5. Create a simple stopwatch using an LCD display and two buttons. Use one button to start/stop the stopwatch and the other to reset it.

Program :

```
// Pin definitions for the LCD
const int rs = 7;
const int e = 8;
const int d4 = 9;
const int d5 = 10;
const int d6 = 11;
const int d7 = 12;
// Button pins
const int startStopButton = 2;
const int resetButton = 3;
// Stopwatch variables
unsigned long startTime = 0;
unsigned long elapsedTime = 0;
bool running = false;
void setup() {
// Setup LCD pins
  pinMode(rs, OUTPUT);
  pinMode(e, OUTPUT);
  pinMode(d4, OUTPUT);
  pinMode(d5, OUTPUT);
  pinMode(d6, OUTPUT);
```

```
  pinMode(d7, OUTPUT);
                                        // Setup button pins
  pinMode(startStopButton, INPUT_PULLUP);
  pinMode(resetButton, INPUT_PULLUP);

                                       // Initialize the LCD
  lcdCommand(0x28);                    // 4-bit mode, 2-line display
  lcdCommand(0x0C);                    // Display on, cursor off
  lcdCommand(0x01);                    // Clear display
  lcdCommand(0x06);                    // Increment cursor
  lcdPrint("Stopwatch");
  lcdCommand(0xC0);                    // Move to second line
  lcdPrint("00:00:00");
}
void loop() {
                                        // Read the buttons
  if (digitalRead(startStopButton) == LOW) {
    running = !running;                // Toggle the running state
    delay(200);                        // Debounce delay
  }
  if (digitalRead(resetButton) == LOW) {
    resetStopwatch();
    delay(200);                        // Debounce delay
  }
```

```
  // Update the stopwatch
  if (running) {
    elapsedTime = millis() - startTime;
    displayTime(elapsedTime);
  }
}
void displayTime(unsigned long milliseconds)
                    // Convert milliseconds to hours, minutes, and seconds
{
  unsigned long seconds = milliseconds / 1000;
  unsigned long hours = seconds / 3600;
  seconds %= 3600;
  unsigned long minutes = seconds / 60;
  seconds %= 60;
  // Display in HH:MM:SS format
  lcdCommand(0xC0); // Move to second line
  lcdPrint((hours < 10 ? "0" : "") + String(hours) + ":");
  lcdPrint((minutes < 10 ? "0" : "") + String(minutes) + ":");
  lcdPrint((seconds < 10 ? "0" : "") + String(seconds));
}
void resetStopwatch() {
  elapsedTime = 0;
  startTime = millis(); // Reset start time
  displayTime(elapsedTime);
```

```
}
void lcdCommand(unsigned char cmd) {
  digitalWrite(rs, LOW); // Command mode
  digitalWrite(d4, (cmd >> 4) & 0x01);
  digitalWrite(d5, (cmd >> 5) & 0x01);
  digitalWrite(d6, (cmd >> 6) & 0x01);
  digitalWrite(d7, (cmd >> 7) & 0x01);
  pulseEnable();

  digitalWrite(d4, cmd & 0x01);
  digitalWrite(d5, (cmd >> 1) & 0x01);
  digitalWrite(d6, (cmd >> 2) & 0x01);
  digitalWrite(d7, (cmd >> 3) & 0x01);
  pulseEnable();
}
void lcdPrint(String str) {
  for (int i = 0; i < str.length(); i++) {
    digitalWrite(rs, HIGH); // Data mode
    digitalWrite(d4, (str[i] >> 4) & 0x01);
    digitalWrite(d5, (str[i] >> 5) & 0x01);
    digitalWrite(d6, (str[i] >> 6) & 0x01);
    digitalWrite(d7, (str[i] >> 7) & 0x01);
    pulseEnable();
```

```
    digitalWrite(d4, str[i] & 0x01);
    digitalWrite(d5, (str[i] >> 1) & 0x01);
    digitalWrite(d6, (str[i] >> 2) & 0x01);
    digitalWrite(d7, (str[i] >> 3) & 0x01);
    pulseEnable();
  }
}

void pulseEnable() {
  digitalWrite(e, HIGH);
  delayMicroseconds(1);
  digitalWrite(e, LOW);
  delayMicroseconds(100);
}
```