

# Beweging, Temperatuur Clock en Buttons

Same setup but improved with three buttons to make it completely independent from PC.

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <DHT.h>
#include <DS3231.h>

// --- Definitions ---
#define DHTPIN 4      // Pin connected to the DHT11 data pin
#define DHTTYPE DHT11 // Specify DHT11 sensor
#define BUTTON1PIN 8
#define BUTTON2PIN 9
#define BUTTON3PIN 10
#define TREND_DISPLAY_DURATION_MS 600000 // 10 minutes, time to keep the signal (arrow up/down) in display
#define HISTORICAL_DATA_ENTRIES_COUNT 5 // Define the length of the history (min-max) buffers: so we keep
the last N hours of min max data.
#define MAX_HISTORY_STRING_LENGTH 100 // Maximum characters for the history string
#define DEBUG true // Set to true to enable debug printing, false to disable

DHT dht(DHTPIN, DHTTYPE);

DS3231 myRTC;
bool century = false;
bool h12Flag;
bool pmFlag;

int count = 0;
int pirPin = 12; // Pin for the HC-S501 sensor
int pirValue;

LiquidCrystal_I2C lcd = LiquidCrystal_I2C(0x27, 16, 2);
unsigned long previousMillis = 0;
```

```
const long dhtInterval = 2000; // Interval for DHT readings
```

```
// Custom characters for the LCD arrows
```

```
byte downChar[] = {
```

```
    B00000,
```

```
    B00000,
```

```
    B00100,
```

```
    B00100,
```

```
    B00100,
```

```
    B10101,
```

```
    B01110,
```

```
    B00100
```

```
};
```

```
byte upChar[] = {
```

```
    B00100,
```

```
    B01110,
```

```
    B10101,
```

```
    B00100,
```

```
    B00100,
```

```
    B00100,
```

```
    B00000,
```

```
    B00000
```

```
};
```

```
byte degreeChar[] = {
```

```
    B00110,
```

```
    B01001,
```

```
    B01001,
```

```
    B00110,
```

```
    B00000,
```

```
    B00000,
```

```
    B00000,
```

```
    B00000
```

```
};
```

```
byte maxChar[] = {
```

```
    B01110,
```

```
    B00000,
```

```
    B00100,
```

```
B01110,  
B10101,  
B00100,  
B00100,  
B00100  
};
```

```
byte minChar[] = {  
    B00100,  
    B00100,  
    B00100,  
    B10101,  
    B01110,  
    B00100,  
    B00000,  
    B01110  
};
```

```
//-----
```

```
// Generic MeasurementSensor Class Template
```

```
//-----
```

```
template<typename T>
```

```
class MeasurementSensor {
```

```
public:
```

```
    // Constructor: initializes with an initial measurement value and history capacity N.
```

```
    MeasurementSensor(long sigInterval)
```

```
    : measurement(0),
```

```
      arrow(0),
```

```
      arrowMillis(0),
```

```
      lowestMeasurement(0),
```

```
      highestMeasurement(0),
```

```
      signalInterval(sigInterval),
```

```
      historyCount(0),
```

```
      historyIndex(0) {}
```

```
    // Destructor (no longer needed due to no dynamic memory)
```

```
    ~MeasurementSensor() {}
```

```
    // Update the measurement reading and determine the arrow indicator.
```

```
    void update(T newMeasurement, unsigned long currentMillis) {
```

```

// For the first valid measurement, initialize min/max if needed.
if (lowestMeasurement == static_cast<T>(0) && highestMeasurement == static_cast<T>(0)) {
    lowestMeasurement = newMeasurement;
    highestMeasurement = newMeasurement;
}

// Update the current interval's min and max.
if (newMeasurement < lowestMeasurement) {
    lowestMeasurement = newMeasurement;
}
if (newMeasurement > highestMeasurement) {
    highestMeasurement = newMeasurement;
}

// Determine arrow indicator logic.
if (newMeasurement == measurement && currentMillis - arrowMillis >= signalInterval) {
    arrow = 0;
} else {
    if (newMeasurement < measurement) {
        arrow = 1; // Down arrow
        arrowMillis = currentMillis;
    }
    if (newMeasurement > measurement) {
        arrow = 2; // Up arrow
        arrowMillis = currentMillis;
    }
    if (lowestMeasurement != highestMeasurement) {
        if (newMeasurement == this->getLowest()) {
            arrow = 4; // Indicator for lowest measurement
            arrowMillis = currentMillis;
        }
        if (newMeasurement == this->getHighest()) {
            arrow = 5; // Indicator for highest measurement
            arrowMillis = currentMillis;
        }
    }
}

// Reset arrow if previous value was an invalid initial value.
if (measurement == static_cast<T>(0)) {

```

```

    arrow = 0;
}

measurement = newMeasurement;
}

// Getters for measurement and arrow.
T getMeasurement() const {
    return measurement;
}

// Returns the lowest measurement seen over the history combined with the current interval.
T getLowest() const {
    T minVal = lowestMeasurement;
    // Loop over the history array.
    for (size_t i = 0; i < historyCount; i++) {
        if (lowestHistory[i] < minVal) {
            minVal = lowestHistory[i];
        }
    }
    return minVal;
}

// Returns the highest measurement seen over the history combined with the current interval.
T getHighest() const {
    T maxVal = highestMeasurement;
    // Loop over the history array.
    for (size_t i = 0; i < historyCount; i++) {
        if (highestHistory[i] > maxVal) {
            maxVal = highestHistory[i];
        }
    }
    return maxVal;
}

int getArrow() const {
    return arrow;
}

// Reset the min and max values.

```

```

// The current lowest and highest measurements are stored in the history arrays.
void resetMinMax(T newMeasurement) {
    // Store the current min and max in the arrays at the current history index.
    lowestHistory[historyIndex] = lowestMeasurement;
    highestHistory[historyIndex] = highestMeasurement;

    lowestMeasurement = newMeasurement;
    highestMeasurement = newMeasurement;

    // Increment historyIndex as a circular buffer.
    historyIndex = (historyIndex + 1) % HISTORICAL_DATA_ENTRIES_COUNT;
    if (historyCount < HISTORICAL_DATA_ENTRIES_COUNT) {
        historyCount++;
    }
}

void getHistoryString(bool useHighest, char* buffer, size_t bufferSize) const {
    // Initialize the buffer to an empty string.
    buffer[0] = '\0';

    // Determine the index of the oldest element.
    size_t oldestIndex = (historyCount < HISTORICAL_DATA_ENTRIES_COUNT) ? 0 : historyIndex;

    // Loop over the valid history entries in order.
    for (size_t i = 0; i < historyCount; i++) {
        size_t index = (oldestIndex + i) % HISTORICAL_DATA_ENTRIES_COUNT;
        T value = useHighest ? highestHistory[index] : lowestHistory[index];

        // Temporary buffer for the converted float value.
        char tempValue[10];
        // Convert the float value to a string with width 4 and one decimal point.
        dtostrf(static_cast<double>(value), 4, 1, tempValue);

        // Check if adding the next value will overflow the main buffer.
        size_t remainingSpace = bufferSize - strlen(buffer) - 1;
        size_t charsNeeded = strlen(tempValue) + (i < historyCount - 1 ? 2 : 0); // value + ", "

        if (charsNeeded > remainingSpace) {
            Serial.println("Error: Insufficient buffer space in getHistoryString!");
            return; // You may choose to handle this differently.
        }
    }
}

```

```

    }

    // Concatenate the value to the buffer.
    strcat(buffer, tempValue);

    // Add the separator if it's not the last element.
    if (i < historyCount - 1) {
        strcat(buffer, ", ");
    }
}
}
}

```

private:

```

    T measurement;
    int arrow;
    unsigned long arrowMillis;
    T lowestMeasurement;
    T highestMeasurement;
    long signalInterval;

    // History storage: fixed size arrays
    T lowestHistory[HISTORICAL_DATA_ENTRIES_COUNT];
    T highestHistory[HISTORICAL_DATA_ENTRIES_COUNT];
    size_t historyCount;
    size_t historyIndex;
};

```

class Button {

private:

```

    int pin;
    int prevState;
    const char* name;
    unsigned long pressStartTime;
    bool longPressTriggered;
    const unsigned long LONG_PRESS_DURATION = 1000; // 1 second for long press

```

public:

```

// Constructor: initialize the button pin and its name
Button(int pin, const char* name)
: pin(pin), prevState(LOW), name(name), pressStartTime(0), longPressTriggered(false) {
    pinMode(pin, INPUT);
}

// Update the button state and return true if the button was pressed (transition from LOW to HIGH)
bool update() {
    int currentState = digitalRead(pin);
    bool pressed = false;

    if (currentState != prevState) {
        // Button state changed
        if (currentState == HIGH) {
            // Button was just pressed
            pressStartTime = millis();
            longPressTriggered = false;
        } else {
            // Button was just released
            if ((millis() - pressStartTime < LONG_PRESS_DURATION) && !longPressTriggered) {
                // Short press detected
                pressed = true;
            }
            pressStartTime = 0;
        }
        prevState = currentState;
    }

    return pressed;
}

// Check for long press and return true if long press is detected
bool checkLongPress() {
    int currentState = digitalRead(pin);

    if (currentState == HIGH && prevState == HIGH) {
        // Button is being held down
        if (millis() - pressStartTime > LONG_PRESS_DURATION && !longPressTriggered) {
            longPressTriggered = true;
            return true;
        }
    }
}

```



```

    }
}

return false;
}

// Getter for the button's name
const char* getName() {
    return name;
}
};

class DateTimeSettings {
private:
    // RTC reference
    DS3231& rtc;

    // LCD reference
    LiquidCrystal_I2C& lcd;

    // Setting state variables
    bool isActive;
    int settingIndex; // 0=day, 1=month, 2=hour, 3=minute
    int currentDay, currentMonth, currentHour, currentMinute;

    // Blinking effect variables
    unsigned long lastBlinkTime;
    const unsigned long BLINK_INTERVAL = 500; // 500ms blink interval
    bool showField;

    // Reference to century flag needed for RTC
    bool& centuryFlag;
    bool h12Flag, pmFlag; // RTC flags

public:
    // Constructor
    DateTimeSettings(DS3231& rtcInstance, LiquidCrystal_I2C& lcdInstance, bool& century)
        : rtc(rtcInstance),
          lcd(lcdInstance),
          isActive(false),

```

```

    settingIndex(0),
    lastBlinkTime(0),
    showField(true),
    centuryFlag(century),
    h12Flag(false),
    pmFlag(false) {
}

// Start the settings mode
void start() {
    isActive = true;
    settingIndex = 0; // Start with day

    // Get current values from RTC
    currentDay = rtc.getDate();
    currentMonth = rtc.getMonth(centuryFlag);
    currentHour = rtc.getHour(h12Flag, pmFlag);
    currentMinute = rtc.getMinute();

    showField = true;
    lastBlinkTime = millis();

    displaySettings();
}

// Check if settings mode is active
bool isSettingActive() const {
    return isActive;
}

// Exit settings mode
void exit() {
    isActive = false;
    lcd.clear();
}

// Move to the next field
void nextField() {
    settingIndex++;
    showField = true; // Reset blink state

```

```
if (settingIndex > 3) {
    // All fields set, save the time
    rtc.setDate(currentDay);
    rtc.setMonth(currentMonth);
    rtc.setHour(currentHour);
    rtc.setMinute(currentMinute);
    rtc.setSecond(0); // Reset seconds to 00

    // Exit setting mode
    exit();
    return;
}

displaySettings();
}

// Increase the current field value
void increaseValue() {
    switch (settingIndex) {
        case 0: // Day
            currentDay++;
            if (currentDay > 31) currentDay = 1;
            break;
        case 1: // Month
            currentMonth++;
            if (currentMonth > 12) currentMonth = 1;
            break;
        case 2: // Hour
            currentHour++;
            if (currentHour > 23) currentHour = 0;
            break;
        case 3: // Minute
            currentMinute++;
            if (currentMinute > 59) currentMinute = 0;
            break;
    }
    showField = true; // Reset blink state
    displaySettings();
}
```

```

// Decrease the current field value
void decreaseValue() {
    switch (settingIndex) {
        case 0: // Day
            currentDay--;
            if (currentDay < 1) currentDay = 31;
            break;
        case 1: // Month
            currentMonth--;
            if (currentMonth < 1) currentMonth = 12;
            break;
        case 2: // Hour
            currentHour--;
            if (currentHour < 0) currentHour = 23;
            break;
        case 3: // Minute
            currentMinute--;
            if (currentMinute < 0) currentMinute = 59;
            break;
    }
    showField = true; // Reset blink state
    displaySettings();
}

// Update method to be called in the main loop
void update() {
    // Return if not in setting mode
    if (!isActive) return;

    // Handle blinking effect
    if (millis() - lastBlinkTime >= BLINK_INTERVAL) {
        lastBlinkTime = millis();
        showField = !showField;
        displaySettings();
    }
}

private:
    // Display the settings screen

```

```
void displaySettings() {  
    lcd.clear();  
    lcd.setCursor(0, 0);  
    lcd.print("Set Date & Time");  
  
    lcd.setCursor(1, 1);  
  
    // Display day - blinking when being set  
    if (settingIndex != 0 || showField) {  
        print2digits(currentDay);  
    } else {  
        lcd.print(" ");  
    }  
  
    lcd.print("-");  
  
    // Display month - blinking when being set  
    if (settingIndex != 1 || showField) {  
        print2digits(currentMonth);  
    } else {  
        lcd.print(" ");  
    }  
  
    lcd.setCursor(8, 1);  
  
    // Display hour - blinking when being set  
    if (settingIndex != 2 || showField) {  
        print2digits(currentHour);  
    } else {  
        lcd.print(" ");  
    }  
  
    lcd.print(":");  
  
    // Display minute - blinking when being set  
    if (settingIndex != 3 || showField) {  
        print2digits(currentMinute);  
    } else {  
        lcd.print(" ");  
    }  
}
```

```

}

// Helper function to print 2 digits with leading zero
void print2digits(int number) {
  if (number < 10) {
    lcd.print("0");
  }
  lcd.print(number, DEC);
}
};

//-----
// Global Instances for Temperature and Humidity
//-----
MeasurementSensor<float> tempSensor(TREND_DISPLAY_DURATION_MS);
MeasurementSensor<int> humiditySensor(TREND_DISPLAY_DURATION_MS);

void setup() {
  Serial.begin(9600);
  dht.begin();
  delay(2000);

  lcd.init();
  lcd.backlight();
  lcd.clear();
  lcd.createChar(1, downChar);
  lcd.createChar(2, upChar);
  lcd.createChar(3, degreeChar);
  lcd.createChar(4, minChar);
  lcd.createChar(5, maxChar);

  pinMode(pirPin, INPUT);

  pinMode(BUTTON1PIN, INPUT);
  pinMode(BUTTON2PIN, INPUT);
  pinMode(BUTTON3PIN, INPUT);

  // myRTC.setYear(2025);
  // myRTC.setMonth(3);

```

```
// myRTC.setDate(20);  
// myRTC.setHour(10);  
// myRTC.setMinute(49);  
// myRTC.setSecond(0);  
}
```

```
void print2digits(int number) {  
    if (number < 10) {  
        lcd.print("0");  
    }  
    lcd.print(number, DEC);  
}
```

```
int lastResetHour = -1; // Initialize to an invalid hour
```

```
// Create instances for each button  
Button button1(BUTTON1PIN, "Button 1");  
Button button2(BUTTON2PIN, "Button 2");  
Button button3(BUTTON3PIN, "Button 3");
```

```
int displayModus = 1; // we want temp range when 2 we want humidity range
```

```
// Add this near the top of your code, with your other global instances  
DateTimeSettings dateTimeSettings(myRTC, lcd, century);
```

```
void loop() {  
    delay(20);
```

```
    // Check if we are in setting mode  
    if (dateTimeSettings.isSettingActive()) {  
        dateTimeSettings.update();
```

```
    // Check for long press on button 1 to exit setting mode  
    if (button1.checkLongPress()) {  
        dateTimeSettings.exit();  
        return;  
    }
```

```
    // Handle button 1 (short press - move to next field)
```

```
if (button1.update()) {
    dateTimeSettings.nextField();
}

// Handle button 2 (decrease value)
if (button2.update()) {
    dateTimeSettings.decreaseValue();
}

// Handle button 3 (increase value)
if (button3.update()) {
    dateTimeSettings.increaseValue();
}

return; // Skip the normal loop when in setting mode
}

// Check for long press on button 1 to enter setting mode
if (button1.checkLongPress()) {
    dateTimeSettings.start();
    return;
}

// The rest of your existing loop code stays the same
// Update each button and print if pressed
if (button1.update()) {
    Serial.print(button1.getName());
    Serial.println(" pressed");
}
if (button2.update()) {
    Serial.print(button2.getName());
    Serial.println(" pressed");
    count = 5;
    previousMillis = 0;
    displayModus = 1;
}
if (button3.update()) {
    Serial.print(button3.getName());
    Serial.println(" pressed");
    count = 5;
```



```
previousMillis = 0;
displayModus = 2;
}

// Check for movement
pirValue = digitalRead(pirPin);
// Serial.println(pirValue);

if (pirValue) {
    lcd.backlight();
}

// Do we need to update the display?
unsigned long currentMillis = millis();
if (currentMillis - previousMillis >= dhtInterval) {
    previousMillis = currentMillis;

    if (!pirValue) {
        lcd.noBacklight();
    }

    count++;

    // Read new values from the DHT sensor
    float newTemperature = dht.readTemperature();
    int newHumidity = dht.readHumidity();

    if (isnan(newTemperature) || isnan(newHumidity)) {
        Serial.println("Failed to read from DHT sensor!");
        lcd.clear();
        lcd.print(" *** DHT Error *** ");
        delay(5000);
        return; // next iteration in the loop
    }

    // Update our measurement sensors
    tempSensor.update(newTemperature, currentMillis);
    humiditySensor.update(newHumidity, currentMillis);

    // Get current hour from RTC
```

```

int currentHour = myRTC.getHour(h12Flag, pmFlag);
// Check if hour has changed
if (currentHour != lastResetHour) { // || count%10==0

    tempSensor.resetMinMax(newTemperature);
    humiditySensor.resetMinMax(newHumidity);

    lastResetHour = currentHour;
}

Serial.println(count);
char tempHistoryBuffer[MAX_HISTORY_STRING_LENGTH];
tempSensor.getHistoryString(false, tempHistoryBuffer, sizeof(tempHistoryBuffer));
Serial.print("min temp history: ");
Serial.println(tempHistoryBuffer);

char tempHistoryBuffer2[MAX_HISTORY_STRING_LENGTH];
tempSensor.getHistoryString(true, tempHistoryBuffer2, sizeof(tempHistoryBuffer2));
Serial.print("max temp history: ");
Serial.println(tempHistoryBuffer2);

Serial.println();

// Update the LCD display for temperature
lcd.setCursor(0, 0);
if (!(count % 6) && displayModus == 1) {
    lcd.print("");
    lcd.print(tempSensor.getLowest(), 1);
    lcd.write(3);
    lcd.print(" ");
    lcd.print(tempSensor.getHighest(), 1);
    lcd.write(3);
    lcd.print(" ");
} else {
    if (tempSensor.getArrow()) {
        lcd.write(tempSensor.getArrow());
    } else {
        lcd.print(" ");
    }
}

```

```

    lcd.print(tempSensor.getMeasurement(), 1);
    lcd.write(3); // degree symbol
    lcd.print("C   ");
}

// Update the LCD display for humidity
if (!(count % 6) && displayModus == 2) {
    lcd.setCursor(9, 0);
    lcd.print(humiditySensor.getLowest(), 1);
    lcd.print("% ");
    lcd.print(humiditySensor.getHighest(), 1);
    lcd.print("%");
} else {
    lcd.setCursor(12, 0);
    if (humiditySensor.getArrow()) {
        lcd.write(humiditySensor.getArrow());
    } else {
        lcd.print(" ");
    }
    lcd.print(humiditySensor.getMeasurement());
    lcd.print("%");
}

// Update the LCD display second row, date
lcd.setCursor(1, 1);
print2digits(myRTC.getDate());
lcd.print("-");
print2digits(myRTC.getMonth(century));

// Update the LCD display second row, time
lcd.setCursor(10, 1);
print2digits(myRTC.getHour(h12Flag, pmFlag));
lcd.print(":");
print2digits(myRTC.getMinute());
}
}

```

<https://www.circuito.io/app?components=97,97,97,514,10167,11022,417986,821989,931983>

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Revision #2

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