Case study

Electronic scoreboard and game timer

LEONARDO

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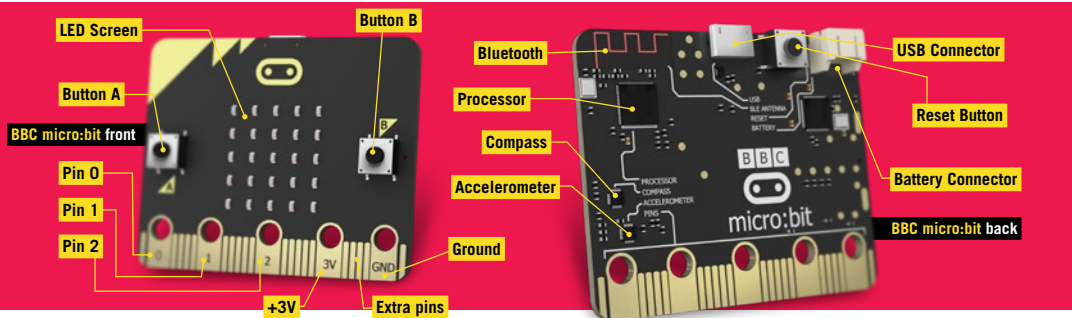for more case studies visit
www.ietfaraday.org/microbit

Contents

About the BBC micro:bit

The BBC micro:bit is a pocket-sized codeable computer with motion detection, a built-in compass and Bluetooth technology. It is an excellent device to prototype ideas with, because you can try lots of creations really quickly, and keep the ones that work best.

The BBC micro:bit:

- **easy to program**
- **lots of choices of different inputs and outputs**
- **use the on-screen simulator to try your ideas first**
- **easy to change a program once you have written it**
- **connects to other BBC micro:bits, devices, kits, mobile phones, tablets, cameras and everyday objects.**

LED Screen

Button B

Bluetooth

Button A

Processor

USB Connector

BBC micro:bit front

Compass

Reset Button

Pin 0

Accelerometer

Battery Connector

Pin 1

Pin 2

BBC micro:bit back

Ground

+3V

Extra pins

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About this case study

Case studies are useful for learning about practical uses of technology that can improve the day-to-day lives of people. This case study focuses on how to create an electronic scoreboard and game timer using canoe polo.

In this case study you will learn:

- **how limited resources cause you to identify the most important points of a system design**
- **how to represent a large amount of information on a small display**
- **how the BBC micro:bit can be used to quickly prototype a new idea**
- **what the code looks like and how it works.**

Meet the author

Rob Edmunds
Project Engineering Lead,
Leonardo Airborne and Space Systems

Rob started working at Leonardo in 2004 on a Year in Industry and joined full-time after graduating as an Electronic Engineer in 2007. He has worked in a number of different roles, including: printed circuit board (PCB) design, firmware design, transferring design to manufacture, LabVIEW development, procurement, test engineering management and now engineering business winning.
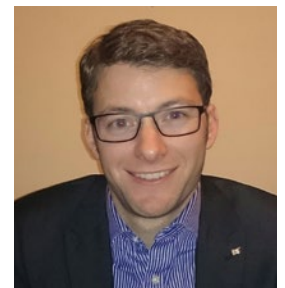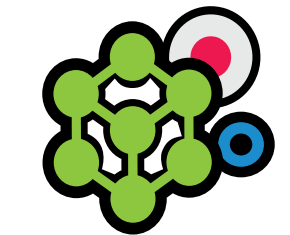
Rob Edmunds

"In canoe polo, we face the challenge of showing the teams on the water the score and current time of the game."

About canoe polo

In canoe polo, we face the challenge of showing the teams on the water the score and current time of the game. As a result, you get lots of shouts from the pitch saying "what's the time?" with the referee shouting back the time remaining in the game. Presently, it's typically done using a stopwatch and some flipcharts to show the current score.

We are going to explore how to build an electronic scoreboard and game timer:

- A game is made up of two halves, each lasting between 7 and 10 minutes.

- Scores can be quite high.

- There are five players per team.

- Flipcharts are used to show the current score.

- The timekeeper uses a stopwatch to monitor the game time. Any player in the water can shout 'time' and the remaining time will be shouted back.
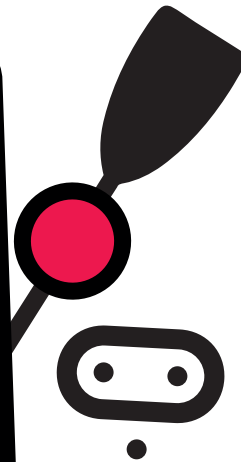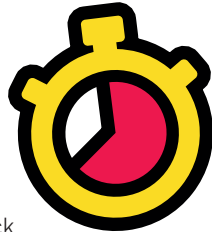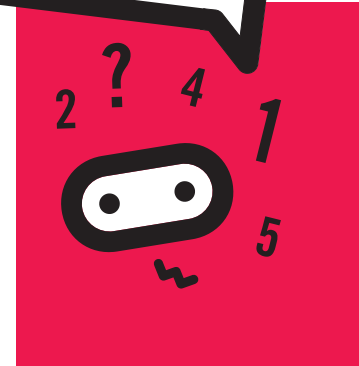
The problem

To make an electronic scoreboard and game timer we need to decide how to do the following:

1. enter the game length

2. start the game

3. keep an accurate score

4. display the score

5. display the remaining game time.

There are only 25 LEDs on the front of the BBC micro:bit, and a lot of information to display. How can we display so much information on such a small display?

Sometimes when you have limited resources, it challenges you to think about what is most important.

Engineers constantly have to 'think outside of the box' and solve challenges with limited resources.

for more case studies visit

The solution

Inputs
Button A to start the game, button A and B to count a point for each team, shake to show the time.
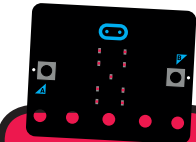
Processing
Add to team A or team B score, keep/show the remaining time in minutes and seconds.

Outputs
Show the team score as a tug of war line. Show the remaining time as a number of dots for minutes and seconds.

User
Referee presses A and B on each ball score, and shakes micro:bit when anyone shouts out 'time'

Using the product

- Select the total game time (up to 10 minutes) by pressing button A.
- Start the game with button B.
- Press A or B each time a team scores, to move the tug of war line.
- Shake to display the remaining game time, minutes on top, seconds on bottom (each line means 10 seconds).
- When the game is over, press A or B to read out that team's scores.

We have produced two fundamental screens, one to show the time remaining and the second to show the score.
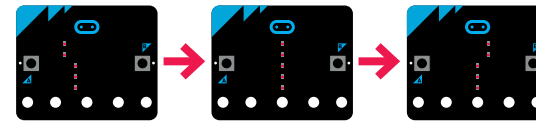
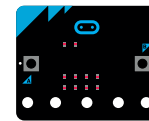for more case studies visit

Program flowchart

Start here
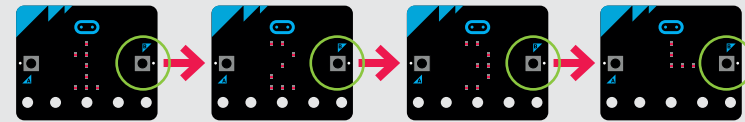
Choose game time in minutes

Wait for referee to blow whistle to start game

A button adds a point to team A, B button adds a point to team B
The 'tug-of-war' line moves closer to team A or B as you press each team's button.

Pressing A or B buttons when the time is displayed will always still update the score so that it is correct.
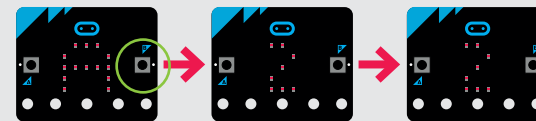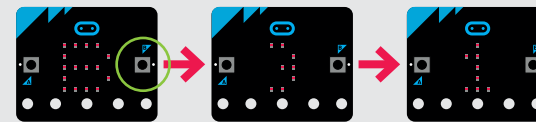
Time remaining
(2 minutes 40 seconds)

Shake to see the time remaining

Each dot at the top is 1 minute,
each vertical line at the bottom is 10 seconds
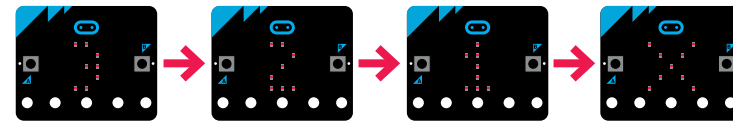
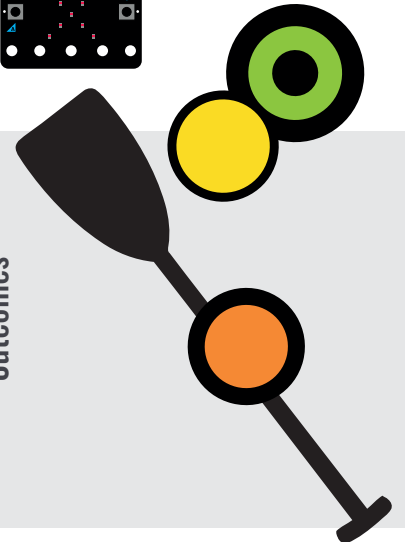Countdown from 10 to 1 of the last 10 seconds of the game

Press button A to get team A score

Press button B to get team B score

Outcomes

Code listing

Here is the code listing for part of the scoreboard. Compare it against the flowchart on the previous page and see if you can identify which parts of the flowchart it relates to.

See the full program listing by following the links at the end of this booklet.

Quiz

Now that you have worked through this case study booklet and tried the program for yourself, test how much you have remembered with our quiz! You can look up the answers at the bottom of page 11.

Q What is the maximum length of a game of canoe polo?

Q How many different pieces of information are represented on the BBC micro:bit display?
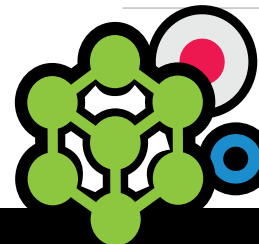
Q If the score for any team is 15 higher than the other team, will the code still measure the correct score?

Q How are the final scores read out at the end?

Q What might you change about how this program works?

Q What feature might you add to this program to make it even better?

Q Why do you think you might enjoy a career as an engineer?

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More information

If you want to read more about the topics covered in this case study, why not take a look through some of the suggested websites and additional resources?

Electronic scoreboard and game timer

■ **Downloadable eBooklet, video and program code**
https://faraday-secondary.theiet.org/stem-activities/microbit/microbit-case-studies

Information about canoe polo

■ **Canoe polo**
www.canoepolo.org.uk

■ **Canoe polo rulebook 2015-2017**
www.canoepolo.org.uk/files/Rulebook15_Web.pdf

■ **Nomad Kayak Club**
www.nomadkayakclub.co.uk

■ **International Canoe Federation**
www.canoeicf.com

■ **Video's showing the sport in action**
www.youtube.com/watch?v=yyFypW3Sx-U

■ **Photo album with a collection of action shots from real games**
www.sportpicsuk.com/canoepolo

About IET Faraday

How can I get involved?

The IET Education team will be working on this exciting project in three main areas:

1 Teaching resources
The IET Education team have developed a new suite of resources covering 13 separate topics to help you to introduce the BBC micro:bit to your students. Each of these free resources includes a starter/introduction, main and extension activity as well as video clips to contextualise the information provided. For more information and to view the resources:
https://faraday-secondary.theiet.org/resource-pages

2 Faraday Challenge Days
Aimed at Year Eight students in England and their equivalents across the whole of the UK, these off-timetable STEM activity days encourage creativity, team working, problem solving and the application of the technology to real-life situations.

3 BBC micro:bit classroom poster
This poster is free to download or order direct from the IET Education team. It provides a quick look at the individual components of the BBC micro:bit and how you can use it in your classroom.

For more information please visit

www.ietfaraday.org/microbit

or contact **faraday@theiet.org**

Questions and answers

Q. What is the maximum length of a game of canoe polo?

P4: Each half-game lasts between 7–10 minutes. So a full game can be a maximum of 20 minutes of actual play-time.

Q. How many different pieces of information are represented on the BBC micro:bit display?

P6: There are two fundamental screens, one that shows the time remaining and the second to show the score. You could say there are two pieces of information (game time and score), or even four pieces of information (score of team A, score of team B, game time in minutes, game time in seconds).

Q. If the score for any team is 15 higher than the other team, will the code still measure the correct score?

P8: The code has two variables 'score A' and 'score B', which it adds one to every time the respective team button is pressed. The tug-of-war line only shows the difference between the scores, but the final readout at the end will show the total score for each team. So the answer is 'yes', the code will always measure the correct score.

Q. How are the final scores read out at the end?

P7: The ref presses the A button to read out Team A's score, and presses the B button to read out Team B's score.

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