



RICM 4 – April 2013

Building Management System



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Introduction

« Building Management System is a computer-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems. » Wikipedia

Our project is intended to control temperature, ventilation, lighting in a building and report residents' preferences.

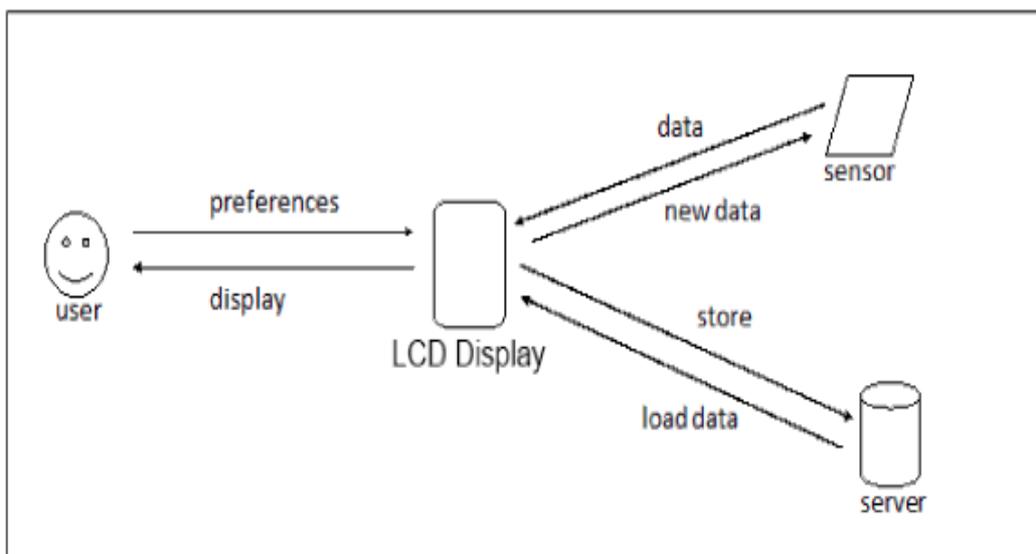
I. Specifications

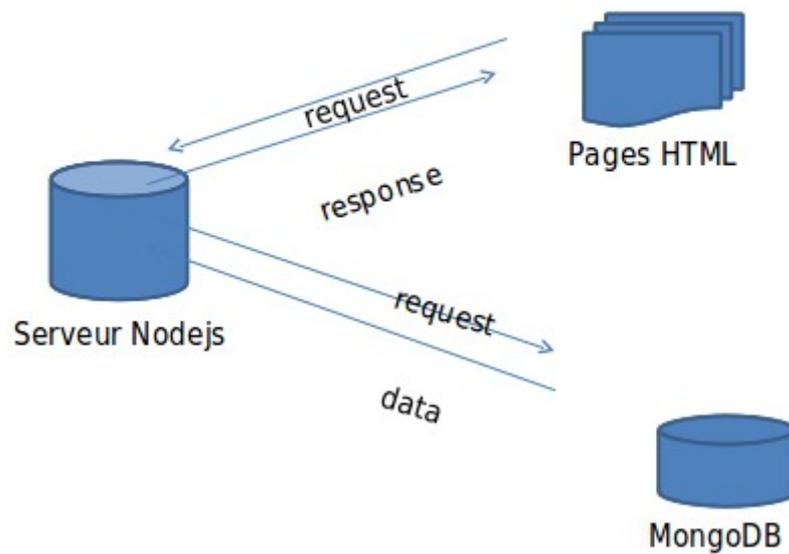
1. Identification
 - Allows users to access or not to the house
 - Recording usernames and passwords
 - Administrator who has all the rights on the system
2. Recording of users' preferences about the temperature and the luminosity
3. Ventilation
 - Triggering the fans depending on the internal temperature and/or the user's preferences or the occupation of the room
4. Lighting
 - Triggering the RGB Led depending on the internal luminosity and/or the user's preferences
5. Counting the number of occupants in a room
6. Technologies
 - Sensors (temperature sensor, light sensor, ultrasonic sensor, keypad) using Arduino and control with NodeJS.
 - Software development in JavaScript and database using MongoDB
 - Data display using Android

II. Structure

The system works with client-server and displays the data in the following way: the pages html sends the request in the format POST, the server Nodejs receives the request, if the request is to a file, the server sends a response with the page html solicited. If the request is to the data, the server sends a request to the database MongoDB and the database returns a data to the server that sends the data to pages html.

Overall scheme





We command the Arduino by sending values on the circuit board to specify what do we want to do on the equipments.

III. Technologies

1. NodeJS

Used for the realization of the application server in JavaScript.

2. Arduino

Arduino is a circuit board on which there is a microcontroller able of being programmed to analyze and produce electrical signals. Arduino is widely used in home automation, battery charge or control of robot.

3. MongoDB

Used to manages the persistents objects of NodeJS software.

4. GIT

Free software version management. Useful for software development.

IV. Achievements

First, a user creates an account by giving a name and password in order to can access to the building. The system stores these information with the user's preferences in the database.

Then with the keypad, the user can authenticate himself. If the password is wrong, the led in the door turns on orange else it turns on green to inform that the access is allowed.

Once in the house, the different sensors store the values they read in the database. These values are updated according to the principle of hysteresis. The light (RGB Led strip) is turns on only if the value (in Lux) read by the sensor of luminosity (LDR) is superior to a threshold else it turns off . It is the same principle with the regulation of temperature : the fan turned on only if the value (in °C) read by the temperature sensor (DS18S20) is superior to a threshold else it turns off.

Finally the ultrasonic sensor (HCSR04) increments or decrements the number of people who occupy the room. These number is also stored in the database. It can be used in the future in order to clean up the room.

V. Difficulties

All the problems we faced to were about the familiarization with the technologies. We also had a big difficulty concerning the choice of these technologies : we worked with another technology (Java, Processing, ...) until the mid-term of the project then we changed, in agreement with our tutor. Consequently, we did not have enough time to complete all of our goals.

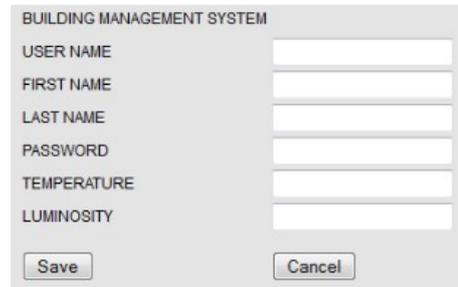
Finally the electronical part of the project was not easy for some complex components.

VI. Demonstration

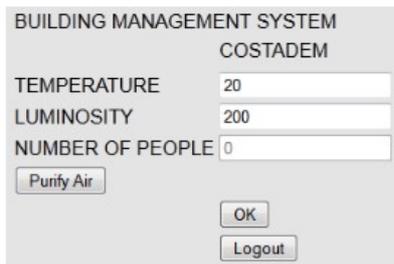
First, there is the client-side application with the display of the account and the preferences.



Page de login



Page d'enregistrement



Contrôle Page

After the right authentication of an user, we turn on the Led if the value read by the LDR is superior to 300 Lux.



The fan is turned on if the internal temperature is superior to 23°C.

Conclusion

Our project is very interesting from the point of view of innovation and creativity. It would have been better if we had more time. In the future other features will have to be developed such as the integration of other sensors (smoke sensor, weather station, alarm, etc) and the users's preferences will be taken into account.

Finally we thank the students for their collaborating in the designing of the house model.

Appendices

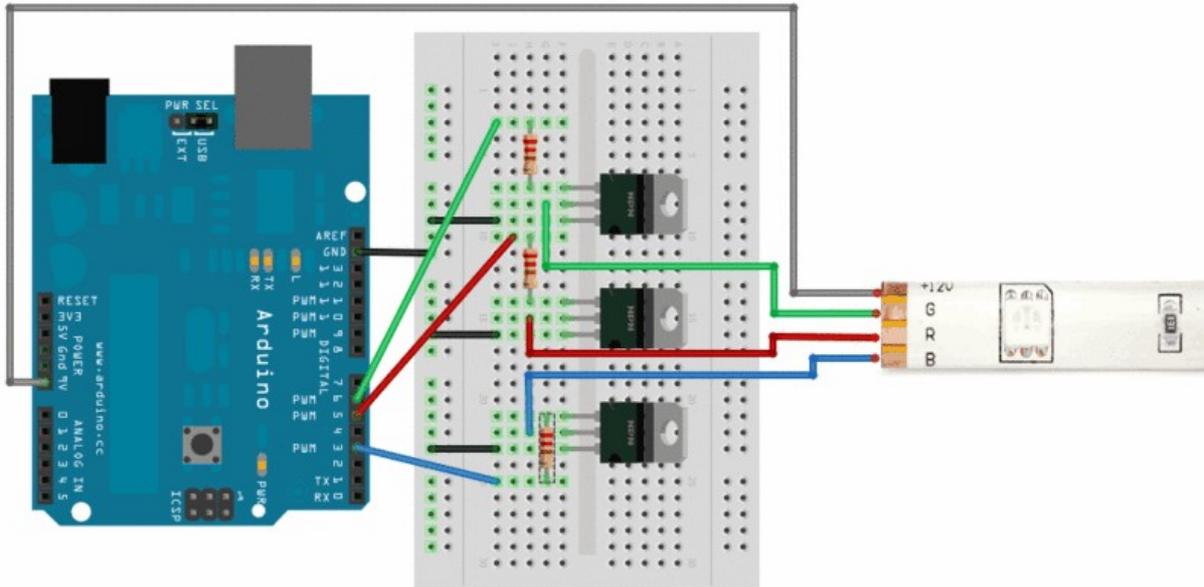


Fig.1 : RGB Led strip mounting

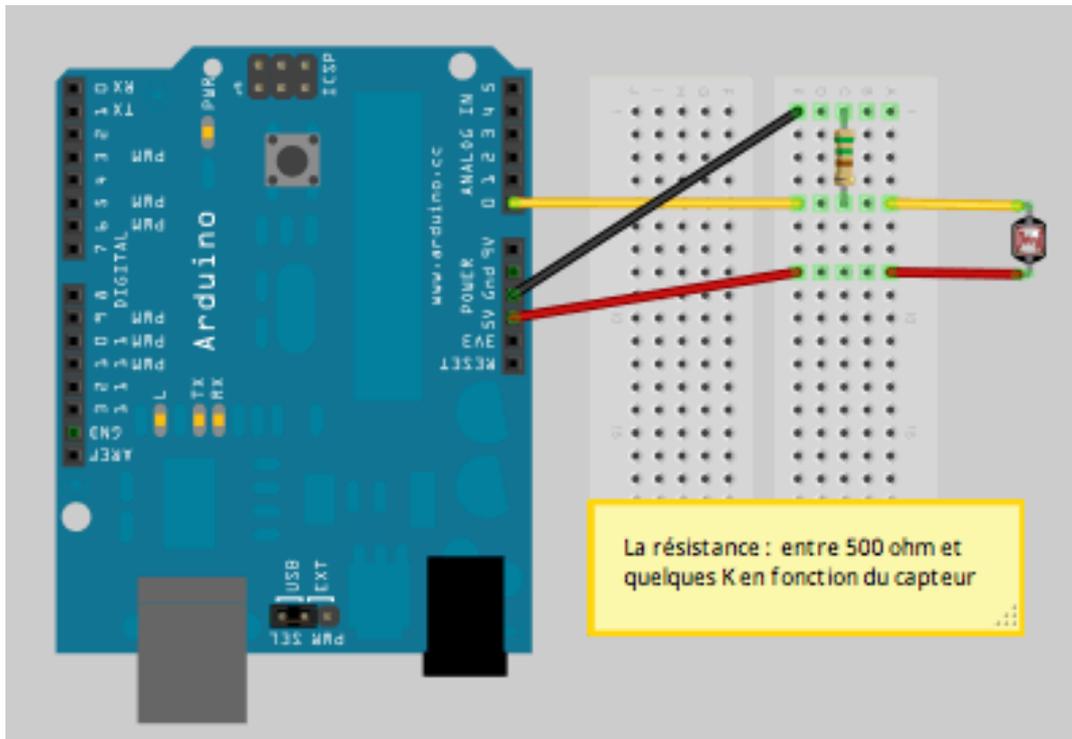


Fig.2 : LDR mounting

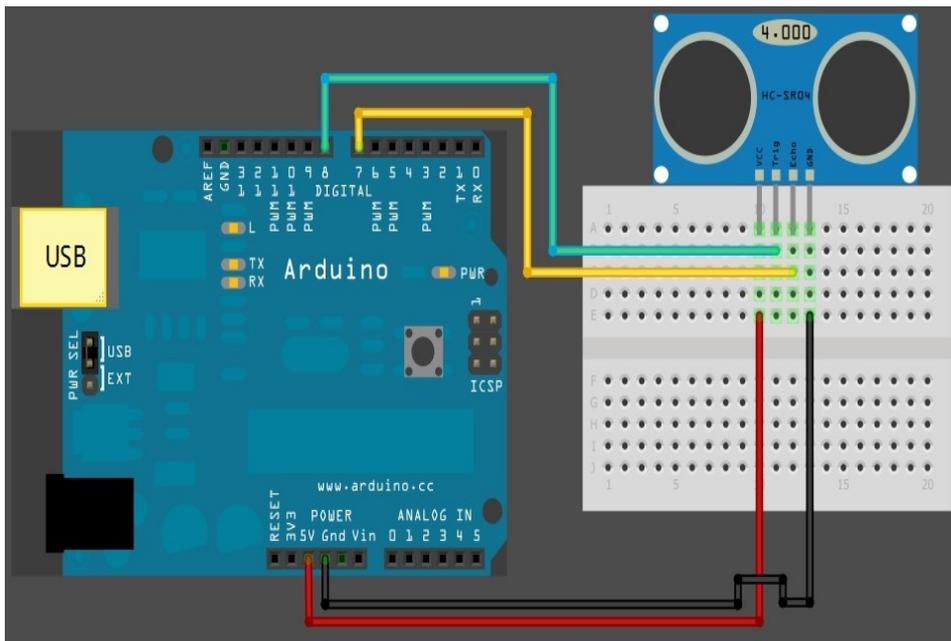


Fig.3 : HCSR04 mounting

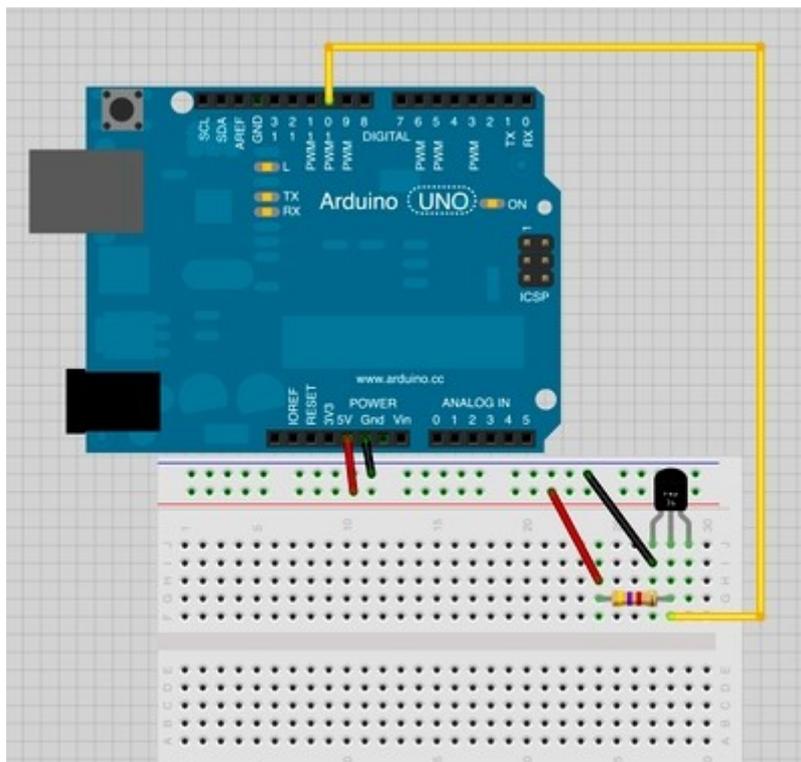


Fig.4 : DS18S20 mounting