

IoT Thermostat with Passive Notification System

Human Computer Interaction

Iacopo Erpichini

Computer Engineering
University of Florence

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Introduction

The Internet of Things is an ecosystem of connected physical objects accessible through the Internet.

Smart Systems and IoT are driven by a combination of:



Connectivity



People & Processes



Sensors

Some fundamental aspects used in this project are:

- Integration human society an physical system
- Act as technology integrator
- Flexible configuration
- Improve the resource utilization ratio
- Dynamic control of industrial and daily life



Home Automation

Home automation makes your life more convenient by making certain tasks occur automatically. Generally, most home automation devices are IoT devices.

Home automation works on three levels:

- **Monitor:** the user can check in on their devices remotely through an app
- **Control:** the user can control these devices remotely
- **Automation:** the user can setting up devices to trigger one another

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Ubiquitous Computing

It is a concept where computing is made to appear anytime and everywhere.
The main aspect are:

- Remove complexity of new technology
- Invisible
- Decision Making & Information Processing
- Enhancing experience

Communicate in different ways, *Ubiquitous Sensing* give to a system "eyes and ears", adding "Awareness" and Automatic Measuring



Project Idea

The idea is to create a low-cost, easily reproducible, Open Source system that allows users to use the Ubicomp idea to receive a passive notification based on the temperature of a room.

Goal

- Make a physical device that can be installed everywhere
- Make an interface to interact via Internet to the device
- Using UbiComp idea on a Smart Bulb



Device

Features

The device features are:

- Low-Cost
- Open Source
- Can be installed in every environment
- Connection to a smart bulb **to send passive notification**
- Measures temperature/humidity
- Provides an interface through a Chat Bot

Two alternatives have been considered for the realization of the system.

In the end a 3D print model has been realized.

Features

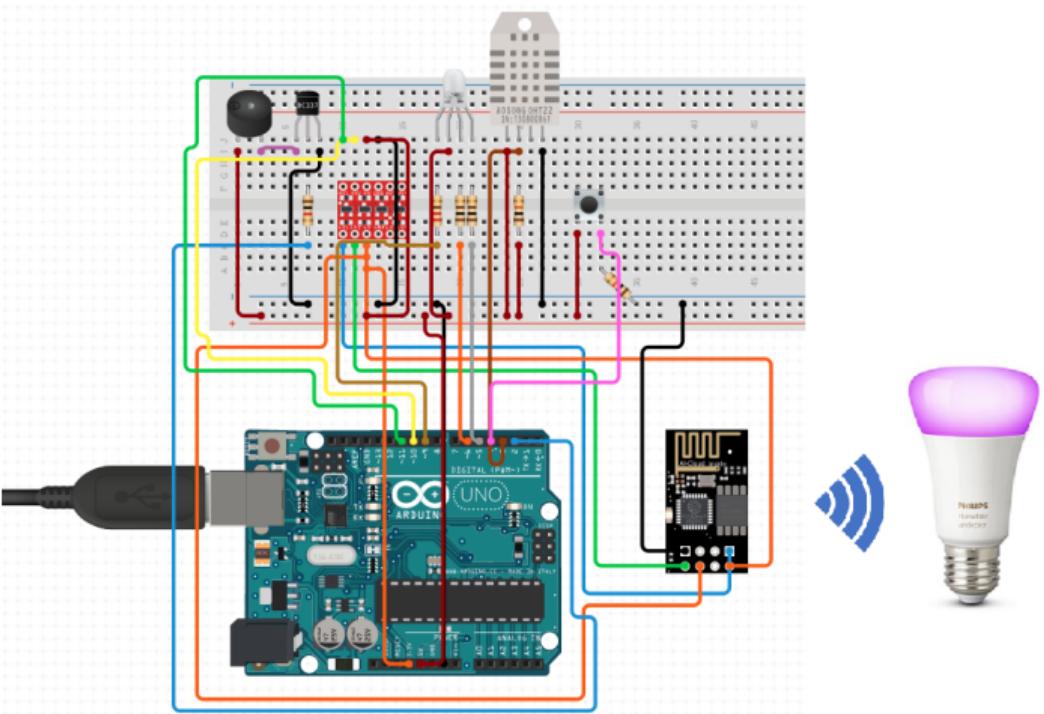
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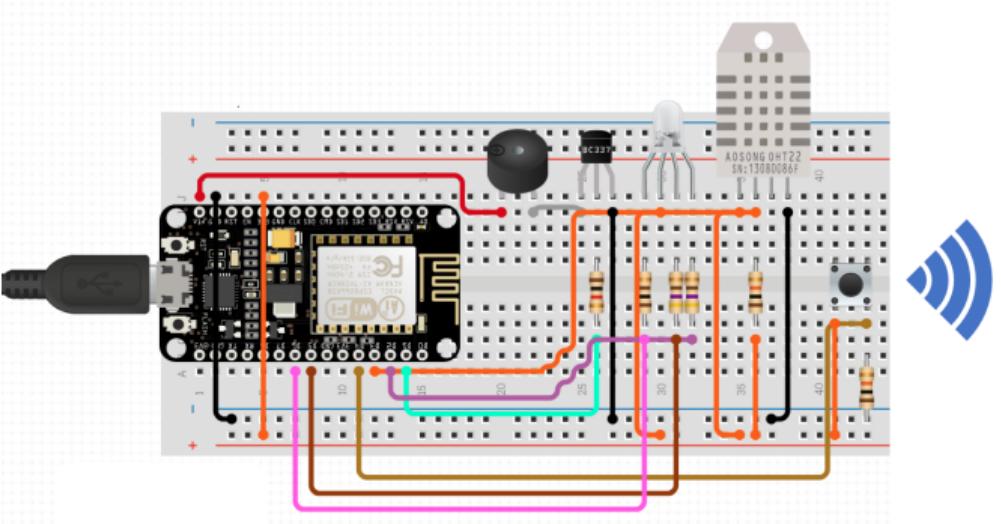
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Arduino Circuit



Node MCU ESP-12 Circuit





Arduino vs ESP-12

Pro:

- Node MCU is cheaper than Arduino
- Node MCU has Wi-Fi module on board
- IoT oriented

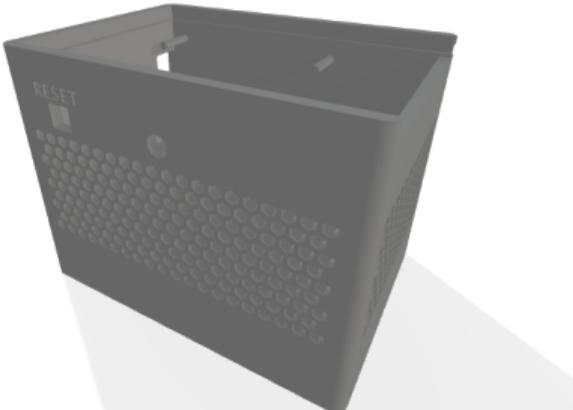
Cons

- Some Node MCU Chips are without documentation
- Needs an integration to flash code with Arduino IDE
- For more complex circuit Node MCU has less pins than Arduino

Prototyping

Features:

- A honeycomb grid that allows airflow to measure the temperature
- A led that displays sensor state in real time
- A reset button



Result





Interface - Chat Bot

Telegram Bot

Chat Bots are third-party applications that run inside Telegram

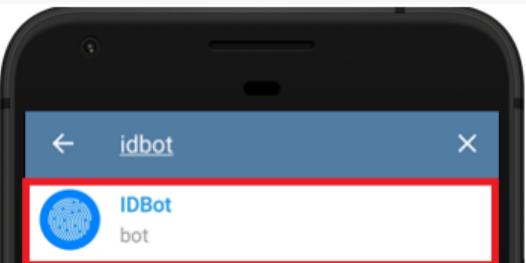


- BotFather is a bot that allows users to create new bot with the command /newbot
- The bot interactions are programmed in the device firmware

Security



Anyone that knows the bot username can interact with it.



To prevent this problem users can get the Unique Telegram ID with this bot
texting to it /getid.

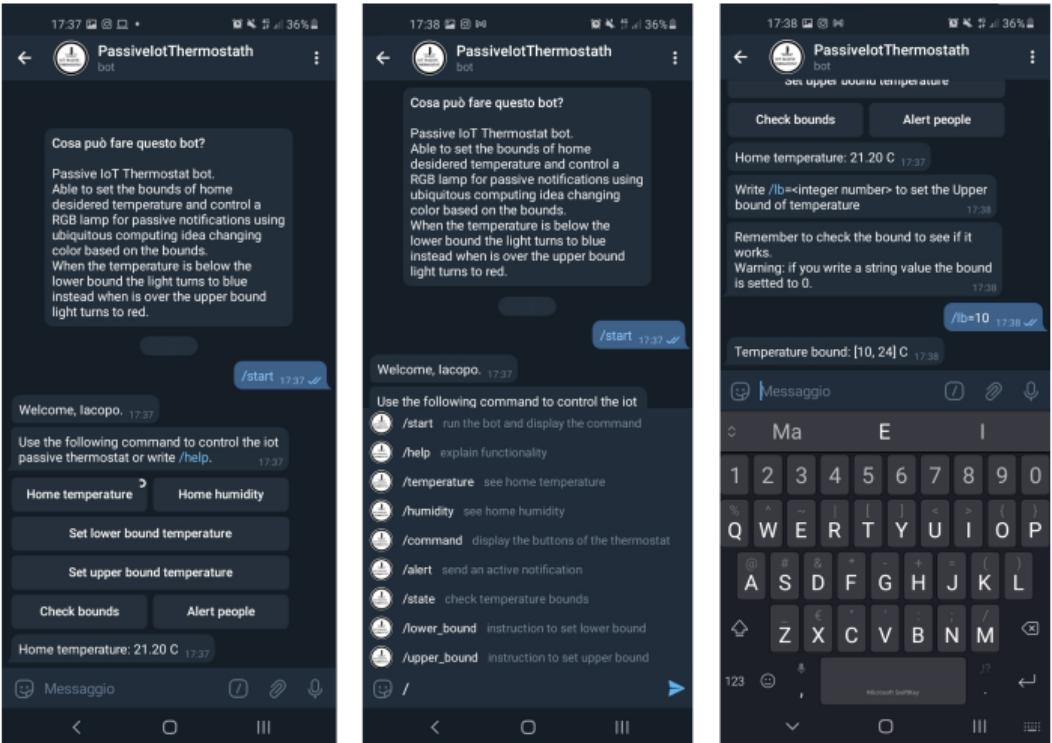
Use unique ID in micro controller firmware

Functions

Main Functions:

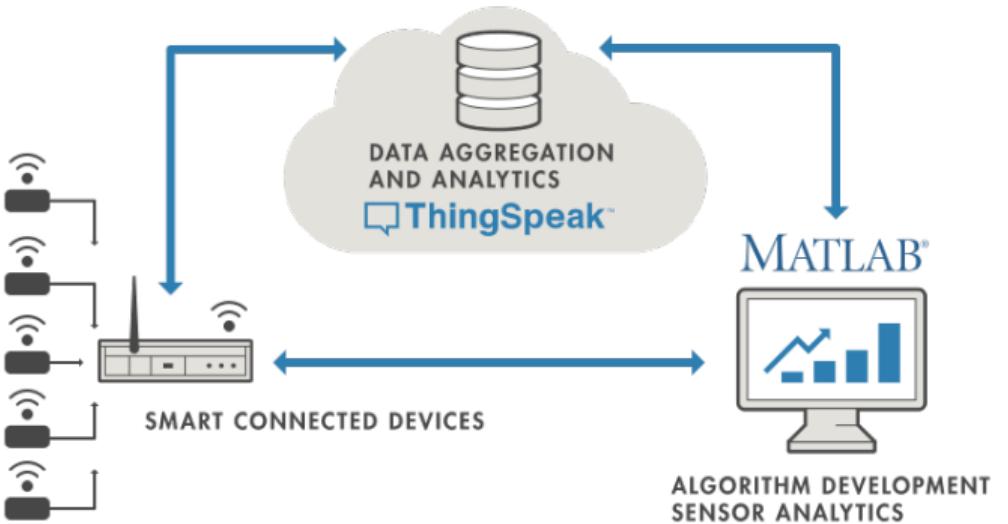
- Retrieve information about temperature and humidity
- Check temperature bound
- Set temperature bound
- Notify user with alarm
- Being notified when user reset the device

Bot Screen



Another tool for IoT: ThingSpeak

Easily configure devices to send data to cloud using popular IoT protocols.



The device historical data are stored with this service.



Test

Test type:

- 1: Test for user without computer skills. Consists in chat with bot and check if the prototype made is sufficiently user-friendly
- 2: Test for users with IT skills. It is about replicating the whole system

All the tasks are of the “closed” type.

Test 1: Standard User

Question	Mean Rating	σ
Find Bot on Telegrams and start messaging	6.75	0.187
Retrieve information about Temperature	6.875	0.109
Retrieve information about Humidity	6.875	0.109
Change Thermostat Bound	5.125	1.109
Check Thermostat Bound	6.375	0.734
Launch the alarm through bot	6.75	0.187
Reset physical device	6.375	0.484
The system is easy to learn	6	0.5
Overall, I am satisfied the system	6.125	0.359



Test 2: Advanced User

Question	Mean Rating	σ
Build the circuit	6	1
Analyze firmware and change parameters	7	0
Install add-on in Arduino IDE	6.5	0.25
Flash the ESP 12	7	0
Create Telegram Bot	7	0
Create ThingSpeak Channel	6	1



Conclusions



Conclusion

The system has a physical low-cost device for passive notification, it also provides an interface with a high customization.

The system is designed to be replicated in a easy way by a user who has IT skills. Test 2 confirm this result.

Test 1 shows a limit in Telegram Bot. Unfortunately, Telegram API only provides an interaction via text commands. Therefore to set a bound, it was decided to do it via a text string.

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Future Works



This project has been entirely designed to be extensible.

The idea of passive notification using a light bulb can be used in many fields:

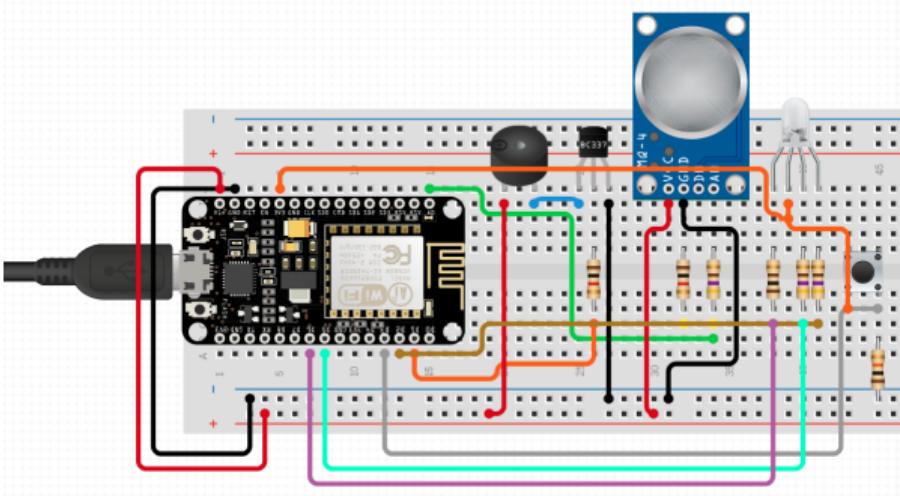
- **Example 1:** a circuit with a gas sensor to control the air quality
- **Example 2:** a circuit with a proximity sensor that can be installed on a door jamb and used like an intrusion detector



Thanks for the attention!

Extra (1)

Circuit for air quality sensor



Extra (2)

Circuit for proximity alarm sensor

