Interfacing a 4x4 Keypad with Arduino

Key Components:

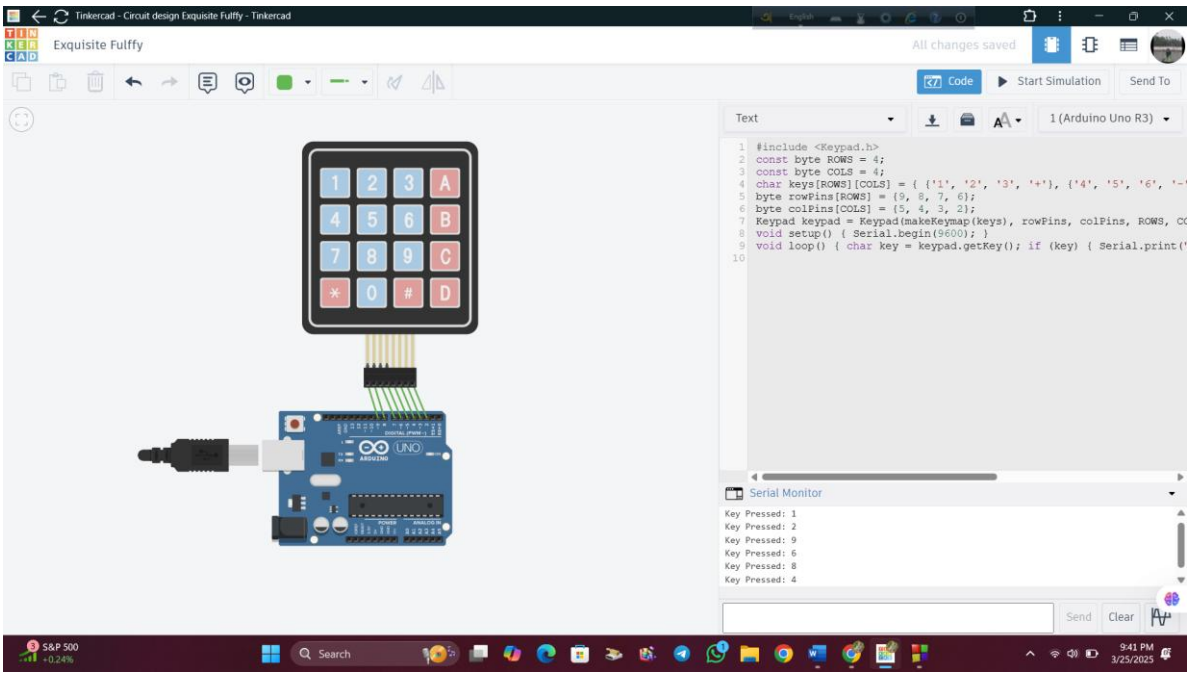
- **Arduino Uno**
- **4x4 Matrix Keypad**
- **Jumper Wires**
- **LCD Display (Optional)**
- **Keypad Library** (Keypad.h by Mark Stanley & Alexander Brevig)

Pin Connections:

Keypad Pin	Arduino Pin
Row 1 (R1)	9
Row 2 (R2)	8
Row 3 (R3)	7
Row 4 (R4)	6
Col 1 (C1)	5
Col 2 (C2)	4
Col 3 (C3)	3
Col 4 (C4)	2

Installing the Keypad Library:

- Open **Arduino IDE → Sketch → Include Library → Manage Library**.
- Search for **Keypad** and install **Keypad by Mark Stanley & Alexander Brevig**.



Working Principle:

The **4x4 matrix keypad** consists of **rows and columns** forming a grid. When a key is pressed, it creates a connection between a specific row and column. The **Arduino scans each row and column** to detect which key is pressed. Using the **Keypad library**, the Arduino reads the input and displays the detected key on the **serial monitor** (or optionally on an LCD).

Arduino Code:

```
#include <Keypad.h>

const byte ROWS = 4;

const byte COLS = 4;

char keys[ROWS][COLS] = { {'1', '2', '3', '+'}, {'4', '5', '6', '-'}, {'7', '8', '9', '*'}, {'0', '#', '/', '='} };

byte rowPins[ROWS] = {9, 8, 7, 6};

byte colPins[COLS] = {5, 4, 3, 2};

Keypad keypad = Keypad(makeKeymap(keys), rowPins, colPins, ROWS, COLS);

void setup() { Serial.begin(9600); }

void loop() { char key = keypad.getKey(); if (key) { Serial.print("Key Pressed: "); Serial.println(key); } }
```

Simulation Output (TinkerCAD/Serial Monitor):

- **Pressing '1'** → Key Pressed: 1
- **Pressing '+'** → Key Pressed: +
- **Pressing '9'** → Key Pressed: 9
- The output is displayed in the **serial monitor**. An **LCD can also be used** for better visualization.

Arduino Code Explanation:

- **Includes the required library** (Keypad.h).
- **Defines constants** for row and column numbers.
- **Creates a 2D array** representing the keypad layout (e.g., '1', '2', '3', '+', etc.).
- **Initializes row and column pins**.
- **Creates a keypad object** to read key inputs.
- **Reads and displays key presses** on the serial monitor.

Conclusion:

This project successfully interfaces a **4x4 matrix keypad** with **Arduino Uno** using the **Keypad library**. It enables **real-time key detection**, making it useful for applications like **calculators, password-protected systems, and embedded control panels**. The code can be extended to include **LCD display, buzzer alerts, or further processing based on key inputs**.