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| **Iotronics Techlab Pvt Ltd.** | |
| **Aim:** | To design and implement a basic calculator using Arduino, a 4x4 keypad, and an LCD display. |
| **Requirements:** | Automation kit (Lcd), Wireless and iot (4x4Key pad ) |
| **IDE:** | Arduino IDE |
| **Connection Diagram:** |  |
| **Working** | 1. Keypad allows input of numbers and arithmetic operators. 2. Arduino processes keypad input and performs calculations. 3. Results are displayed on the LCD screen. 4. Basic arithmetic operations like addition, subtraction, multiplication, and division are supported. |
| **Procedure:** | 1. **Setting Up the Hardware**:    * Connect the 4x4 keypad to the Arduino Uno using jumper wires.    * Connect the LCD display to the Arduino Uno using jumper wires.    * Power the components using the appropriate power source. 2. **Programming the Arduino Uno**:    * Open the Arduino IDE on your computer.    * Write the code to read input from the keypad and display output on the LCD.    * Implement functions to perform basic arithmetic operations based on keypad input. 3. **Testing the Hardware**:    * Upload the code to the Arduino Uno.    * Test each button on the keypad to ensure proper input recognition.    * Verify that the LCD display shows the correct output for arithmetic operations. |
| **CODE:** | #include <Key.h>  #include <Keypad.h>  #include <Wire.h>  #include <hd44780.h>                       // main hd44780 header  #include <hd44780ioClass/hd44780\_I2Cexp.h> // i2c expander i/o class header  //LCD I2C Initialization  hd44780\_I2Cexp lcd; // declare lcd object: auto locate & config exapander chip  // LCD geometry  const int LCD\_COLS = 16;  const int LCD\_ROWS = 2;  double num1,num2 ;  double total;  char operation,button;  const byte ROWS = 4; // Four rows  const byte COLS = 4; // Three columns  // Define the Keymap  char keys[ROWS][COLS] = {    {'1','2','3','+'},    {'4','5','6','-'},    {'7','8','9','\*'},    {'=','0','%','/'}  };  byte rowPins[ROWS] = { 64, 62, 68, 66 };// Connect keypad ROW0, ROW1, ROW2 and ROW3 to these Arduino pins.  byte colPins[COLS] = { 65, 63, 69, 67 }; // Connect keypad COL0, COL1 and COL2 to these Arduino pins.  Keypad kpd = Keypad( makeKeymap(keys), rowPins, colPins, ROWS, COLS ); //  Create the Keypad  void domath() // Simple switch case to pick what operation to do, based on button pressed by user.  {    switch(operation)    {      case '+': // Addition        total = num1+num2;        break;      case '-': // Subtraction        total = num1-num2;        break;      case '/': // Division.        total = num1/num2;        break;      case '\*': // Multiplication        total = num1\*num2;        break;       case '%': // Modulus        total = (int)num1%(int)num2;        break;    }    // Based on case selected print our total and    lcd.setCursor(0,1);    lcd.print('=');    lcd.setCursor(1,1);    lcd.print(total);  }  void setup() {  int status;    // initialize LCD with number of columns and rows:    // hd44780 returns a status from begin() that can be used to determine if initalization failed.    status = lcd.begin(LCD\_COLS, LCD\_ROWS);    if(status) // non zero status means it was unsuccesful    {      status = -status; // convert negative status value to positive number      // begin() failed so blink error code using the onboard LED if possible      hd44780::fatalError(status); // does not return    }    // initalization was successful, the backlight should be on now    lcd.setCursor(0, 0);    lcd.print("Welcome");    lcd.setCursor(0, 1);    lcd.print("Iotronics Pvt.Ltd");    delay(3000);    lcd.clear();    // Print a message to the LCD    lcd.print("   Calculator   ");    lcd.setCursor(0, 1);    lcd.print("  Enter Number  ");  }  void loop()  {    // Loops are convenient for reading key press from keypad    while(1) // First loop. Composing first number. Until operator pressed    {      button = kpd.getKey(); // Button read      if (button >='0' && button <='9') // If user pressed numeric value, 1 character at a time.      {        lcd.clear();        num1 = num1\*10 + (button -'0'); //First operand composing        lcd.setCursor(0,0); // Select first row on lcd        lcd.print(num1); // Print current number1      }        //Inputting operator      if (num1 !=0 && (button=='+' || button=='-' || button=='\*' || button=='/' || button=='%'))      {        operation = button; // operation remembers what mathematical operation user wants on numbers        lcd.setCursor(0,1); // set cursor to row 2        lcd.print(operation); // print our operator        break;      }    }      while(1) // Second loop. Inputting second operand. Until '=' pressed    {      button = kpd.getKey(); // Button read      if (button >='0' && button <='9') // Getting chars from keypad for second number      {        num2 = num2\*10 + (button -'0'); //Second operand composing        lcd.setCursor(1,1); // Select second row, second column on lcd        lcd.print(num2); // Print current operand2      }      if (button == '=' && num2 !=0) //Do calculation if '=' is pressed      {        domath(); //Calls domath() subroutine        break;      }    }      while(1) // Clearing screen for next calculation    {      //Waits ‘=’ key to be pressed so it can reset program and start over.      button = kpd.getKey();      if (button =='=')      {        lcd.clear();        lcd.setCursor(0,0);        lcd.print("  ENTER NUMBER  ");              num1=0;        num2=0;        total=0;        operation=0;        break;      }    }  } |
| **Result/Output** |  |