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TEMPERATURE AND HUMIDITY MEASUREMENT DEVICE

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Abstract: Temperature measurement is important in monitoring and controlling many processes. To maintain constant temperatures in storage rooms, laboratories, incubators and other enclosures is an important issue. For home inside, temperature and humidity measurement can be used to monitor the climate of several rooms or areas we often don't see, such as a basement or attic space. In this work we present a device we made for monitoring temperature and humidity inside a room that was achieved using an Arduino microcontroller and a temperature and humidity sensor DHT22. To set the temperature within a preset range, a relay was used which, depending on the temperature inside the room, can command a fan on and off.

Keywords: sensor, arduino, thermometer, temperature, humidity

1. INTRODUCTION

The most frequently measured quantity in industrial applications is temperature. It is of interest in applications that track the evolution of process parameters (monitoring), in automatic regulation systems or in remote control systems [2], [5], [8], [10].

Temperature is important in all fields of natural science, including physics, chemistry, electrotechnics, Earth science, astronomy, medicine, biology, ecology and geography as well as most aspects of daily life [1], [5], [6], [14].

Temperature is a quantity of thermal state that characterizes the heating degree of bodies. For measuring it, a thermometric body is used whose physical properties depend on temperature [9]. The indication is obtained by establishing the

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thermodynamic equilibrium between the body whose temperature is to be established and the thermometric body, a state in which the heat transfer between them stops [7].

A first classification of temperature transducers based on how the sensitive element takes over the energy from the environment whose temperature is to be measured, allows us to distinguish two main categories [3], [4]:

- contact temperature transducers;
- contactless temperature transducers.

The transducers that have contact with the measuring object are also divided into two categories [3], [4]:

a) with non-electrical sensors:
   - based on dilatation of: - solids (metals). (with rod or bimetal);
     - liquids (mercury, alcohol);
     - gases (manometers).
   - with chemical sensors, in which any dilatation of a body can be taken over by a displacement transducer, thus creating a thermometer based on dilatation.

b) with electrical sensors: thermal resistors, thermocouples, junctions p-n. etc.

2. MAIN COMPONENTS

2.1 Arduino Uno

Arduino Uno SMD R3 (fig. 1) is a development board based on the ATmega328 microcontroller. By executing powerful instructions in a single clock cycle, ATmega328 performs transfers close to 1MIPS per MHz, allowing the designer to optimize power consumption compared to the processing speed [11], [12], [13].

The Arduino Uno SMD R3 development board has 14 digital input / output pins (of which 6 of them can be used as PWM outputs), 6 analog inputs, a 16MHz crystal oscillator, a USB connection, a power plug, a set of ICSP pins and a reset button.

Specifications:

ATmega328 microcontroller
Operating voltage 5V
14 x Digital I / O pins (of which 6 PWM outputs)
6 x Analog input pins
32 KB flash memory (ATmega328) of which 0.5 KB is used by the bootloader
SRAM 2 KB (ATmega328)
EEPROM 1 KB (ATmega328)

2.2 DHT22 temperature and humidity sensor

DHT22 is a digital temperature and humidity sensor (fig. 2). This consists of a capacitive humidity sensor and a thermistor that measures the air temperature. It is very

easy to use; just connect the first pin on the left to a voltage of 3-5V, the second pin to the data pin and the far right pin to ground.

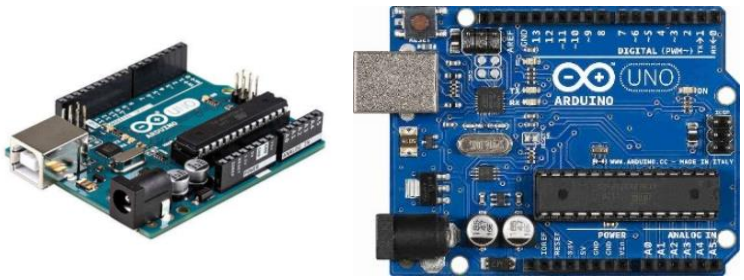

Fig. 1. ARDUINO UNO R3 Development Board

Fig. 2. DHT22 temperature and humidity sensor

Technical specifications:
Size: 28mm X 12mm X 10mm
Humidity measurement range: 0 - 100 RH
Humidity measurement accuracy: ± 2% RH
Temperature measurement accuracy: ± 0.5 °
Working voltage: DC 3-5V
Consumption: 2.5mA max (when processing data)

2.3 TFT 1.8” SPI Display

KMR-1.8 SPI (fig. 3) is a 1.8 "TFT LCD module with a resolution of 128 x 160 pixels and 262k colors. The display interface is in series, so only 5 wires are needed (CS, RS, SCL, SDA, RST) for control. The controller of this LCD module is ST7735. If you use an Arduino board, then each IO port should be connected with a resistance of 500 ~ 2KΩ. The screen supports both a level operating power of 5V, as well as 3.3V. For power supply, you can use the 3.3V power supply through the PIN "3.3V" or 5-9V through the PIN "VIN".

Technical specifications:
Colors: 262,000
128 x 160 pixels resolution

Power supply: 3.3V - 5V
Pin definition: 1-RST, 2-CE, 3-D / C, 4-DIN, 5-CLK, 6-UCC, 7-BL

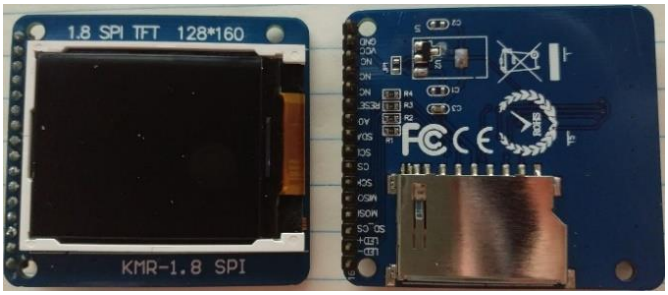

Fig. 3 TFT 1.8 SPI Display

2.4 One channel relay module

The module with 1 relay is useful in the case of projects made with Arduino development boards, for the control of several devices that operate at high voltage (fig. 4).

This module can be used with an Arduino Uno development board or with any other board that has 2 digital pins and a 5V VCC pin.

Fig. 4 One channel relay module

Technical specifications:
Maximum load: AC 250V/10A, DC 30V/10A
Trigger current: 5mA
Operating voltage: 5V

3. ACHIEVEMENT OF TEMPERATURE AND HUMIDITY MEASUREMENT DEVICE

The connection diagram is shown in fig. 5. The TFT display is interfaced with the DHT22 humidity and temperature sensor via the Arduino UNO development board and a middle deck that helps this interface (breadboard). The fan is controlled with the help of a relay.

The entire temperature and humidity measurement device is shown in fig. 6.

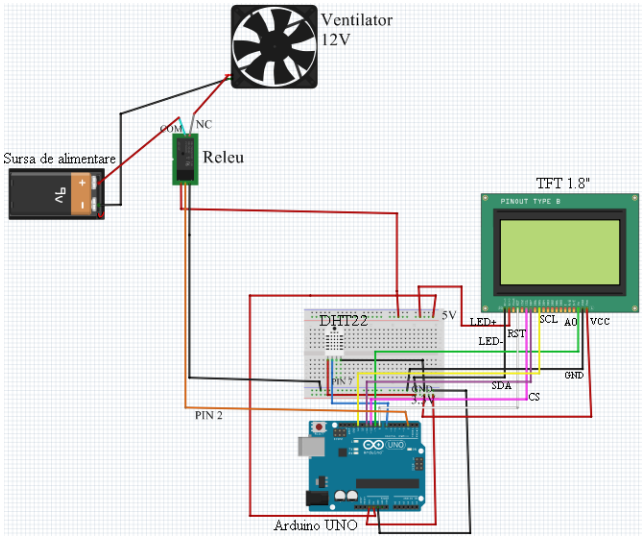

Fig. 5 The connection diagram of the entire system

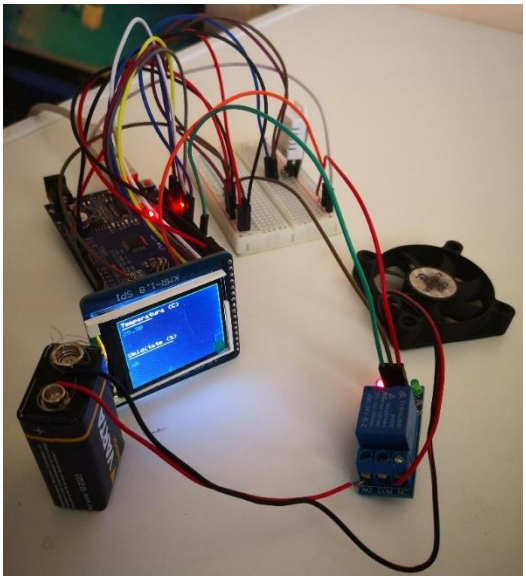

Fig. 6 Temperature and humidity measurement device

4. CONCLUSIONS

The device we presented above was made in the Laboratory of Sensors and Transducers from the Department of Automation, Computers, Electrical and Power Engineering in order to be used for monitoring the temperature and humidity of an

enclosure. It also can be used in learning activities for studying temperature and humidity measuring methods and the appropriate sensors as well.

We used a DHT 22 temperature and humidity sensor. We chose it because it is very easy to use and implement, it has only 3 connection pins, as well as due to the fact that it has a good accuracy class and it can measure temperatures between -40 and 80 ºC.

To adjust the temperature in a preset range, a relay was used which, depending on the room temperature, can give the command to turn on or off a 12V fan. The measuring temperature is continuously monitored and displayed on a 1.8" TFT display.

In the future, we intend to develop this application to be able to transmit information in the cloud. For this purpose, we will use a web server with side scripting for the php server. Then we can access the temperature from anywhere in the cloud (web server) to check the current temperature.

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