DESIGN AND IMPLEMENTATION OF A SMART HOME AUTOMATION SYSTEM FOR ACCESS CONTROL AND DEVICE MANAGEMENT IN A DATA CENTER

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Resumen: Trabajo final para el curso de Taller de electrónica III que trata de un circuito que cumple con tres funciones: la primera es del control de cerraduras eléctricas mediante dispositivos móviles, RFID y teclado, la segunda sobre el control de luces o cualquier actuador conectado al circuito mediante un smartphone. Finalmente, la última función trata sobre la medición de temperatura y humedad de la habitación en tiempo real.

Palabras clave – Domótica, Ingeniería, Diseño, RFID, Bluetooth, motorreductor.

Abstract - Final work for the Electronics Workshop III course that deals with a circuit that fulfills three functions: The first is the control of electric locks through mobile devices, RFID and keyboard, the second about the control of LED spotlights or any actuator connected to the circuit via a smartphone. Finally, the last function deals with the measurement of room temperature and humidity in real time.

Keywords - Home automation, Engineering, Design, RFID, Bluetooth, gear motor.

1. INTRODUCTION

Security in data centers is a fundamental concern to guarantee the integrity, confidentiality and availability of the critical information housed in these environments. With the exponential growth of data and the importance of technological infrastructure, it is increasingly necessary to implement effective security measures to protect assets and ensure the uninterrupted operation of services.

In this context, home automation systems have proven to be a promising solution for improving security in data centers. Domotics, or home automation, consists of the integration of technology and intelligent devices to control and monitor various aspects of the environment. By applying these systems to data centers, a more efficient and proactive management of security is achieved, allowing a quick and accurate response to critical situations.

Home automation systems offer a wide range of applications in data center security. From physical access control to device monitoring and alarm management, these solutions provide an additional layer of protection and enable greater visibility and control over the operating environment.

In this sense, home automation systems can integrate technologies such as video surveillance cameras, motion sensors, alarm systems, biometric access control, among others. These devices communicate with each other and connect to a centralized platform, which facilitates real-time monitoring and informed decision-making.

The implementation of domotic systems in data centers provides significant benefits in terms of security. Early detection of intrusions or anomalies, management of authorized access, environmental monitoring and automated incident response are just some of the capabilities that contribute to strengthening the security and protection of critical assets.

In conclusion, data center security is a crucial aspect in today's digital era. The application of domotic systems offers an innovative and effective solution to improve security and control in these environments, allowing a faster response, more efficient management and comprehensive protection of the technological infrastructure. With the continuous advance of technology, the incorporation of domotic systems in data centers is becoming increasingly relevant to safeguard the integrity and availability of sensitive information. For such reasons, in this article we will present the implementation and design of a domotic system controlled by Arduino for access control and management of electronic devices, such as lights, air conditioning systems, sensor monitoring, etc.

2. PROBLEM DESCRIPTION

What are the possible risks and consequences of an inadequate temperature in a data center for the availability and performance of the hosted equipment and services? How important is it to prevent intruders' access to a data center? Can we efficiently automate the maintenance of a data center without putting the stored information at risk?

The purpose of our work is to solve these problems of both privacy and maintenance through the design and implementation of a home automation system that allows us to control staff access, monitor the temperature and humidity of the room and control certain actuators to automate the maintenance of a data center through home automation.

3. SOLUTION DESCRIPTION

Although there are already existing solutions, they are expensive, so we sought to reduce these costs without affecting quality. For this, we used first quality and economical components. Such as the use of the Arduino microcontroller and its different modules that complement it.

4. THEORETICAL FRAMEWORK

On the left side of the block diagram, we have the sensing stage, where a signal with data is entered, either by fingerprint, RFID or keyboard. At the top we find a smartphone that will be running with an App that is connected directly to the Arduino via Bluetooth, then that signal goes directly to the control system, in this case the Arduino Mega microcontroller that is responsible for light control, lock control and finally will be displayed on an LCD panel the variables measured by the humidity and temperature sensors. On the other hand, in the right section, we find the actuators: the relay that is responsible for the passage of current to drive the LED lights and the lock and the geared motor controlled by the L298N driver, activating or deactivating the lock. The LED lights are controlled by an App from the smartphone.

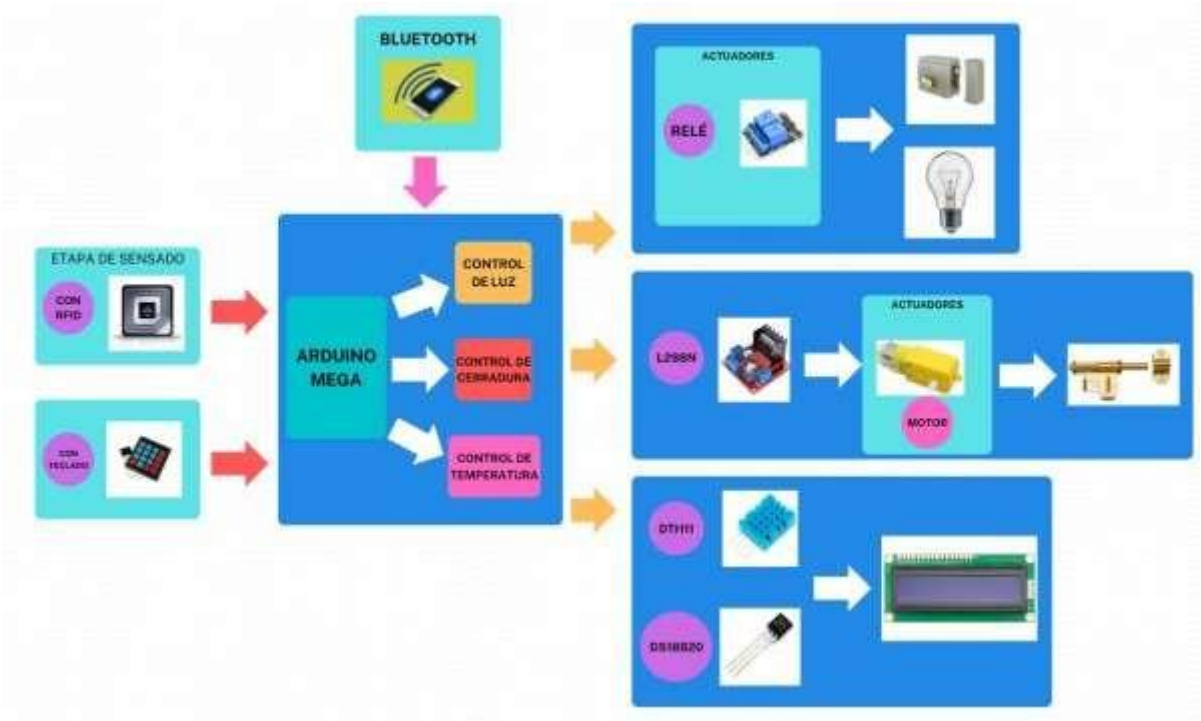


Fig. 1. Block Diagram

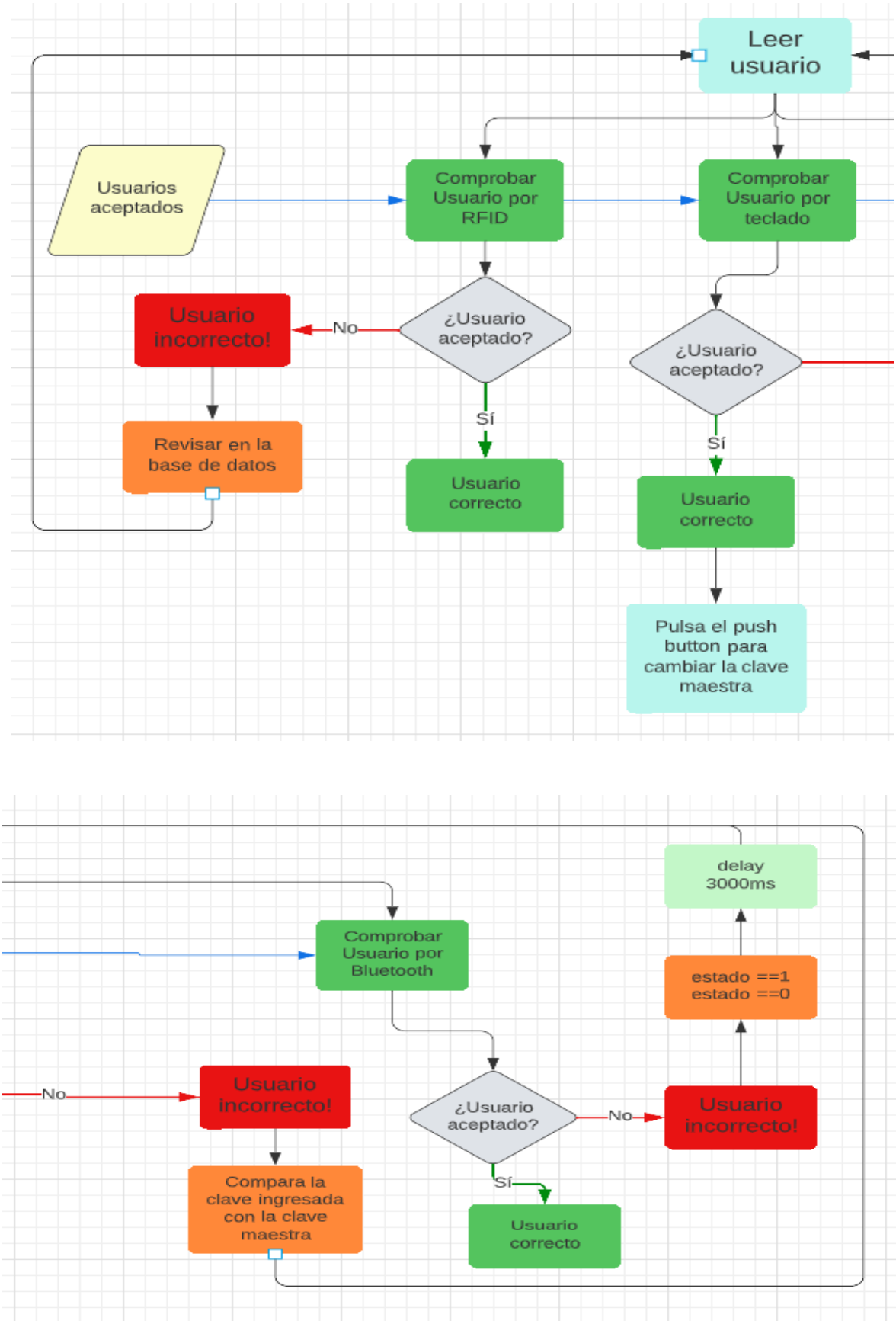


Fig. 2. Electric lock flow diagram

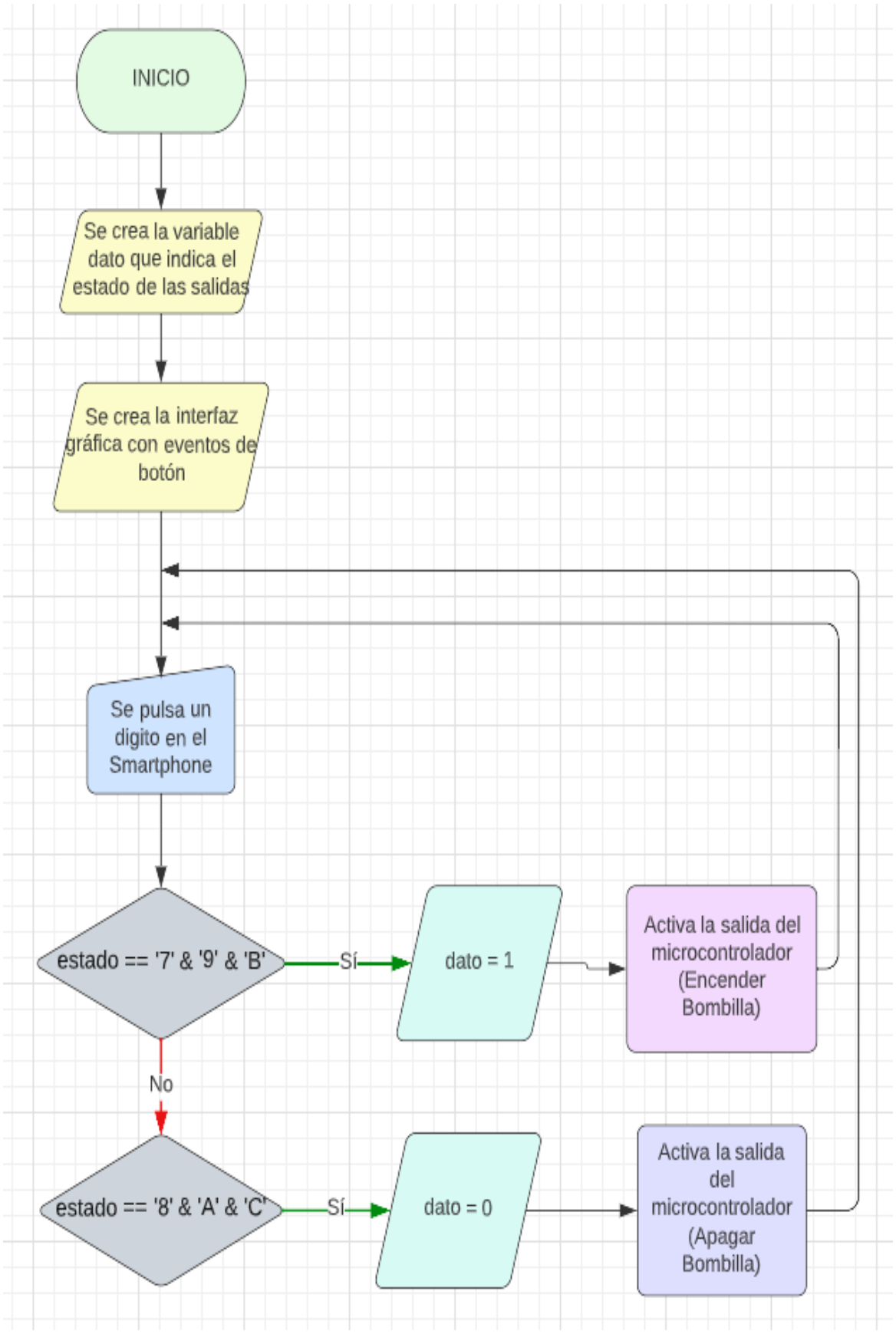


Fig. 3. LED Spotlight Control Flowchart

Fig. 4. Flowchart to detect humidity and temperature of the DTH11 sensor.

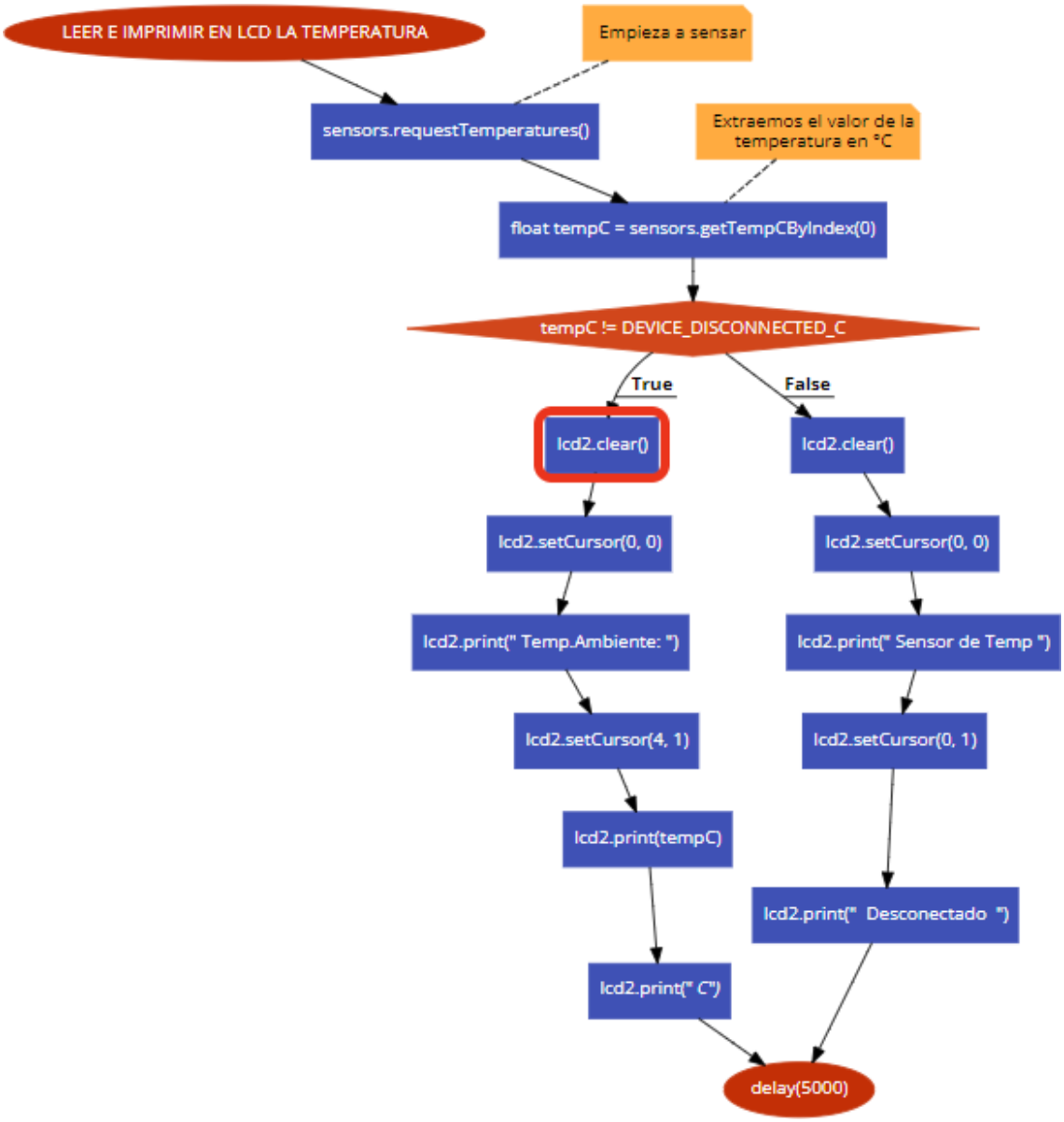
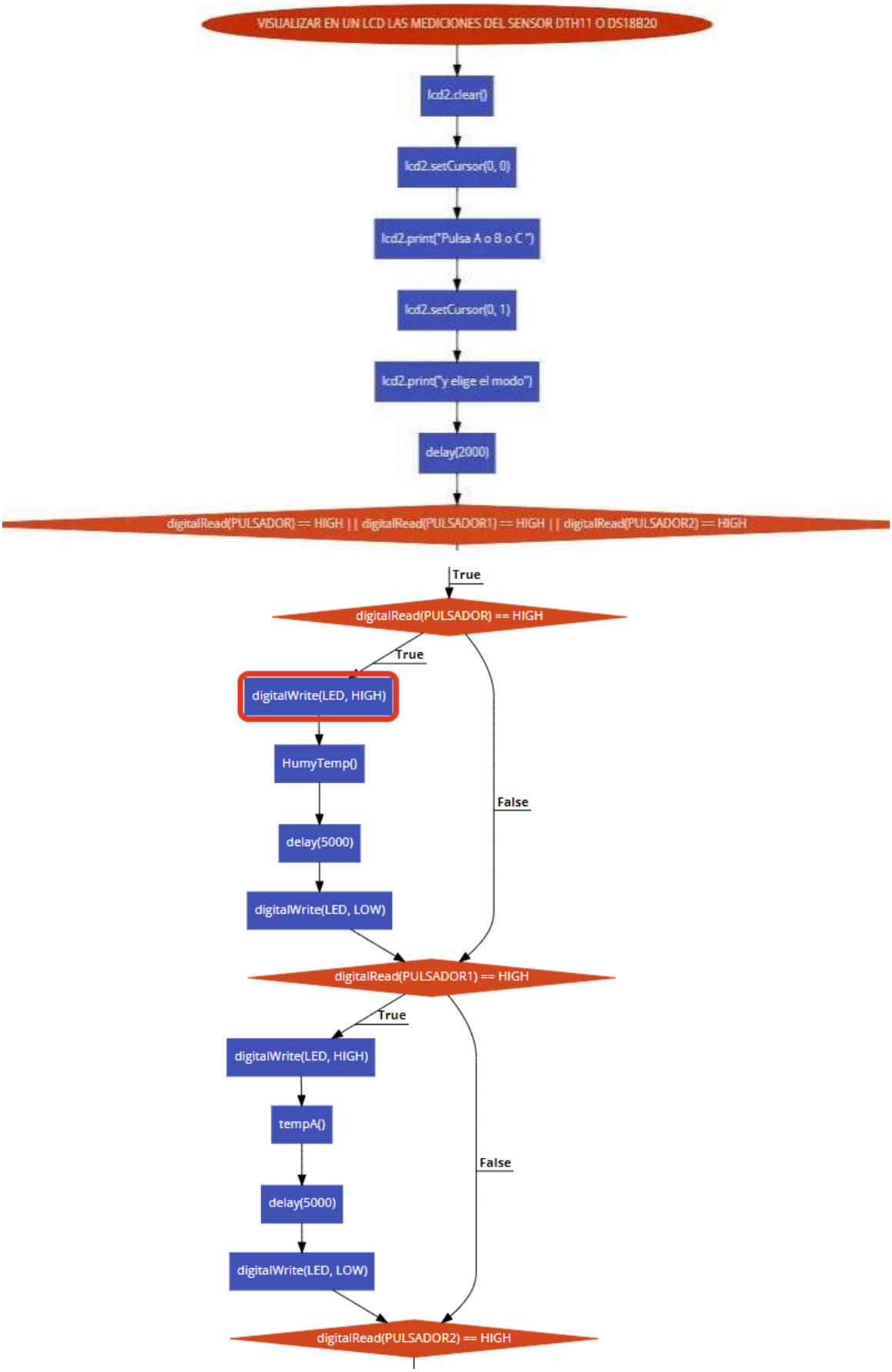


Fig. 5. Flowchart for detecting the temperature of the DS18B20 sensor.


VISUALIZAR EN UN LCD LAS MEDICIONES DEL SENSOR DTH11 O DS18B20
lcd2.clear()
lcd2.setCursor(0, 0)
lcd2.print("Pulsa A o B o C ")
lcd2.setCursor(0, 1)
lcd2.print("y elige el modo")
delay(2000)
digitalRead(PULSADOR) == HIGH || digitalRead(PULSADOR1) == HIGH || digitalRead(PULSADOR2) == HIGH
True
digitalRead(PULSADOR) == HIGH
True
digitalWrite(LED, HIGH)
HumyTemp()
delay(5000)
digitalWrite(LED, LOW)
False
digitalRead(PULSADOR1) == HIGH
True
digitalWrite(LED, HIGH)
tempA()
delay(5000)
digitalWrite(LED, LOW)
False
digitalRead(PULSADOR2) == HIGH

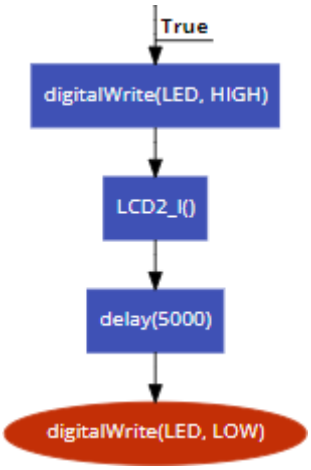


Fig. 6. Flowchart to visualize the measurements taken by the DTH11 and DS18B20 sensors.

5. RESULTS

In the case of the electric lock, it worked well; it responded correctly to the commands sent via Bluetooth with a slight delay of 10ms. On the other hand, RFID card recognition is very fast, however, you have to be very close to the sensor (40cm) to be recognized. Finally, the 4-digit key entry is a bit slow, because the keypad used is a membrane type and it does not have a faster response as other keypads available in the market. It should also be noted that for the key change the conditions proposed in the programming take time to be recognized in its implementation because the Arduino is executed sequentially and not in parallel. The opening with the latch using the geared motor tends to be very fast because it uses 5V to generate the torque needed to slide the latch, however, experimentally it was shown that it takes 130ms to rotate from 0° to 180° to open the door and the same time for the opposite effect; thanks to the H-bridge, L298N.

In the case of light bulb control, the results were successful since the relays responded satisfactorily to the orders sent through the cell phone and, thus, the correct switching on and off of the light bulbs immediately.

Finally, the temperature and humidity measurements performed were successful. On the one hand, the DTH11 sensor provided a measurement of both variables, but its accuracy and operating range are not optimal. On the other hand, the DB18DB20 sensor provides the temperature in degrees Celsius with a more accurate precision than the DTH11 sensor, but it cannot calculate the humidity of the environment.

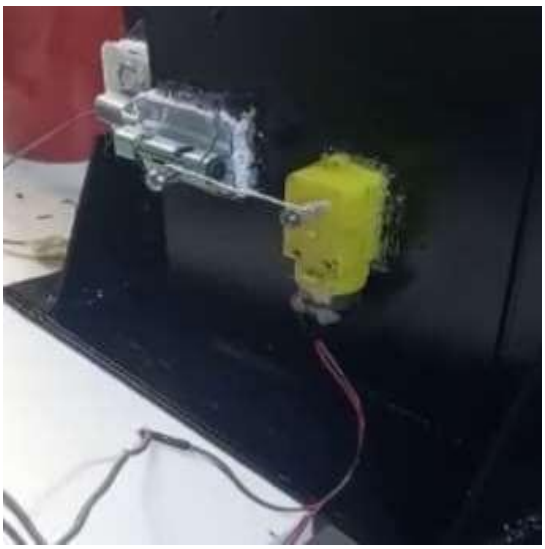


Fig. 7. Electric Lock

Fig. 8. Latch and geared motor

Fig. 9. LED spotlights

6. CONCLUSIONS

It was possible to design and implement the three proposed systems using the Arduino and the mobile device.

This set of systems serves as a guide for the transition to a smart home, in which you can increase the feeling of comfort to manage lighting, locks, etc. and be able to do it in a simple way simply by using the cell phone.

The project allowed us to discern between the measurement of variables produced by two inexpensive sensors on the market, in which we preferred the DB18DB20 sensor, due to its accuracy and greater range of temperatures to be measured.

REFERENCES

[1] Rodriguez-Gracia, D., Piedra-Fernandez, J. A. & Iribarne, L. (2015). Adaptive Domotic System in Green Buildings.

[2] Vaidya, V. D. & Vishwakarma, P. (2018). A Comparative Analysis on Smart Home System to Control, Monitor and Secure Home, based on technologies like GSM, IOT, Bluetooth and PIC Microcontroller with ZigBee Modulation.