
Calculator

Supervised By:
Eng. Eman Hesham



Abdelrahman Yousry

Aya Adel Gomaa

Mohamed Hosny

Nehal Amgad

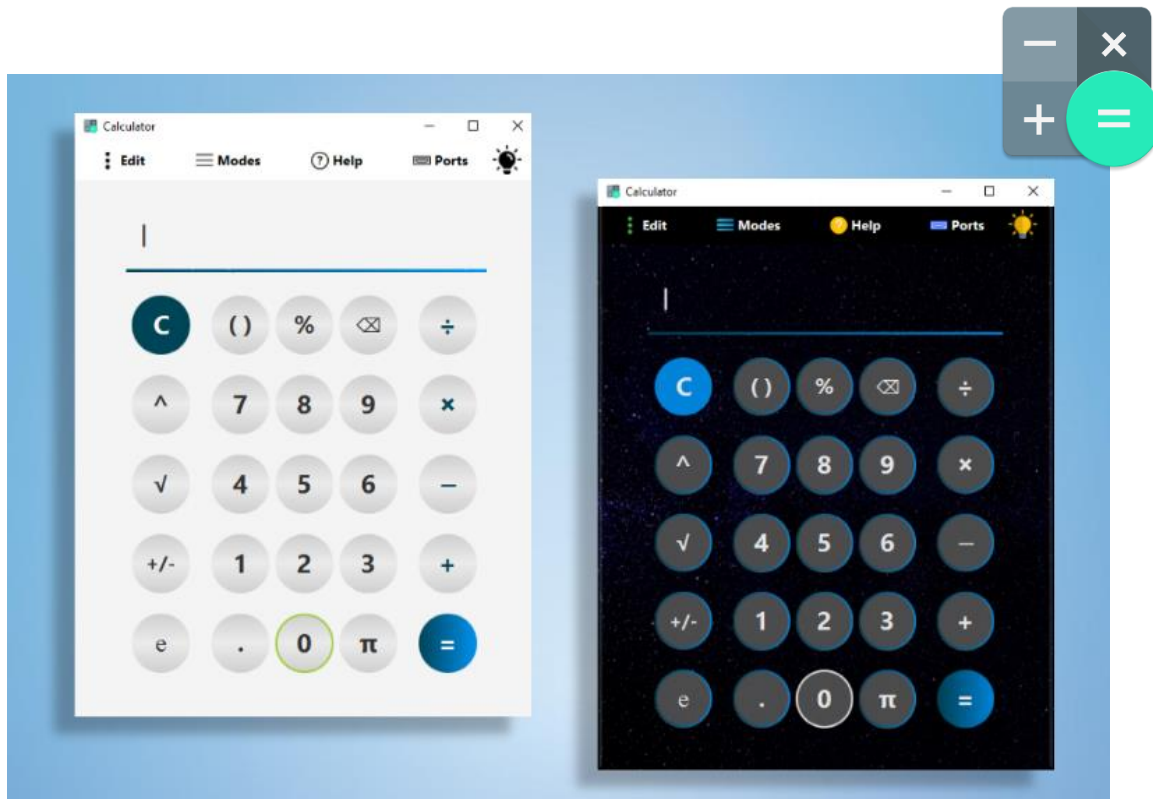
Yomna El-Shaboury

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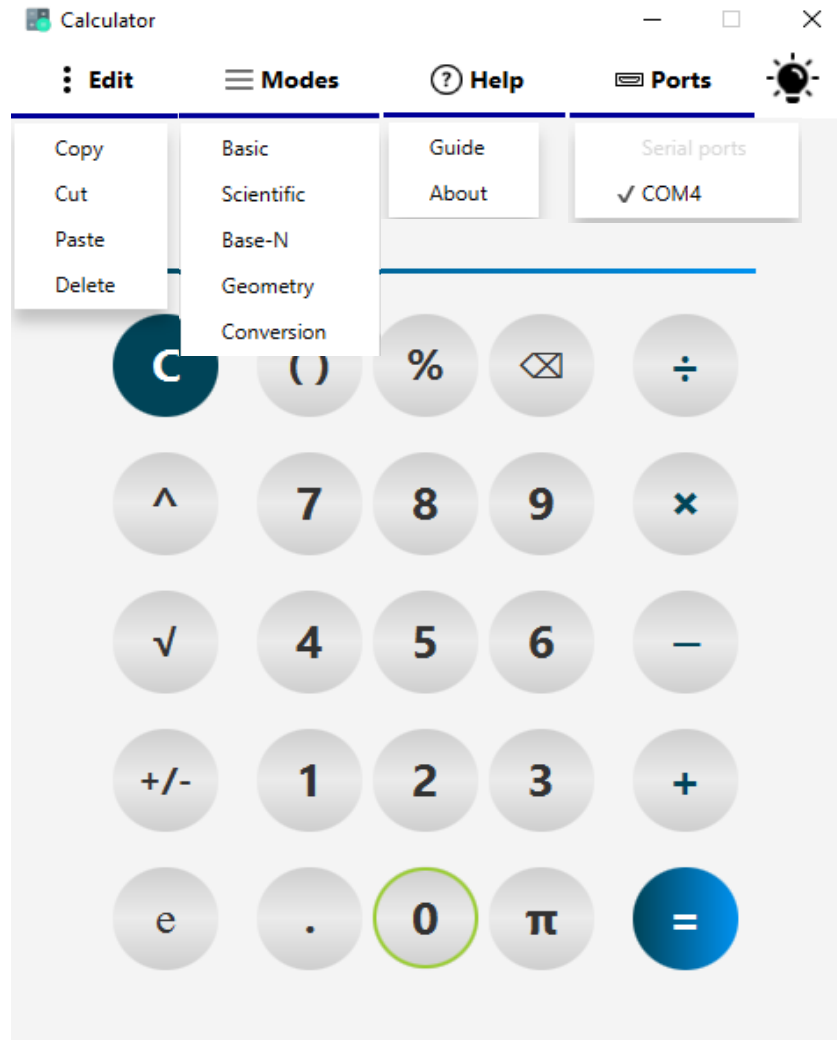
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Introduction

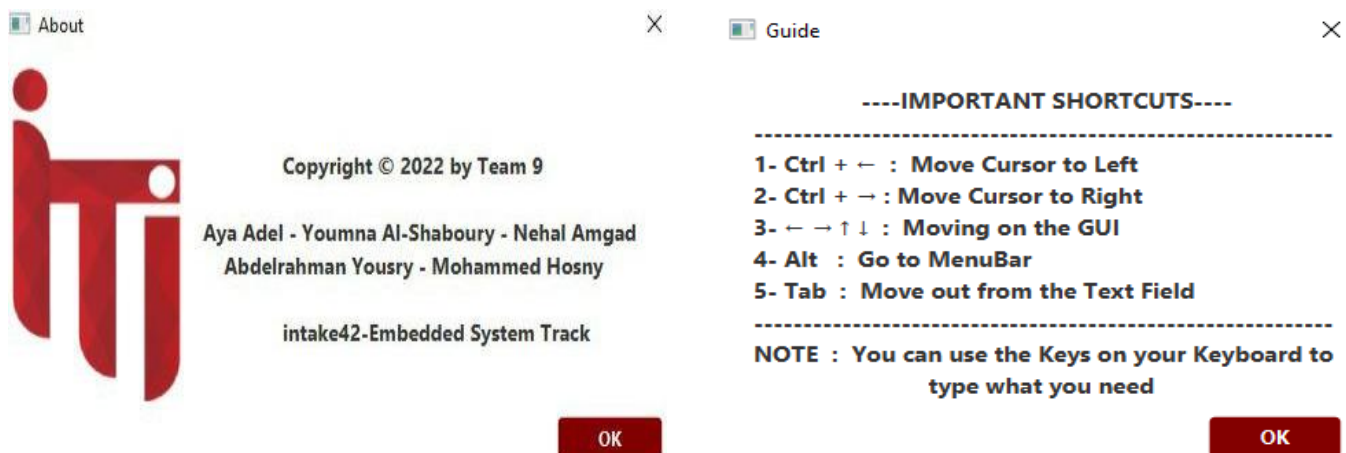
This project is a calculator program, it can be used as only software calculator by using the graphical user interface only (GUI) and computer keyboard, or by using it with the external keypad connected to the GUI by an Arduino microcontroller using way of communication. The calculator has many features to try. It aims to work on different modes to raise the functionality The modes are: Basic Mode, Scientific Mode, Base-N Mode, Conversion Mode, and Geometry Mode. Each mode has its normal and dark scenes. Also, there is extra features in the menu bar like: edit to make some edits on the input screen like copy, paste cut and delete, help to know how to use the calculator and the important shortcuts ,choosing the mode also from the menu bar item, connecting to the port to communicate the external keypad with the calculator , also changing the mode from normal to dark and vice versa



– All Menu Items in Menu Bar



– Guide and About Dialogs

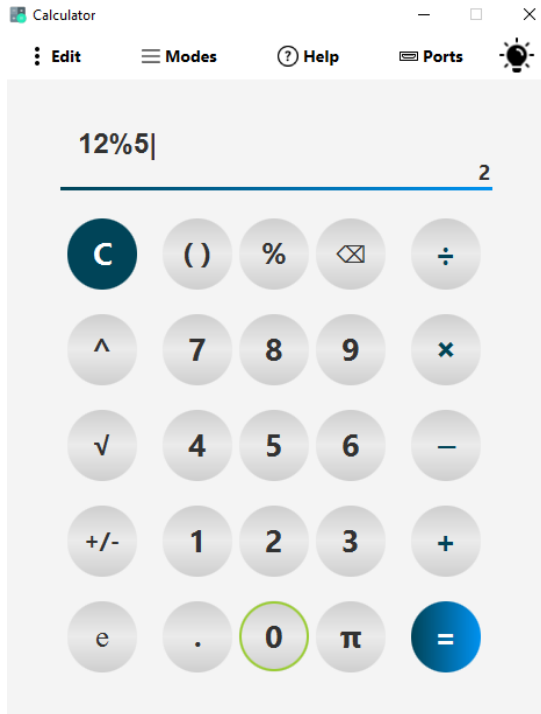


Modes

– Basic Mode

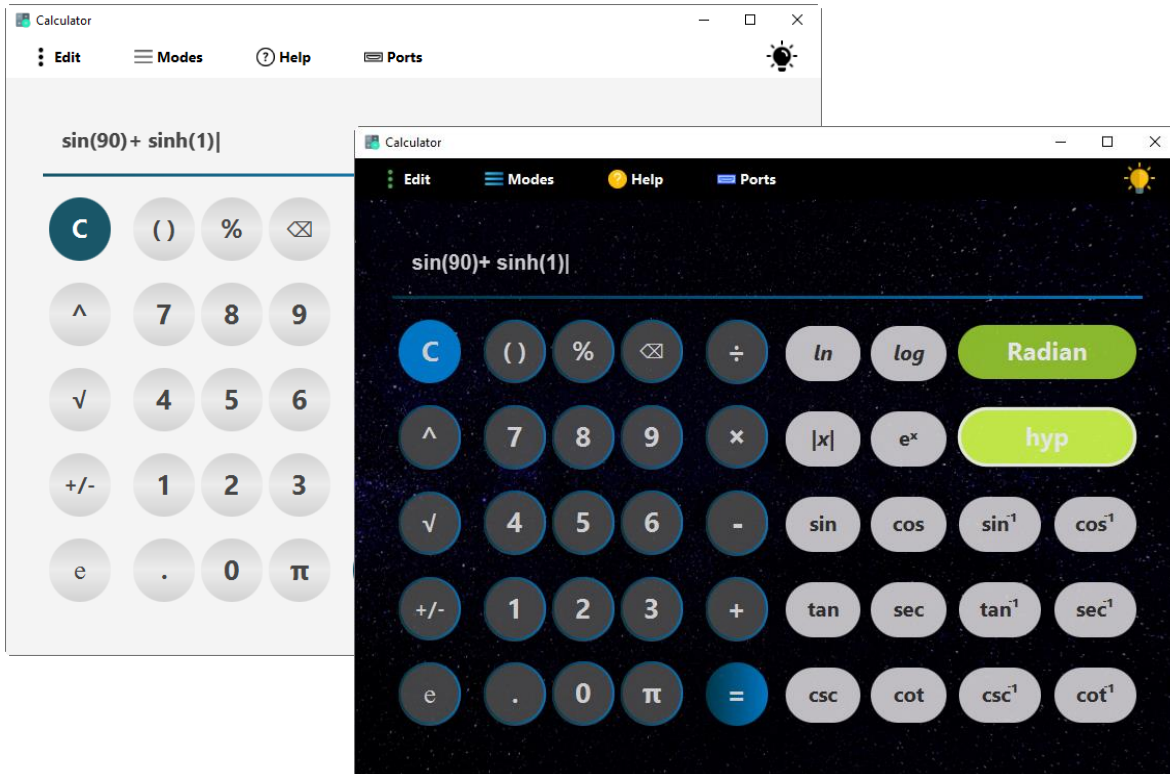
This mode performs simple arithmetic operations.

– Arithmetic Operations Examples:

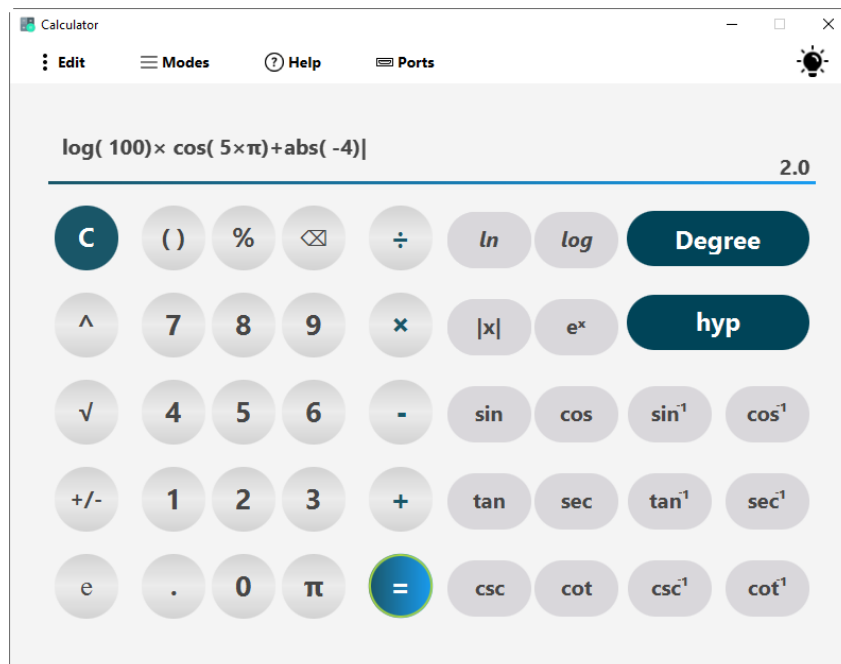


– Scientific Mode

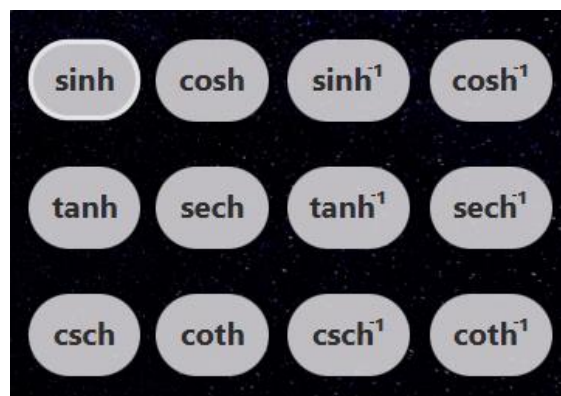
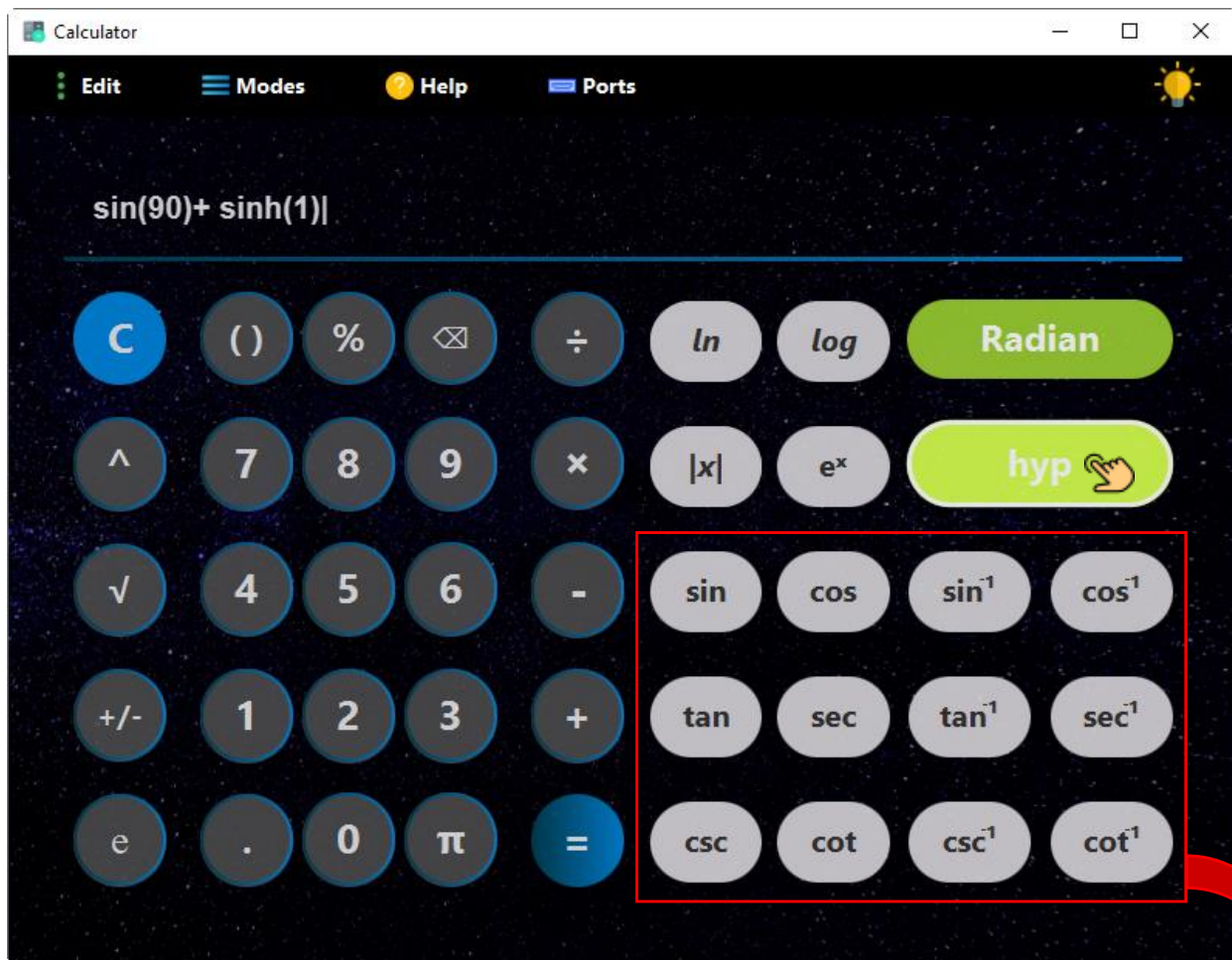
This mode performs advanced calculations involving powers, roots, exponents, logarithms, trigonometry, and more.



– Example:



- User can convert the trigonometry functions (sin, cos, tan, sec...) to hyperbolic functions using the **hyp** button.



- User can compute the trigonometric functions in both radian and degree using the toggle button **Radian/Degree**.

– Base-N Mode

This mode performs Base-N calculations besides basic calculations, it supports operations and conversions in modes. During the different modes, the unused buttons are disabled like in decimal only numbers and operations are enabled, in binary only one and zero numbers are enabled besides the operations buttons, same as for octal and hexadecimal, in octal numbers from one to seven are enable and operations, at the last mode all buttons are enabled.

For example, in the conversions:

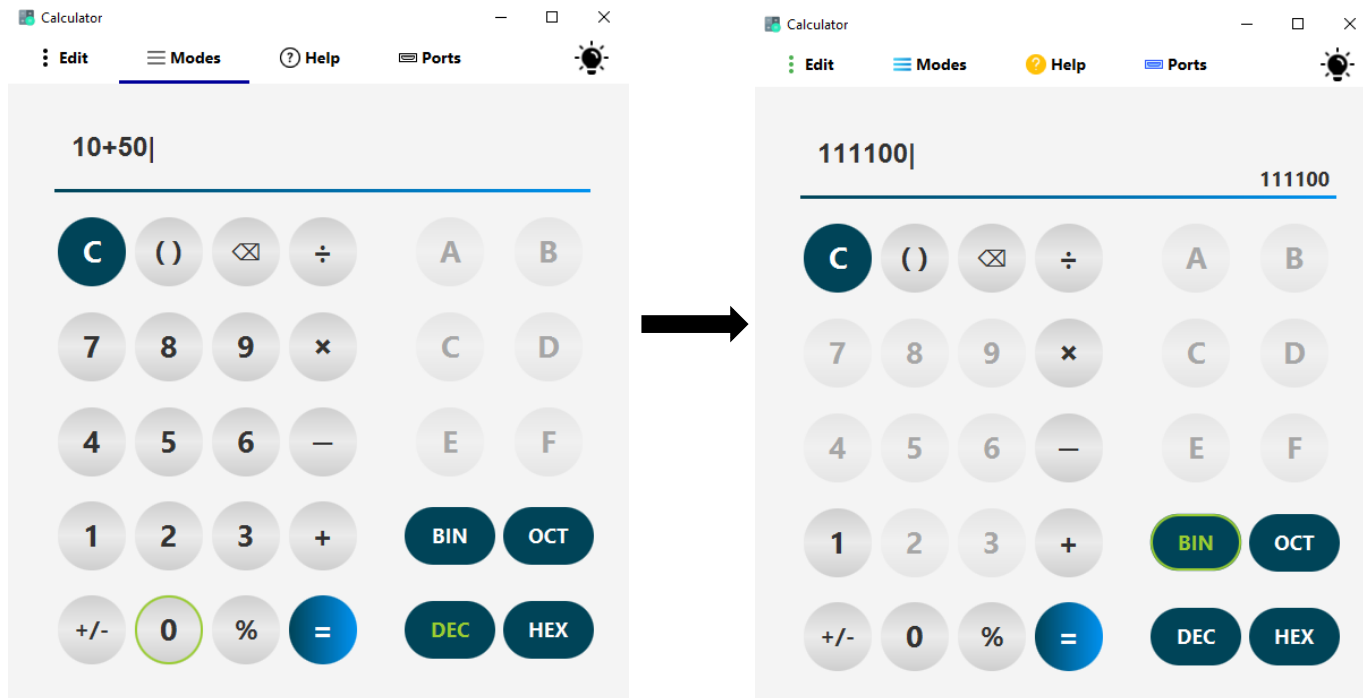
Binary -> Octal

Binary-> Decimal

Binary -> Hex

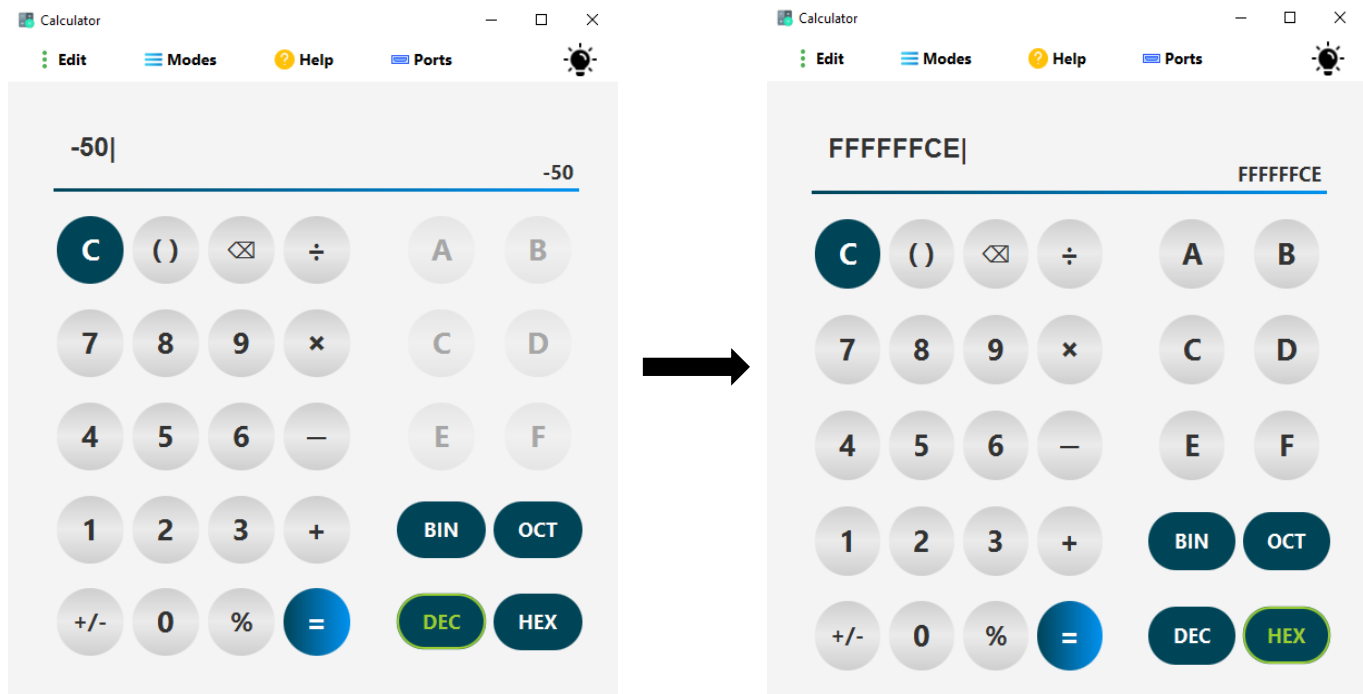
The same as for the rest conversions, to and from any mode to other.

– Example: convert from decimal number to binary, octal and hex.

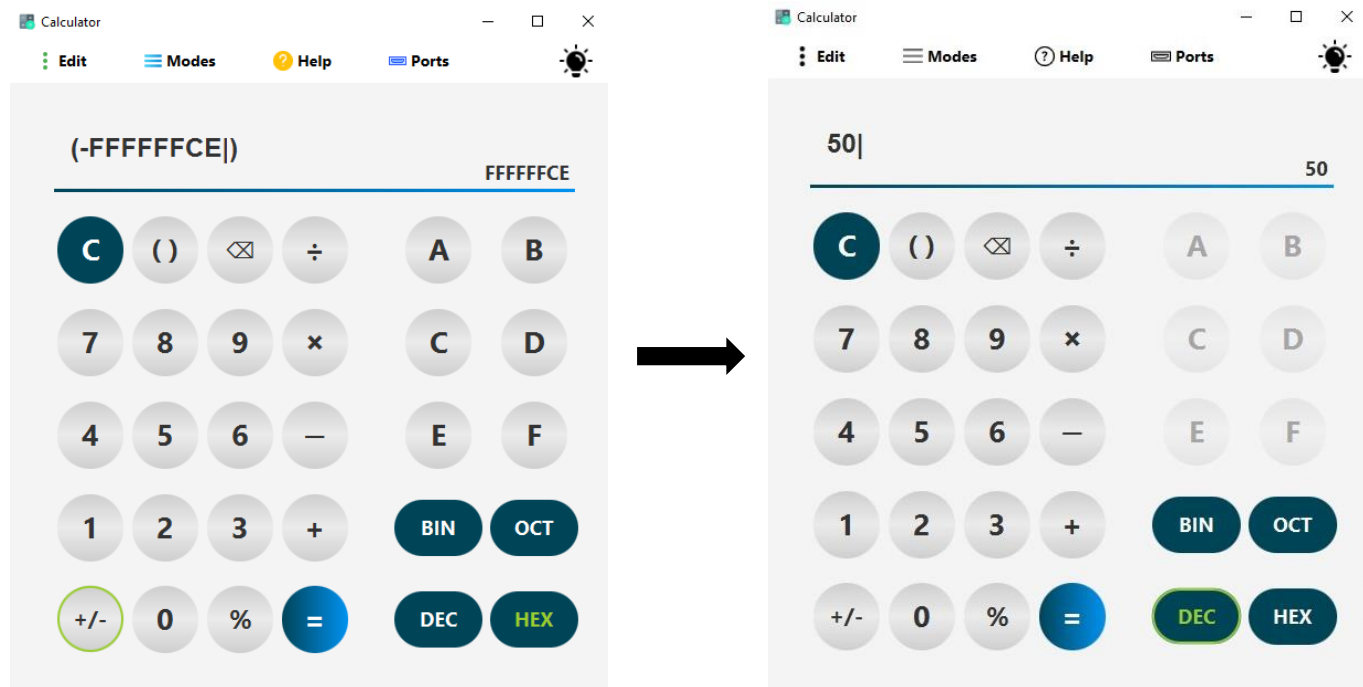


Another operation example is inverter:

- Converting -50 in Decimal to Hexadecimal Format:



- Converting negative Hexa number to positive Decimal Number :

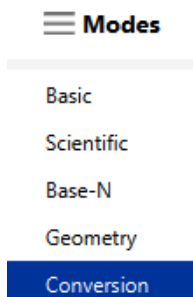


– Converter Mode

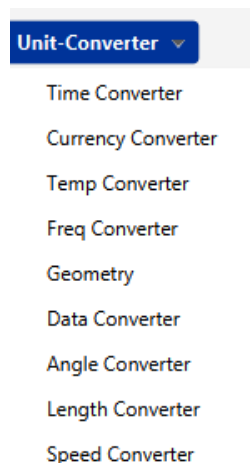
Using this mode, user can convert mathematical units by just choosing any of the conversion types we provided him. And here are the conversion types the user can choose between:

- Time
- Currency
- Temperature
- Frequency
- Data
- Angle
- Length
- Speed

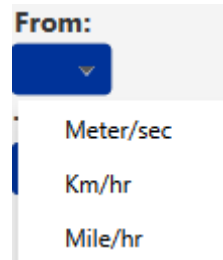
To use this mode, user has to choose “Conversion” mode from “Modes” menu which exists on the menu bar as shown:



Now, three menu buttons will appear on the GUI to the user which are “Unit-converter”, “From” and “TO”. From “Unit-Converter” menu button, user has to choose one of the conversion types shown in following menu to choose which type he wants.

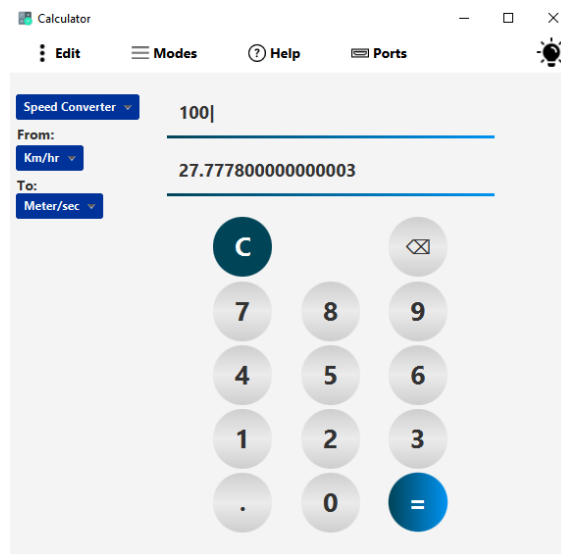


Then, User has to choose from “From” menu button the unit has wants to convert from. For Example, supposing that the user choose Speed from Unit-Converter menu button, from menu button now contains the units to allow the user to convert from.



On the same way, the user will choose from “To” menu button the unit he wants to convert to, which has the same units.

Finally, As shown, the first Text area will be used to take in input number from the user and the second one will show the result after pressing the “=” button.



- **Currency Converter**

In this mode, we convert between currencies by sending an HTTP GET request to the server and receive the response on JSON format which can be read using **JSON Library**.

- This is the GET URL we used:

```
https://api.exchangerate.host/convert?From=fromCountry &to=toCountry&amount=amount
```

- For Example, if we want to convert 2 \$ (USD) to Egyptian Pound LE (EGP).

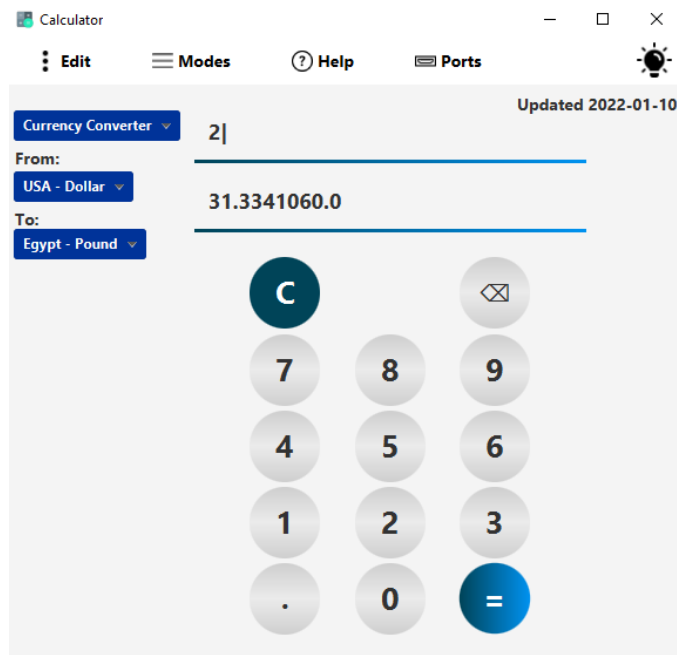
The URL will be as following:

```
https://api.exchangerate.host/convert?From="USD"&to="EUR"&amount="2"
```

And this is the JSON response:

```
{ "motd": { "msg": "If you or your company use this project or like what we  
doing, please consider backing us so we can continue maintaining and  
evolving this  
project.", "url": "https://exchangerate.host/#/donate" }, "success": true, "que  
ry": { "from": "USD", "to": "EGP", "amount": 2 }, "info": { "rate": 15.667053 }, "histo  
rical": false, "date": "2022-01-10", "result": 31.334106 }
```

Then using **JSONParser** from JSON Library we get the result of the conversion and the updated date from the JSON response.



– Geometry

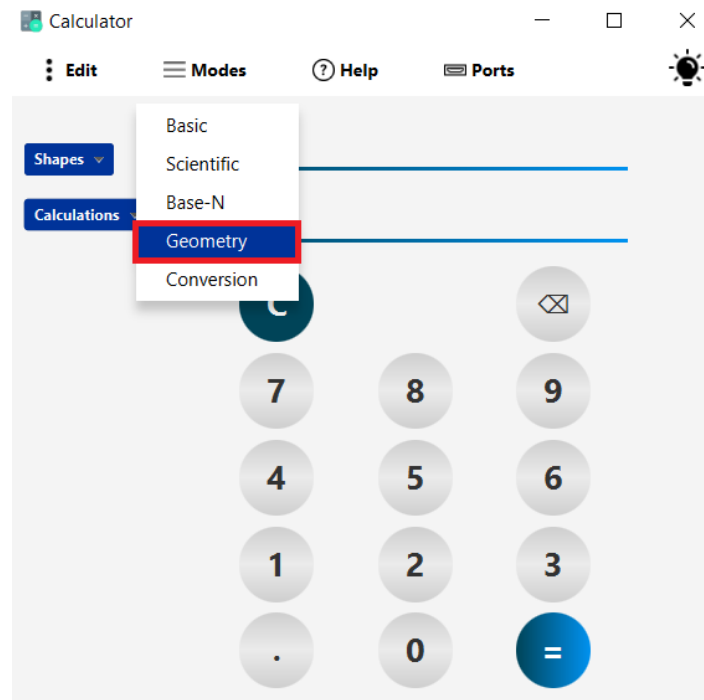
This mode is to calculate the area and the perimeter of those geometry shapes:

- Circle
- Rectangle
- Square
- Triangle
- Rhombus
- Parallelogram

Guide:

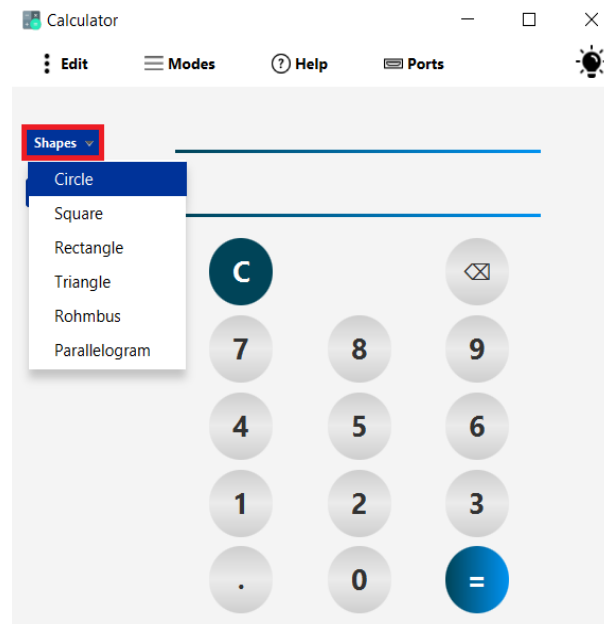
First:

To use this mode, user has to choose “Conversion” mode from “Modes” menu which exists on the menu bar :



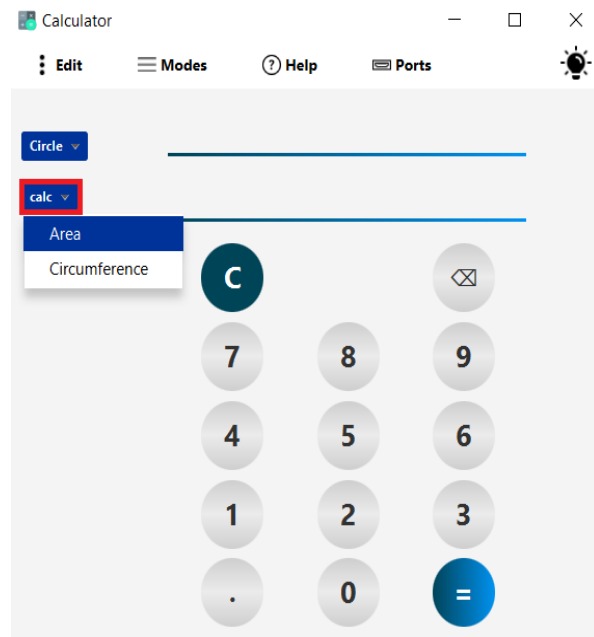
Second:

You should select the geometry shape from “shapes” menu-button :



Third:

You should select the calculation type from the “calc” menu button:



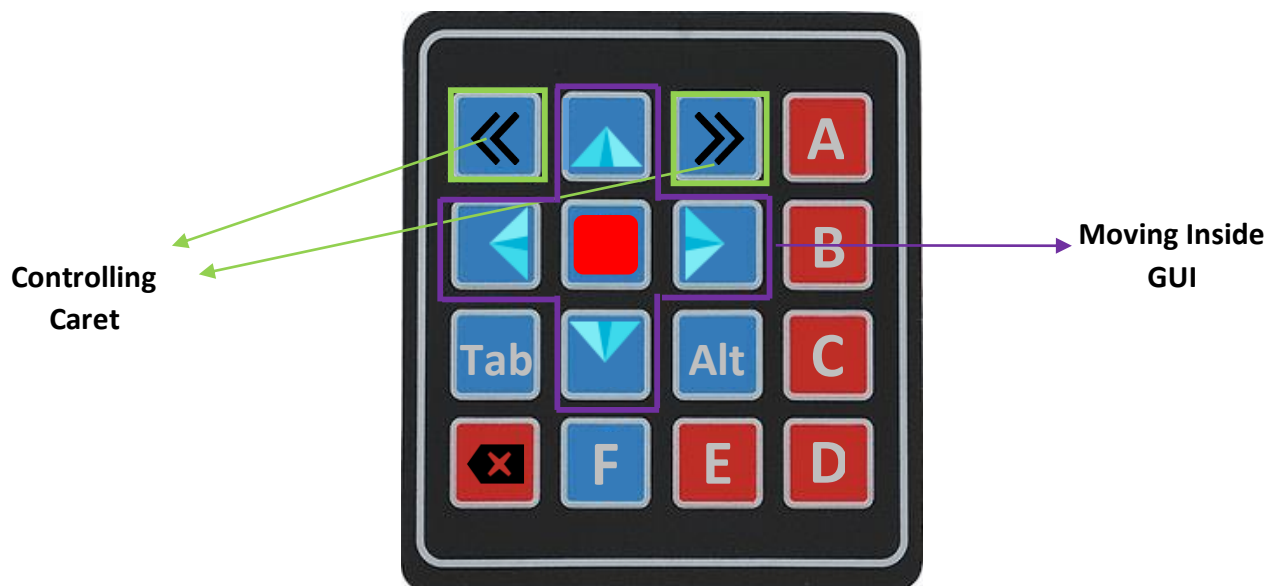
Hardware

In this project, we used two 4x4 Keypad connected to Arduino Mega2560. Data is transferred between Arduino and the desktop calculator using UART communication protocol to control all the modes and features in the calculator.

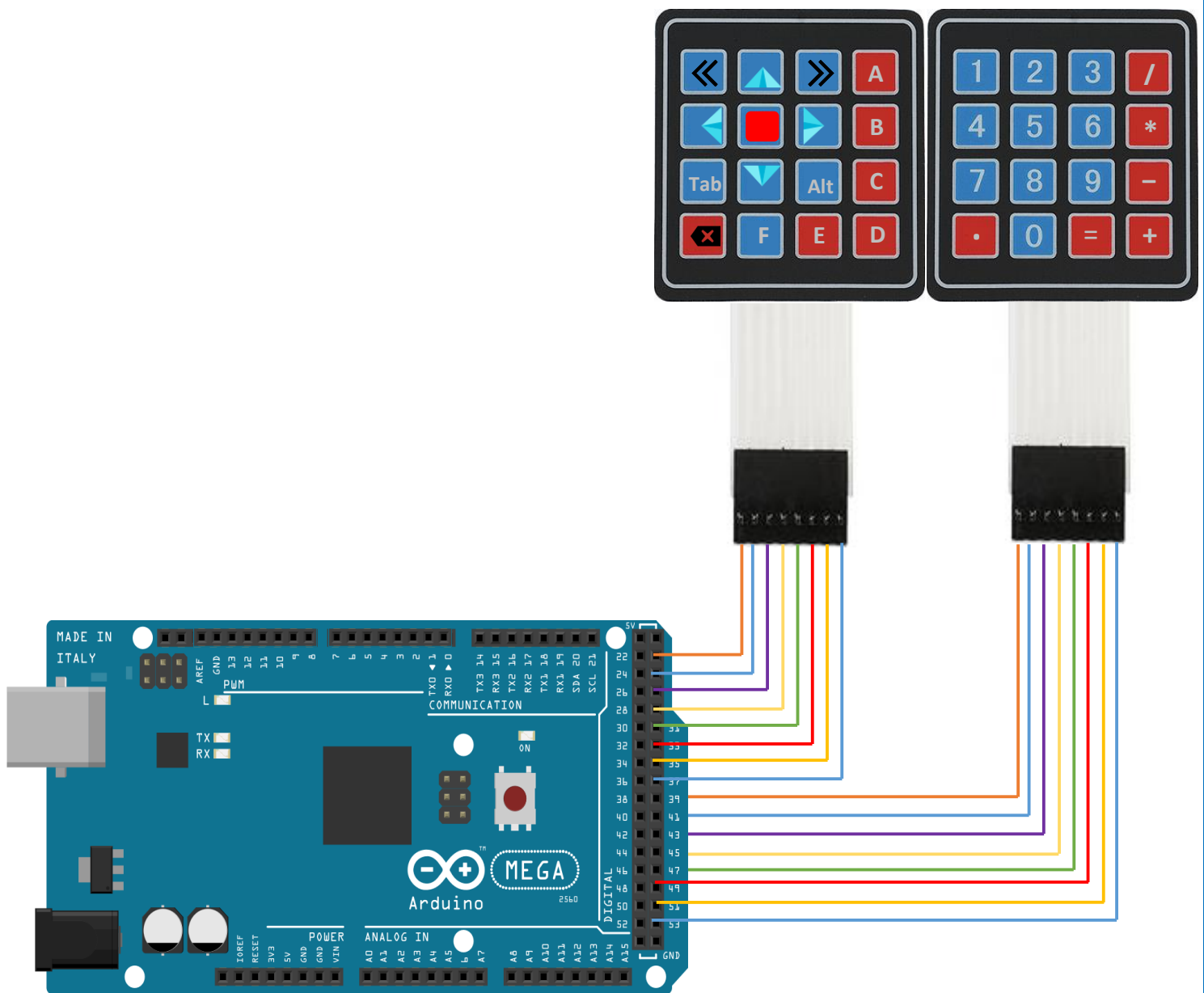
- **First Keypad:** In this keypad we manage all the numbers from 0 – 9, dot operator, equal button and the basic operations $+$ $-$ $/$ $*$ $.$



- **Second Keypad:**



- Connecting to Arduino Mega



Keyboard Shortcuts

