Documentation

Hammer

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1 Team members

- Moataz Elbayaa " moataz.elbayaa@stud.hshl.de "
- Ahmed Helmy " ahmed.helmy@stud.hshl.de "
- Manoj Luitel " manoj.luitel@stud.hshl.de "
- Saikot Das Joy " saikot-das.joy@stud.hshl.de "

Introduction

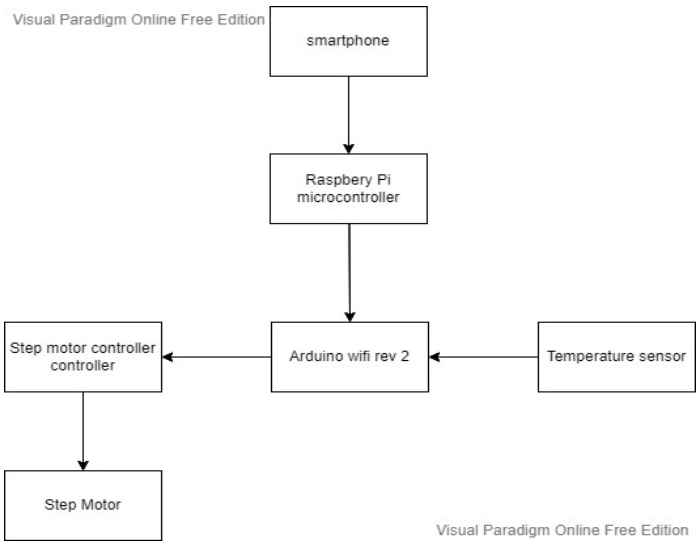
Smart homes are the technological advancement that have made our lives easier, more comfortable and convenient, also it is ensures that we save electricity and reduce the used power, for example in our case and our device which is used to control the room temperature can help us to save a significant power and electricity by setting the room temperature always in a specific range or a desired temperature according to what user sets from smart phone.

The "Internet of Things" is established under a spatial network interconnected with the devices such as Raspberry Pi, an android control application called IoT MQTT Panel and Arduino Uno Wi-Fi connected with a temperature module. These devices use Wireless Sensor Network that checks current temperature, receives the desired temperature from the user via. Smartphone and enables the system to setup the temperature on demands. The output of the sensor is an electrical signal that's transmitted to a controller for further processing.

Concept description

Our concept is kind of Smart home ideas, Room temperature controller where the user can enter the desired temperature by using android control application then accordingly the step motor will start rotating either to make room warmer or cooler.

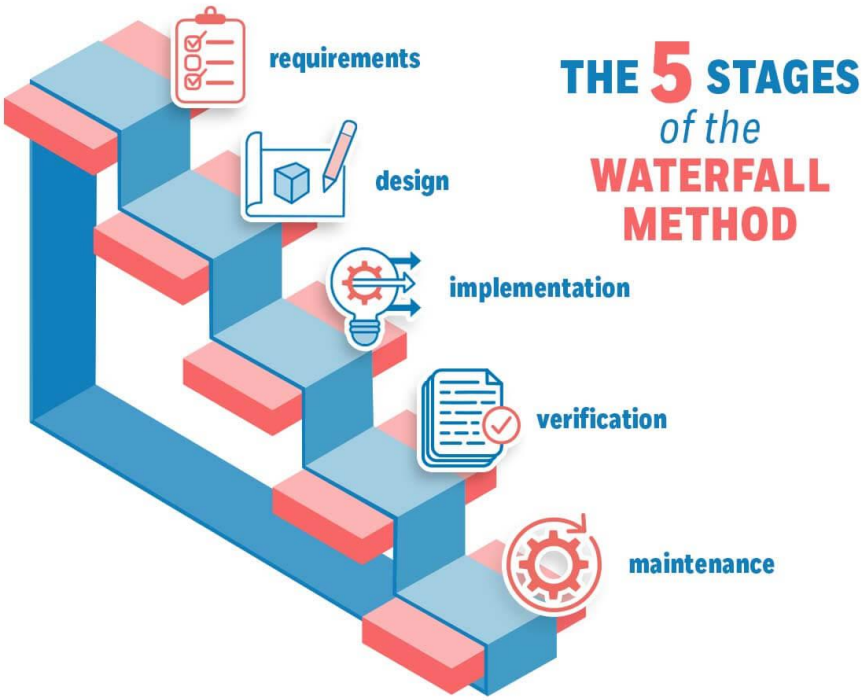
Here you can find a video for the idea o the Project and it is Implementation. (**Link**)



Project/Team management

the method that we used for our project management is the Waterfall model which allowed us to set our requirement clearly from the beginning as well as it is fit to our team members because it is require a small size team and it is for less complex system.
The steps that we followed for our project are the following:

1-Requirements:is the first phase that setting the stage for the rest of the phases of the software application development, and it aims to come up with Requirement Specification.
2-Design: in the Design Phase is to transform the requirements into complete and detailed system design specifications.
3-Implementation: involves putting the project plan into action so in this phase we take the project requirements and specifications and start to code the application.
4-Verification:it is the phase that we check if we are building the product right and we also check if the software meets the requirements and specifications.
5-Maintenance: it is the phase where we provide support and maintenance to the software and making sure it runs smoothly, and checking it comes across errors/defects/ bugs during use, fixing them is the main purpose of this stage.



Source:https://managementhelp.org/waterfall-methodology

Team Management:
The concept of our project (wireless temperature controller) was raised through the intensive discussion among 4 team members. The overall tasks of complete project were handled together and improved based on the feedback from one another within the group.

Technologies

Sensor Technology:

KY-001 Temperature sensor (DS18B20) is used which is a digital thermometer for 9-bit to 12-bit Celsius temperature measurements. The sensor has a programmable upper and lower limit. The DS18B20 communicates via a 1-wire bus system, which requires only one data line for communication with a central microprocessor of Arduino Uno Wi-fi Rev2. In addition, the DS18B20 can draw power directly from the data line and eliminates an external power source. It has a unique 64-bit serial code. This allows multiple sensors to operate on the same 1-Wire bus and be evaluated by only one microprocessor.
Applications that can benefit from this feature include HVAC environmental controls, temperature monitoring systems in buildings, plants or machinery, and process monitoring and control systems.

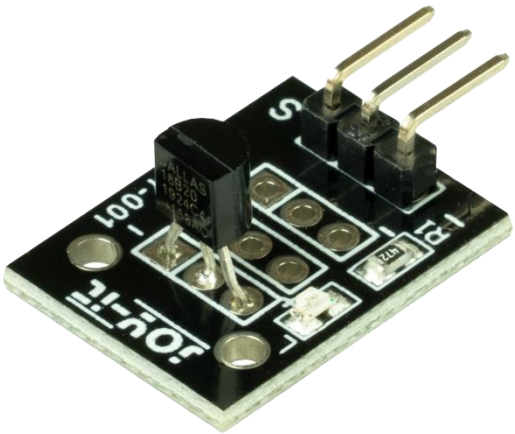


FIG: KY-001 TEMPERATURE SENSOR (DS18B20)

The DS18B20 digital thermometer provides 9-bit to 12-bit Celsius temperature measurement

Hardware we used:

1. KY-001 Temperature Sensor (DS18B20) ---1
2. Arduino Uno Wi-Fi Rev2 --- 1
3. Cable to Upload Arduino code to Arduino ---1
4. Raspberry Pi ---1
5. Raspberry Pi power cable ---1
6. HDMI cable for raspberry PI to connect with Monitor ---1
7. A stepper dc motor ---1
8. Smartphone With Android Operating System --1

Software we used:

(1) Arduino IDE
(2) Raspberry Pi operating System

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(3) IoT MQTT Panel android app

Wireless communication between Arduino, Raspberry Pi and Smartphone:

WIFININA Library: Enables network connection (local and Internet) with the Arduino MKR Wi-Fi 1010, Arduino MKR VIDOR 4000, Arduino UNO WIFI Rev.2 and Nano 33 IoT.
With this library, you can instantiate Servers, Clients and send/receive UDP packets through Wi-Fi. The board can connect either to open or encrypted networks (WEP, WPA). The IP address can be assigned statically or through a DHCP. The library can also manage DNS.
In our Project , we need this library to establish Wi-Fi communication.

MQTT: MQTT (Message Queuing Telemetry Transport) is a messaging protocol for restricted low-bandwidth networks and extremely high-latency IoT devices. Since Message Queuing Telemetry Transport is specialized for low-bandwidth, high-latency environments, it is an ideal **protocol** for machine-to-machine (M2M) communication.
MQTT works on the publisher / subscriber principle and is operated via a central broker. This means that the sender and receiver have no direct connection. The data sources report their data via a publish and all recipients with interest in certain messages ("marked by the topic") get the data delivered because they have registered as subscribers.

Programming language:

- Programming in Arduino.

Implementation

➢ Smartphone:

1. We download the app name "IoT MQTT Panel"
2. We connected our smartphone to the same Wi-Fi that Raspberry Pi and Arduino is connected
3. Open the app.
4. Create a dashboard with any name
5. Establish a connection with Raspberry Pi with Raspberry Pi IP address
6. Create a text input section with any name but the topic name should be "desired_temperature"
7. We can now send data to the topic "desired_temperature" with this text input block

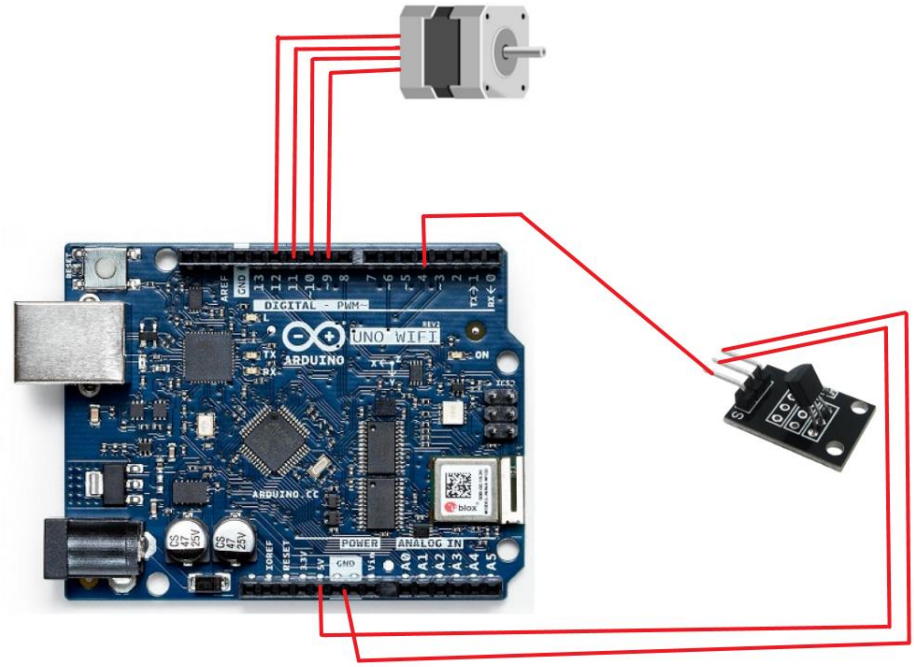
➢ Raspberry Pi

1. We downloaded Raspberry Pi operating system and installed it on a memory card
2. Insert the memory card in the Raspberry PI
3. Power Raspberry Pi
4. Connect Raspberry Pi with a monitor using a HDMI cable
5. Connect raspberry Pi with keyboard and Mouse
6. Connect Raspberry Pi with the same Wi-Fi that Arduino and smartphone is connected

7. Set up Raspberry Pi.
8. Open a command window in Raspberry Pi
9. Install MQTT on it
10. It is possible to get a raspberry pi IP address from a command, But one can also find it on the network host like a router or anything on the connected device list.
11. Allow Raspberry Pi to remote access for MQTT

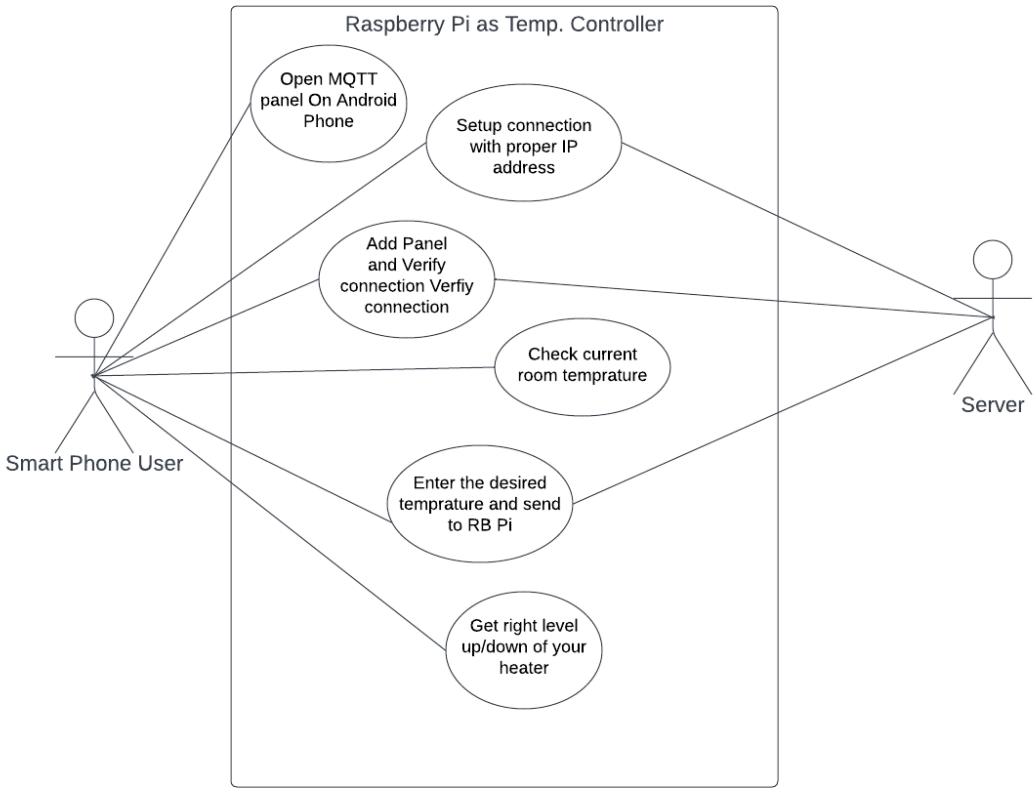
➢ Arduino

1. Set up the circuit connection as shown below



2. Write down Arduino Code in Arduino IDE after installing indicated libraries and board setup in Arduino IDE.
3. Upload the Code (You can find the code in github Repository).
   (**Link** to .rar file of the code)

Use Case



Sources/References

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[2] https://online.visual-paradigm.com/drive/#diagramlist:proj=0&dashboard

[3]https://mymoodle.hshl.de/pluginfile.php/1617518/mod_resource/content/1/00_Lab.pdf?redirect=1

[4]https://mymoodle.hshl.de/pluginfile.php/1621058/mod_resource/content/2/02_Lab_Arduino_Sensors.pdf?redirect=1

[5] https://sensorkit.joy-it.net/en/sensors/ky-001

[6] https://docs.arduino.cc/tutorials/mkr-1000-wifi/mkr-1000-mqtt-device-to-device

*[7]*https://mymoodle.hshl.de/pluginfile.php/1623655/mod_resource/content/3/03_Lab_Raspberry_Pi.pdf?redirect=1

*[8]*https://mymoodle.hshl.de/pluginfile.php/1627076/mod_resource/content/3/04_Lab_MQTT.pdf?redirect=1

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