Control system of an air conditioner using z64 processor

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1 Project

1.1 Requirements

A processor z64 manages the control system of an air conditioner. Via the synchronous peripheral `THERMOMETER` is able to read the current temperature of the room, represented as an unsigned byte.

The user of the air conditioner has an infrared remote control at his disposal which allows him to set the desired temperature and operating mode (fan, dehumidifier, air conditioner). When the button is pressed confirmation, the remote control transmits the desired configuration to a peripheral `RECEIVER` which warns in asynchronous mode the z64 of the required setting change.

The peripheral `RECEIVER` has an interface register available through which it is possible to recover the required configuration. This configuration is an 8-bit word, composed as follows:

- Bit 7 (most significant) is a Boolean flag that indicates that you want to activate fan mode
- Bit 6 is a Boolean flag that indicates whether you want to activate the dehumidifier mode
- Bit 5 is a Boolean flag that indicates whether you want to activate the air conditioner mode
- The 5 least significant bits represent an unsigned integer indicating the required temperature

For example, this configuration indicates turning on the dehumidifier to reach a temperature of $23\,°C$:

7	6	5	4	3	2	1	0
0	1	0	1	0	1	1	1

Table 1. Example configuration

Upon receiving the interrupt request from `RECEIVER`, the z64 processor recovers the configuration request and activates/deactivates the synchronous `FAN`, `DEHUMIDIFIER` and `AIR CONDITIONER` peripherals, depending on the user request.

The `FAN` peripheral has a byte-sized interface register available which allows you to specify the rotation speed, according to the following algorithm:

- if the difference between the current and requested temperature is, the fan is activated at speed 1
- if the difference between the current temperature and the requested one is between $4\,°C$ and $8\,°C$, it is activated at speed 2
- otherwise it is activated at speed 3

To design:

- The interfaces of the `THERMOMETER`, `RECEIVER`, `FAN` peripherals (it is NOT necessary to create the interfaces of the `DEHUMIDIFIER` and `AIR CONDITIONER` peripherals)

– All the software necessary to operate the system, including any drivers

1.2 Implementation

1.2.1 Hardware

The `THERMOMETER` peripheral is a synchronous input device, which provides 8-bit data:

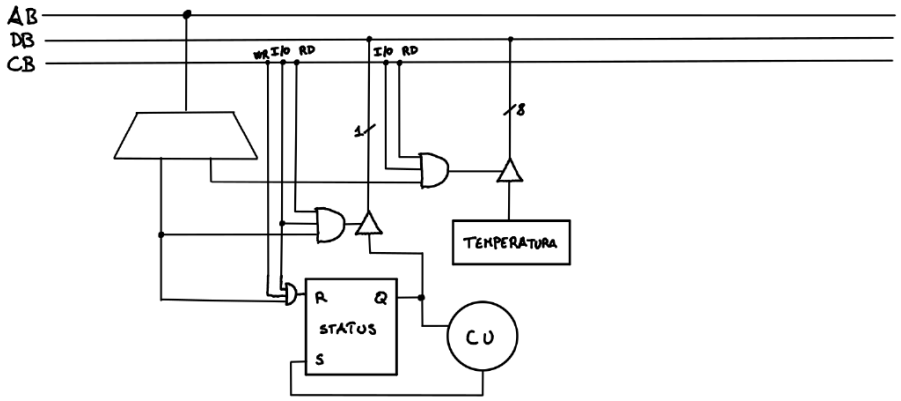

Figure 1. The `THERMOMETER` peripheral

The `RECEIVER` peripheral is input asynchronous:

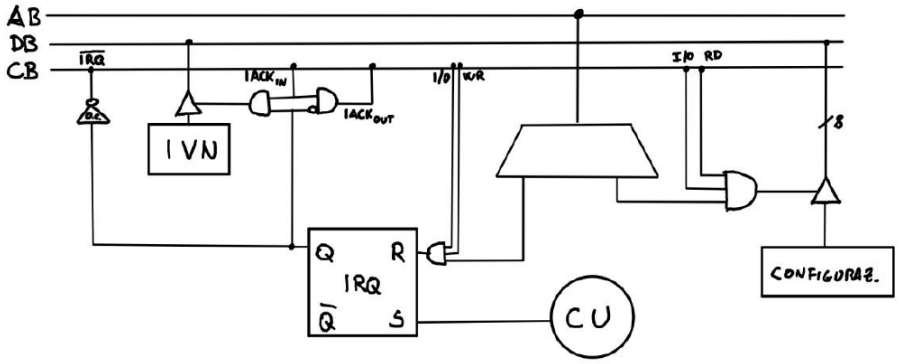

Figure 2. The `RECEIVER` peripheral

The `FAN` peripheral is synchronous in output, with an 8-bit register (since for the maximum value of the speed that you want to represent, one byte is enough):

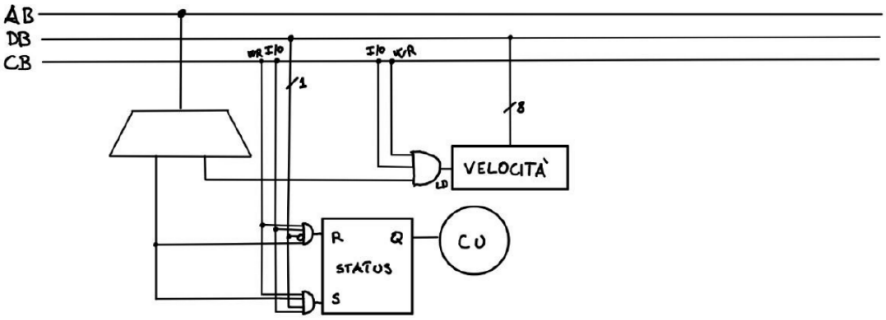

Figure 3. The `FAN` peripheral

1.2.2 Firmware

So, a possible *firmware implementation* can be found here.