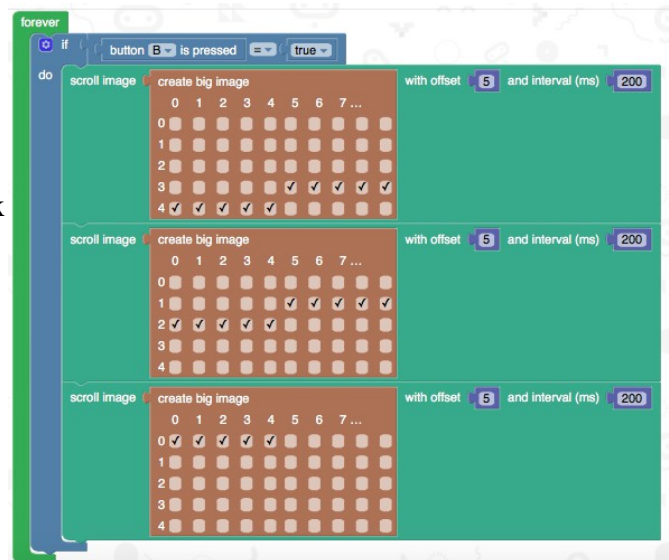


Figure 5: Code for animating a pancake

RUN this program on the emulator, and make sure that when you press button B a pancake floats up the screen. Then COMPILER and load the newly downloaded .hex file onto your real BBC micro:bit, and re-test that when you press button B on the real BBC micro:bit, the pancake floats up into the sky.

The Blocks language is quite simple to start learning to code, but after a while it gets quite crowded with everything on one screen. Your last step in testing this program is to press the CONVERT button. This will convert your Blocks program into a TouchDevelop program (the original locks program is still there).

TouchDevelop is a textual programming language, but is designed so that it works very intuitively on a touch surface like a tablet or a phone. You should recognise the program that you originally wrote in the new TouchDevelop editor. RUN it again in the emulator to make it works, then try the COMPILER button to download a .hex file and drag that to the MICROBIT drive, and make sure the program still works on your real BBC micro:bit before moving to the next step of this tutorial.

3. Experiment with the accelerometer

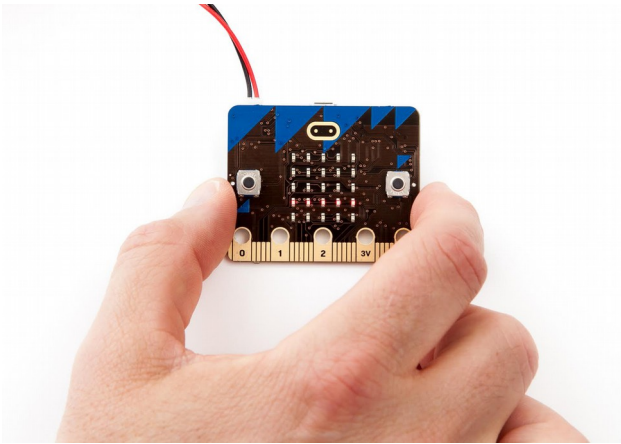


Figure 6: Shaking the BBC micro:bit

In this tutorial step, you will write a small program that floats a pancake when you shake your BBC micro:bit.

This code will be used later in the game to detect that you have flipped your virtual egg, and will be the main gesture used to fry a perfect pancake with your BBC micro:bit.

Create a new script by clicking on CREATE CODE, then under the Microsoft Touch Developer editor, click NEW PROJECT.

Click/touch in the do nothing area, and press appropriate buttons on the bottom palette to enter the first line of the program.

Click the new 'do nothing' area that is inside the on shake block, and press appropriate buttons on the bottom palette to enter the next line of the program.

It is not easy in the emulator to make it sense a shake gesture, so you should test this program directly on your BBC micro:bit. Press COMPILE and load the newly downloaded .hex file onto your real BBC micro:bit, and test that when you shake the BBC micro:bit, the pancake floats up into the sky.

script Float a Pancake on shake

function main ()

input → on shake **do**

basic → show animation([pancake animation], 400)

end

end function

Figure 7: Code for sensing a shake gesture

4. Play the game



Figure 8: An assembled pan and BBC micro:bit

To assemble the game, get a frying pan (preferably a small one). Hold the battery pack against the handle and wrap some tape around them both to hold them together.

Now hold the BBC micro:bit on the top making sure that the system button on the back doesn't touch the handle. Thread a tie-clip through hole 3V, and round the back of the battery. Thread another tie clip through its eye, and thread the tip of that back through the 1 hole. Finally, thread the tip through the eye of the first tie clip, pull tight, and cut off any excess with some scissors. The tie clips should now hold everything securely in place.



Figure 9: Fixing the battery pack with tape

Finally connect the battery pack to your BBC micro:bit.

Using the sample PerfectPancakes.hex file we have provided, plug in the USB and drag this onto the MICROBIT drive. When it has loaded, unplug the USB and press the system button on the back. The game should now show the start screen, which looks like a flashing 'P P' (Perfect Pancakes) and a little arrow pointing at the B button. This is called the splash screen, and it is instructing you to press the B button to start the game.

Explanation of the game

The purpose of this game is to flip the virtual egg 5 times to fry a pancake. But to make this a perfect pancake, the virtual egg must be fried for just the right amount of time. Flip too soon and you won't get a point, as the egg won't be cooked properly. Flip too late and your egg catches fire and you lose the point!

Press the B button to start the game, and you will see a pancake float down from the sky and land ready for cooking. It's corners will flip up and down to show you that it is cooking, and at a random time (which makes the game different every time and more interesting!) the egg will be perfectly cooked. It will curl it's corners up and look a bit happy, and this is the right time to flip the egg!

Flip the frying pan up and down, and your virtual egg on the screen should flip up into the sky, turn over, and land again. But be careful to not tilt your frying pan too much, otherwise you will drop the egg on the floor! (If you see an X come on the screen, it means you dropped your egg and the game is over!)

If you leave your egg cooking for too long it will burn, and you will see an animation on the screen of smoke rising from it – but quick, you can recover this egg, you can turn the smoke alarm off by reaching for the sky with your frying pan! If you do this quickly enough, the egg is recovered but you don't get the point. Try again to get some more points without dropping your egg.

At the end of the game, your score flashes on the screen. The highest score possible is 5 points. Press the B button to finish the game, and the pancake will float up into the sky and the game is finished.

Play the game for a while to learn how the movements work and what each of the animations mean. Then demonstrate the game to a friend – as you are demonstrating it, tell a little story about what the animations and gestures mean, it is the story that you tell that really allows the BBC micro:bit to give a true personality to your frying pan! Then get your friends to play the game and see if they can beat your score.

For a real challenge, buy some coloured foam from a craft shop, you can get packs with multiple coloured sheets in them. Cut out a white base for the egg white, and a yellow circle for the yolk. Stick them together with glue or tape. Now you and your friends can try to play the game again but this time with the foam egg in the pan – make sure you don't drop that egg though! The game is much harder to play with the foam egg, but even more fun to play! Can you get a Perfect Pancake score of 5?

5. Understanding how the game works

Now that you have played the game for a while, it is time to learn how the code that you loaded into the BBC micro:bit actually works, and this will then allow you to start to modify it and alter its personality and make it your own personal version of the game. In doing this, you will learn a lot about how the TouchDevelop programming language works, and you should begin to see the amazing opportunity that the BBC micro:bit offers to help children to learn to code and to create their own amazing inventions with it!

Open the Touch Develop program “Perfect Pancakes”. You can find this as a published script by searching for the script id **jlohm** in the search box.

You should see the `main()` function – this is where the program always starts when the BBC micro:bit is powered up. Because the BBC micro:bit is an embedded device, it will always need a `while true` (or a `forever`) loop, otherwise you will have to turn it off and on again to start the game.

The program is split into 3 levels of detail – `main()` is the first level of detail, it shows the splash screen animation, waits for a button press, and plays the game. The game starts with the pancake floating down from the sky and landing in the pan. When the game is finished, the pancake floats off up to heaven and finally blinks its eyes at you! This might be the first part of the program you would like to tinker with, such as changing the animation.

The second level of detail is in a function called `run game once()` - you can get to this by clicking on `SCRIPT` and choosing “run game once” from the list.

The “run game once” function is where it all happens – it uses a game loop that loops around all the while the game is being played. There are some variables at the top that are used while the game is running, followed by a `while true` loop with a set of `if/else if` statements. Each of these program statements makes a part of the game actually work.

To understand the game loop properly, here is a diagram that shows the different states that the game can be in, and what makes the game change between those states – look back at the Touch Develop program listing in the code editor when viewing the “run game once” function and follow round this diagram with your finger and make sure you understand how the game hangs together as a program.

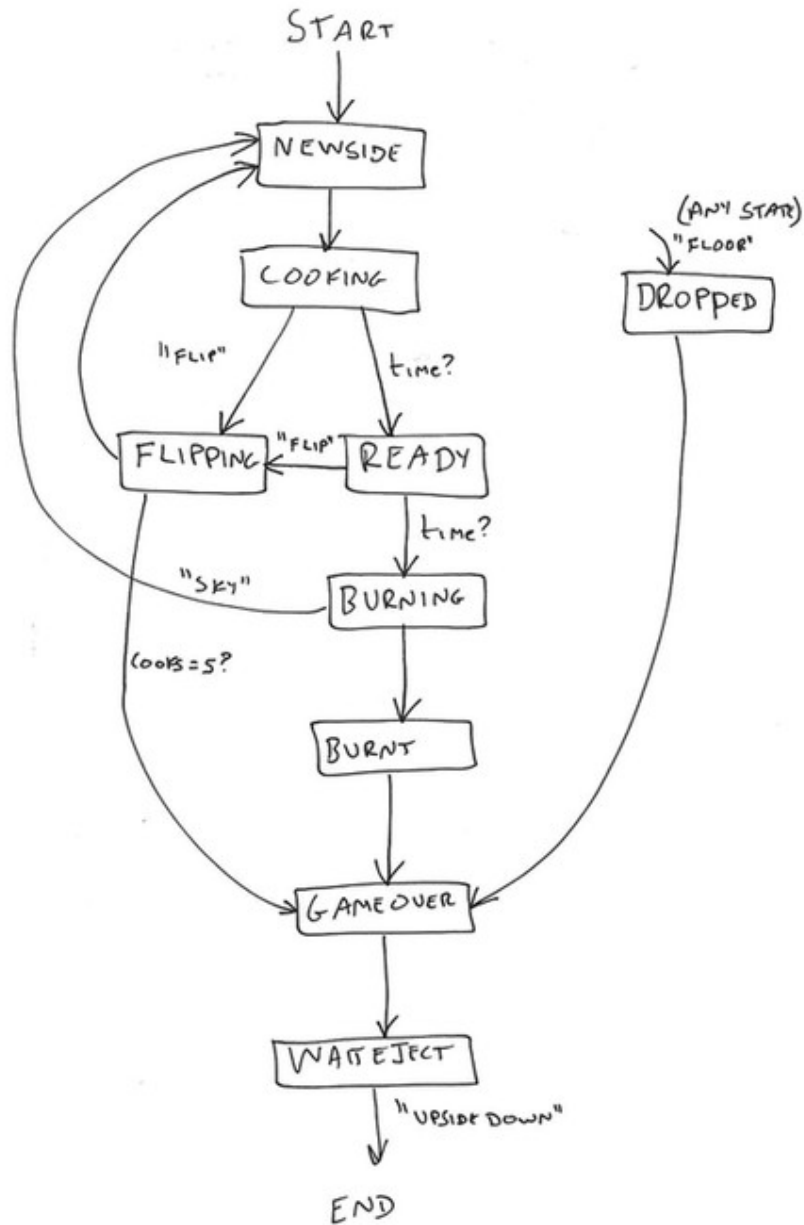


Figure 10: The 'state diagram' of Perfect Pancakes

For each of the states, read the code within the if statement for that state, and familiarise yourself with what the program does in that state, and how it might change to another state. Instead of us describing each of these states in detail here, read through them one by one yourself, and look in the Touch Develop help pages (link at the top right of the screen) to understand what each of the lines of code does for you. You will find you will learn more about the programming language by exploring someone else's program in this way.

The final level of detail of the program is in some lower level code functions, called “get gesture”, “start timer” and “get timer sec” and “splash screen”.

6. Reconfigure the game

The best way to learn about a new programming language, is to read and then change other people's programs. The BBC micro:bit editors and website are a great way to do this, because you can publish your code for others to read, and then you can search for code written by others.

In this tutorial step, you will experiment by changing some of the screen animations of the game to change how it looks, and perhaps making it even more interesting to play, or adding some really funny animations to bring some extra humour into the personality of your frying pan!

Look in the “run game once” function for all of the basic → show animation() code lines, double click on the image grid in each, and mess around with the designs of the screens to add more humour to them. Get your friends to play the game, and show it to some other friends and see if they can work out what your new animations represent, without you explaining the story first. Work out if you have made the game easier or harder to play, and if it is more fun or not!

7. Make the game your own!

In the final step of this tutorial, you should spend some time altering the game to make it your own. Below are some suggestions of things you could try, but the best approach is to play the game and work out what features make the game fun and exciting to play, and then try to add those new features. Remember to use the TouchDevelop help system which is linked in the top right of the screen. Also keep in mind that TouchDevelop “comes alive” when you use it on a Tablet or a touch surface computer of some kind.

- change the splash screen animation
- add a high score feature
- reduce the time limit between each flip
- change all the animations to personalise the game
- display 1 of 4 messages when the game is over based on score

0	bad luck
1	beginner
2	nice try
3	getting good
4	almost!
5	magic!

- display one of 6 icons based on the above score, perhaps use variations on a smiley face, or even design a different ending animation for each of the 6 possible scores.

- using crocodile clips, attach a beeper between pin 0 and pin GND. Use the pins → digital write pin() function to turn the beeper on and off, and a basic → pause() function to insert a short delay. With this you should be able to get the beeper to sound like a smoke alarm when the egg is on fire!

Credits

Software Design: David Whale, Illustration: Pamela Dowie. Photos: Sukkin Pang, Egg design: Gail Forsyth