micro:GUI

Graphical User Interface for the micro:bit

by Innovations in Education

Version 1.0 – 20th January 2018

micro:GUI Overview

This specification defines a **'Graphical User Interface'** or **'GUI'** for the **BBC micro:bit** which acts like a simplified version of the GUI used on most Smart Phones. It uses **Buttons A & B** on the **micro:bit** as '**User Input'** and the **5x5 LED Matrix** on the **micro:bit** as the **'Display'**. One LED acts as the **'Cursor'** and the LEDs along the bottom row act as the **'Apps'** thus creating a **'micro:GUI'.** The specification shows how it is possible to create an intuitive **micro:GUI** within the constraints of the limited controls and display resolution available on the **micro:bit**. The **micro:GUI** could for instance allow multiple programs, known as '**micro:Apps'**, to reside in a single Hex file with the **micro:App** 'launched' using the **micro:GUI**.

Furthermore, the fact that the **micro:GUI** can function with limited controls and limited display resolution lends itself to being adapted to use other forms of **'User Input'** and other forms of **'Display'**. For example, the **'User Input'** could be by **Tilt/Shake Control**, **Headphone Button Control**, **Joystick Control** or **Voice Control** and the **'Display'** could '**Auto Rotate**' or be an **'Audio Display'**.

The primary purpose of the **micro:GUI** is for *education*. A '**Basic**' **micro:GUI** implementation could be coded in **Block.** It could be incorporated into computing lessons to help students understand the concepts of a **Graphical User Interface** and give students the opportunity to code their own **micro:GUI.** In doing so students would learn how to:-

- **write code** to monitor inputs from the **micro:GUI Navigation Controls**
- **move** a '**micro:Cursor'** in response to the **micro:GUI Navigation Controls**
- **write code** for one or more **'micro:App'** programs
- **'install'** one or more **micro:App** programs on the **micro:GUI**
- **display** a **'micro:Icon'** whenever the **micro:Cursor** is on a **micro:App LED**
- **'launch'** their **micro:App** on a **micro:bit** using their **micro:GUI**

micro:GUI specification Version 1.0 covers '**Basic**' **micro:GUI** functionality. Future versions will add '**Advanced**' **micro:GUI** features, some of which may require coding in **JavaScript** or **Python**.

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micro:GUI Display Overview

The **micro:GUI** display has 4 elements:-

1) **'micro:Cursor' LED**
2) **'micro:App' LEDs** along the **Bottom Row**
3) **'micro:Icons'** in the **Centre** of the Display
4) **'micro:Option' LEDs** along the **Top Row** ('**Advanced'**)

micro:Cursor   micro:Apps   micro:Icons   micro:Options
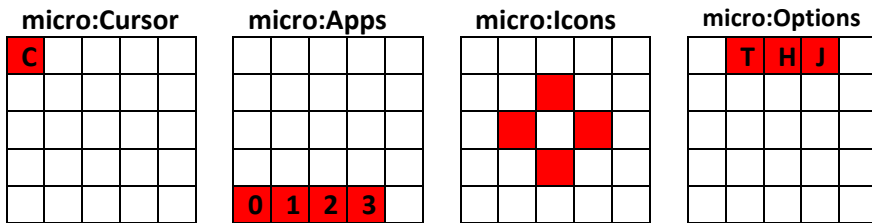
The **micro:App LEDs** along the **Bottom Row** can be seen as the equivalent of the fixed App Icons along the bottom of most Smart Phone displays.

The **micro:Option LEDs** along the **Top Row** can be seen as the equivalent of the menu items along the top of most desktop PC programs.

micro:GUI Display LEDs

Each Display LED is set to one of 5 states:-

LED Off   [ ]

LED On   **[ ]**

LED Half On   **[ ]** (**Advanced**)

LED Slow Flash **[C]** (approx 1 second 'on'/1 second 'off') (**Advanced**)

LED Fast Flash   **[F]** (approx 0.5 seconds 'on'/0.5 seconds 'off') (**Advanced**)

PushButton Navigation Controls

micro:bit PushButtons A, B and **Reset** are used to **navigate the micro:GUI**.

Used with a '**Short Press**' gives 4 '**Basic**' **micro:GUI Navigation Controls**:-

Button 'A' – Short Press   `<A>`

Button 'B' – Short Press   `<B>`

Button 'A+B' – Short Press   `<A+B>`

Reset Button   `<Reset>`

'Basic' micro:GUI - Navigation Controls

Button 'A' is used to move the '**micro:Cursor'** in the **Y-axis ↓**

Button 'B' is used to move the '**micro:Cursor'** in the **X-axis →**

A **Short Button 'A' press** `<A>` is used to move the **micro:Cursor Down ↓** one LED to (0,1) then to (0,2),(0,3),(0,4) and *back to* (0,0).

A **Short Button 'B' press** `<B>` is used to move the **micro:Cursor Right →** one LED to (1,0) then to (2,0),(3,0),(4,0) and *back to* (0,0).

A **Short Button 'A+B' press** `<A+B>` is used to '**Launch**' a **micro:App.**

A **Reset Button press** `<Reset>` is used at any time to **Return to the Home Screen** and **Close any micro:Apps.**

## 'Basic' micro:GUI - Home Screen

At **Power Up**, **Reset** or on '**Return to Home Screen**' the **micro:bit** displays the '**Home Screen**' with available **micro:App LEDs** along the bottom of the display and the '**micro:Cursor**' **[C]** in the top-left of the display - **LED (0,0)**. For a '**Basic**' **micro:GUI** implementation the '**micro:Cursor**' **[C]** would *not* '**Slow Flash**'. It would just be '**On**' **[ ]**

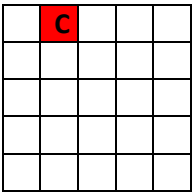| C				
1	2	3	4	

At *any time* a **Reset Button press** `<Reset>` returns to this **Home Screen**.
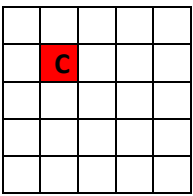
'Basic' micro:GUI - Cursor Navigation

At **Power Up**, **Reset** or **'Return to Home Screen'** the **micro:Cursor [C]** appears in the Top Left **LED (0,0)** position.
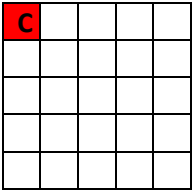
Button 'B' – Short Press <B> moves the **'micro:Cursor'** one LED **Right →** in the **X-axis** to **LED (1,0).**
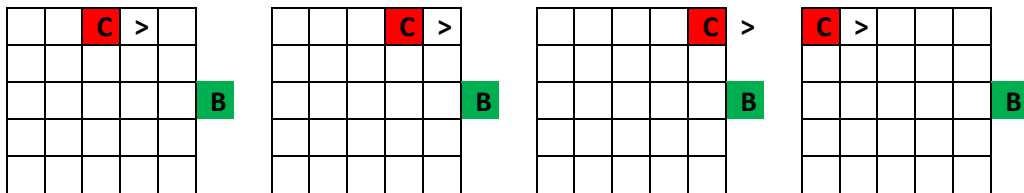
A subsequent **Button 'A' – Short Press <A>** moves the **'micro:Cursor'** one LED **Down ↓** in the **Y-axis** to **LED (1,1).**

The **micro:Cursor [C]** **'Wraps Round'** from **Right-to-Left** and **Bottom-to-Top** of the Display, hence...

When the **micro:Cursor [C]** is moved to an LED in the **Right Column** i.e. LED (4,Y) a **Button 'B' – Short Press <B>** moves the **micro:Cursor** back to the **Left Column** i.e. LED (0,Y) like this:-

When the **micro:Cursor [C]** is moved to an LED on the **Bottom Row** i.e. LED (X,4) a **Button 'A' – Short Press <A>** moves the **micro:Cursor** back to the **Top Row** i.e. LED (X,0) like this:-
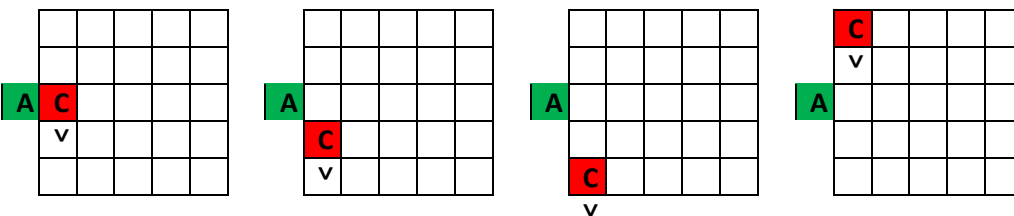
Navigated in this way the **micro:Cursor [C]** can be *moved to any location* on the 5x5 LED matrix *with a maximum of 8 Button Presses*.

'Basic' micro:GUI - micro:App LEDs

micro:Apps are indicated by the LEDs along the bottom of the display. So, for instance, if there were **4 micro:Apps** 'installed', the **Home Screen** would have LEDs (0,4),(1,4),(2,4),(3,4) **'On'** as shown below.

If **micro:Apps** are numbered in any documentation, the numbering should be *from 0 upwards* to match the **LED Column Number** relating to the location of that **micro:App's LED** on the display.

'Basic' micro:GUI - micro:Icons

Moving the **micro:Cursor [C]** onto one of the **micro:App LEDs** brings up the associated '**micro:App Icon'** (or '**micro:Icon'**) on the display. **micro:Icons** could be things like:-

Image.HEART

**Image.DIAMOND**

Image.HAPPY

...etc from the MicroPython images library, or any other user configured Icon. As an example, if **micro:App(0,4)** uses the **SMALL_DIAMOND micro:Icon**, when the **micro:Cursor [C]** is moved to **LED(0,4)** the **SMALL_DIAMOND** would appear on the display like this:-

Note that to help the **micro:Icon** stand out and to simplify the coding, the **micro:App LEDs** and the **micro:Cursor [C]** LED can be 'Off' when a **micro:Icon** is displayed.

'Basic' micro:GUI - Launching a micro:App

When the **micro:Cursor [C]** is on a **micro:App LED** and the **micro:Icon** is displayed, a **Short Button 'A+B'** **press <A+B>** 'launches' the **micro:App.**
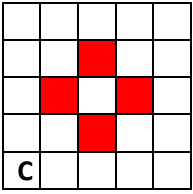
Once a **micro:App** is running the **entire display** is available for use by the **micro:App**.

'Basic' micro:GUI - Closing a micro:App

A **Reset Button press <Reset>** is used to close the **micro:App** and return to the **Home Screen.**

Open Specification

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Contact

Innovations in Education can be contacted via the Web Site **www.zbit-connect.co.uk** or via **Twitter @ZbitConnect**

Change History

V1.0 – **First 'Published' Version** specifying '**Basic**' **micro:GUI** functionality - **20ᵗʰ Jan 2018**