ESW Project Submission

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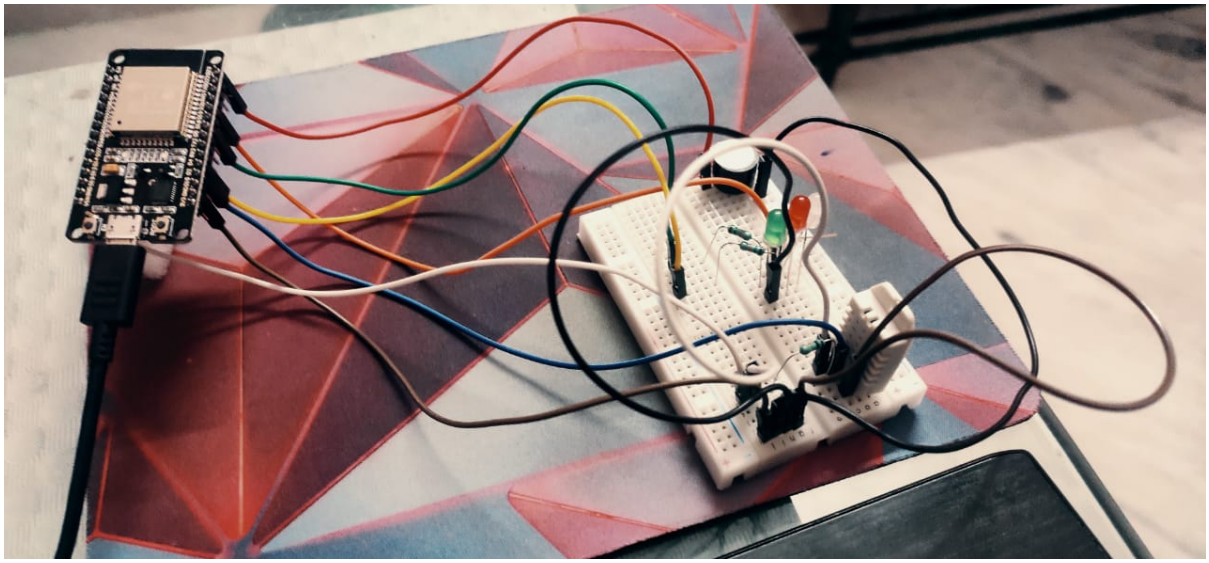
Project Description



We create an IoT device with temperature and humidity measuring capability (via DHT) with LEDs and Buzzer as indicators and warning mechanisms along with a cloud connection for uploading measurements (using ESP32).

Following are the contents of this report:

Link to the required video: https://www.youtube.com/watch?v=0EJCwG2Ehrk

Apparatus Used

- ESP32
- DHT Sensor
- Red LED, Green LED, RGB LED
- Buzzer B10
- 11 wires
- Breadboard
- 3 resistors

- USB connector

Aim

In this project my primary goal is to create a IoT environment to keep track of room temperature and humidity. While trying to do so, I have also maximized the number of parts used.

I shall now describe the usage of each individual parts that I have employed in the project.

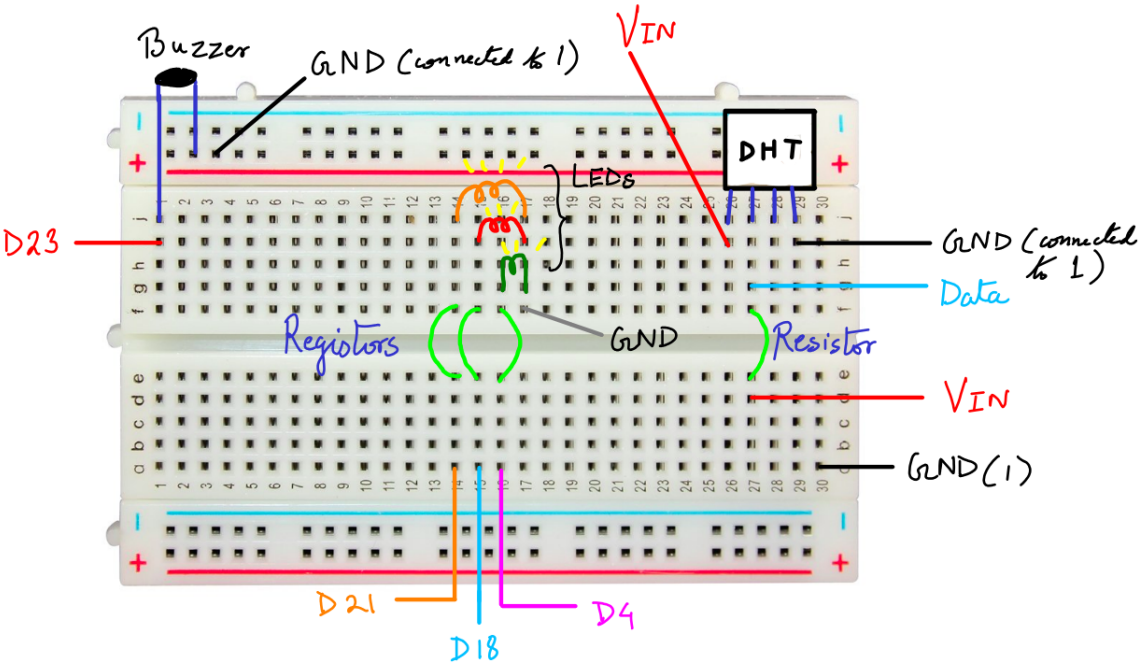
1. DHT sensor: To measure temperature and humidity
2. LEDs: To indicate changes in temperature (bright red to indicate extremities)
3. Buzzer: To alarm residents whenever humidity gets too high or too low
4. ESP32: To record the data, interact with sensors and upload the records to a cloud storage

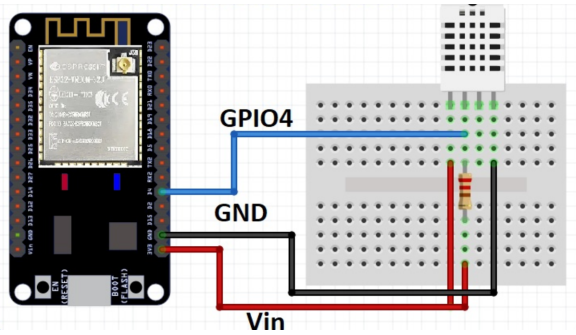
Use and Scalability

This environment can also serve as a fire alarm and is perfect for places in a house where there is a high requirement for temperature moderation or chances of catching fire. Moreover, the project is highly scalable via using more sensors and indicators as can be deemed suited.

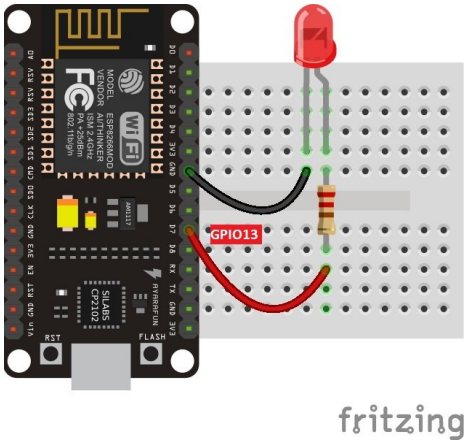
- Adding more sensors could allow us to compare the temperatures across the rooms as well as temperature variation within a particular room.
- Using more indicators, i.e. more LEDs and Buzzers can be used to describe the temperature range with greater precision.

Circuit Analysis





DHT Sensor

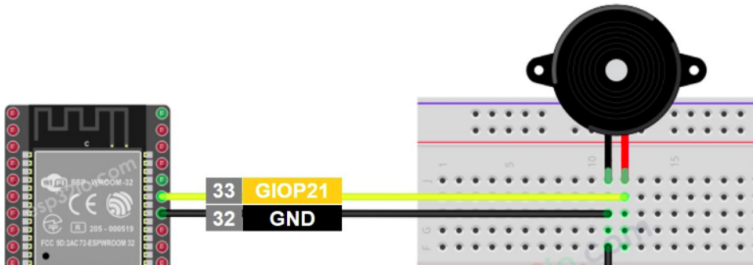


LED Circuit

Here are the circuit arrangements specific to DHT sensor, Buzzer and LED. With respect to my project, I have used a single GND hub and Power (Vin hub).

The pins for input of the LEDs are 4, 18 and 21 respectively while that of the buzzer is 23.

In case of the DHT, I have used pin 2 for the data. The ESP32 is connected to my laptop via an USB port and I am writing to it via `/dev/ttyUSB0`.



Buzzer

Functionality

We use `micropython` to code for the project. It can be found in the `./main.py` file present in the folder.

Instructions to run the code:

- `sudo pip install esptool` to install esptool
- `esptool.py --port /dev/ttyUSB0 erase_flash`
- `esptool.py --chip esp32 --port /dev/ttyUSB0 write_flash -z 0x1000 esp32-20210912-unstable-v1.17-20-g0a5107372.bin` the binary file mentioned here is required to be downloaded and wrt this project can be found in the `./bin/` folder.
- `pip install adafruit-ampy`
- `sudo chmod 777 /dev/ttyUSB0`
- To finally run the program use `ampy --port /dev/ttyUSB0 --baud 115200 run main.py`

The ESP32 takes in data from the DHT sensor (temp, humidity) and then activates the LEDs and Buzzer based on the measured data. This data is also further reported to the thinkspeak channel via an api call.

Working of the LEDs:

```
# Make LED blink corresponding to temperature value
if temp <= 15:
    blink(2)
elif temp <= 30:
    blink(0)
elif temp <= 35:
    blink(1)
else:
    blink(2)
```

1. When $\text{temp} \leq 15$ or > 35, a bright red colour is presented by the multicolor LED, meant to be a warning sign.
2. When it is moderate that is, $\text{temp} > 15$ but ≤ 30, a serene green light blinks.
3. When the temperature is $\text{temp} > 30$ but ≤ 35, a red LED blinks.

Working of the Buzzer:

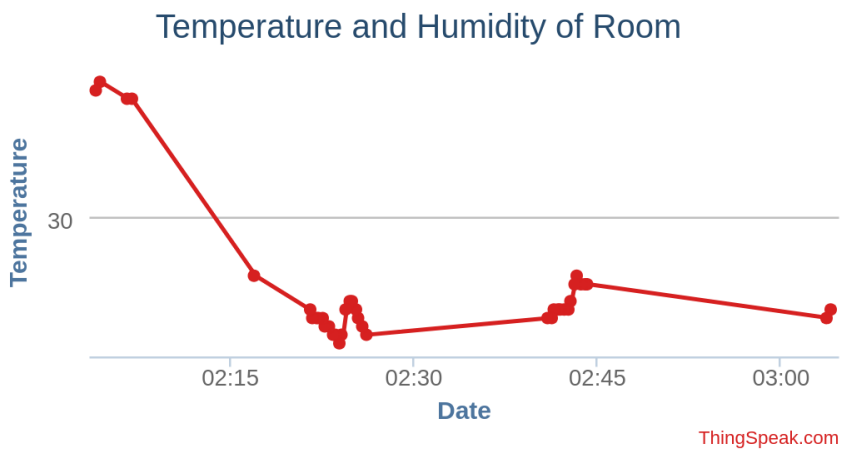
```
# Ring the buzzer when humidity goes beyond threshold
if humidity <= 10:
    buzz()
elif humidity >= 80:
    buzz()
```

The buzzer rings if and only if humidity is ≤ 10 or ≥ 80.

The descriptions on how we are making the LEDs blink and the Buzzer buzz are described in the `blink()` and `buzz()` functions respectively.

Results

Here are the relevant graphs that show the range of measured temperature and humidity based on time.



Initially, the room was at a temperature greater than outside temperature and a humidity value compared to that of outside. Then, after the air conditioner in the room was switched on, we observed a great fall in temperature and humidity.

The spikes in the humidity chart are observed on account of blowing air over the DHT sensor. We also see an associated minor temperature spike because of the same. We observe such an effect because the

air from our nose and mouth is warmer and contains a relative larger amount of water vapour.