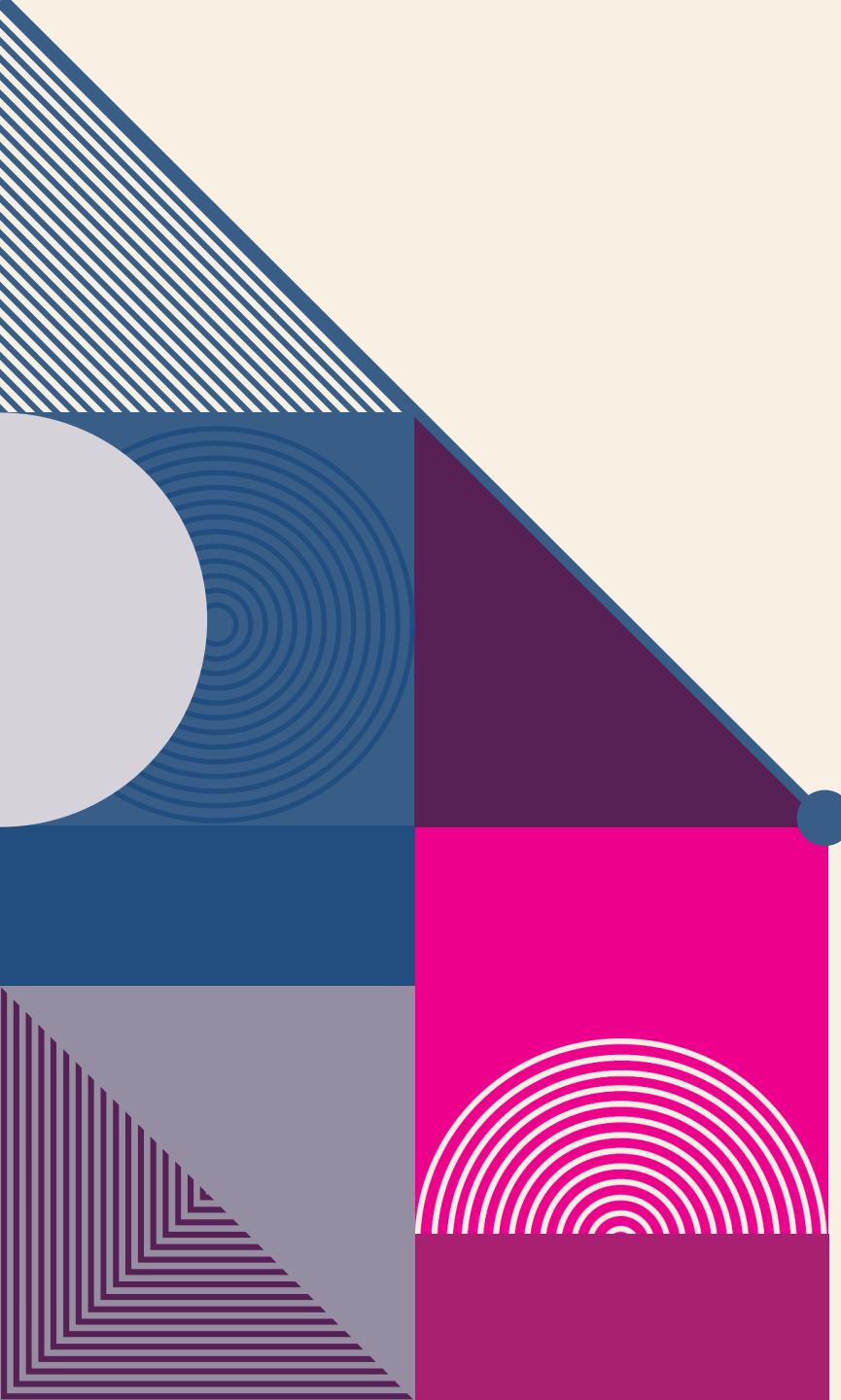
A complex abstract graphic on the left side of the slide consists of several overlapping and nested geometric shapes. It includes a large white circle, a dark blue triangle, a grey circle, a red square, a grey triangle, and a red triangle. The shapes are rendered in various shades of blue, red, and grey, with some featuring internal radial or linear patterns.

SMART HOME AIR HEATER CONTROL AND MONITORING

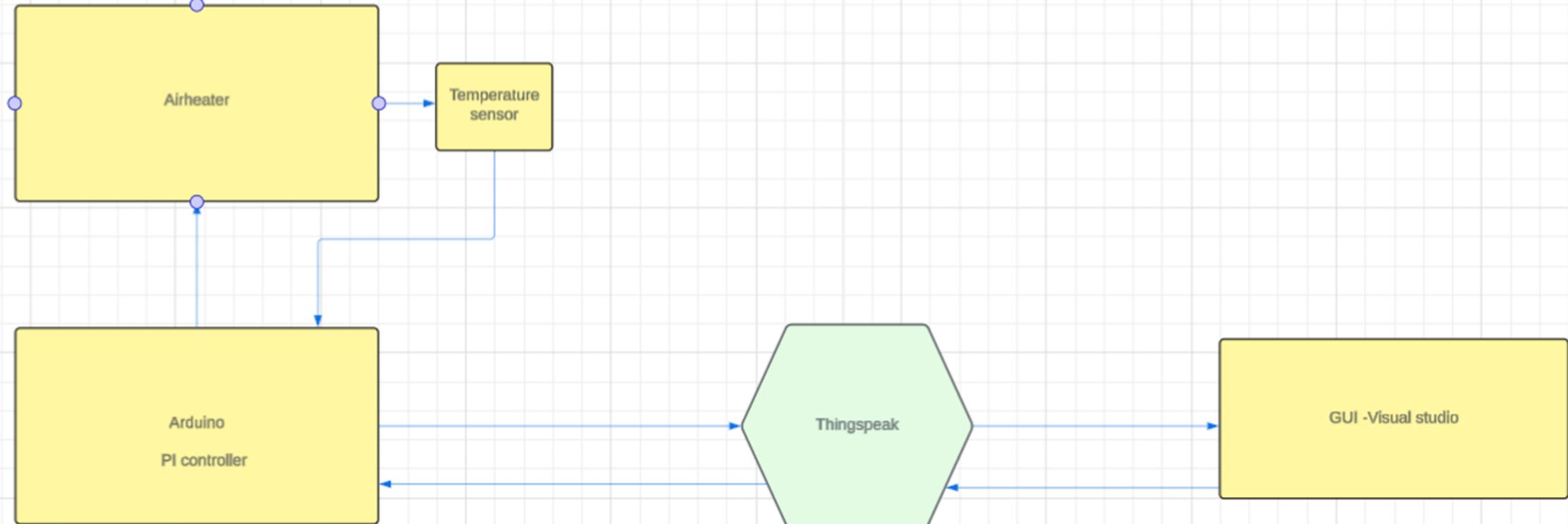
By Ola Reda

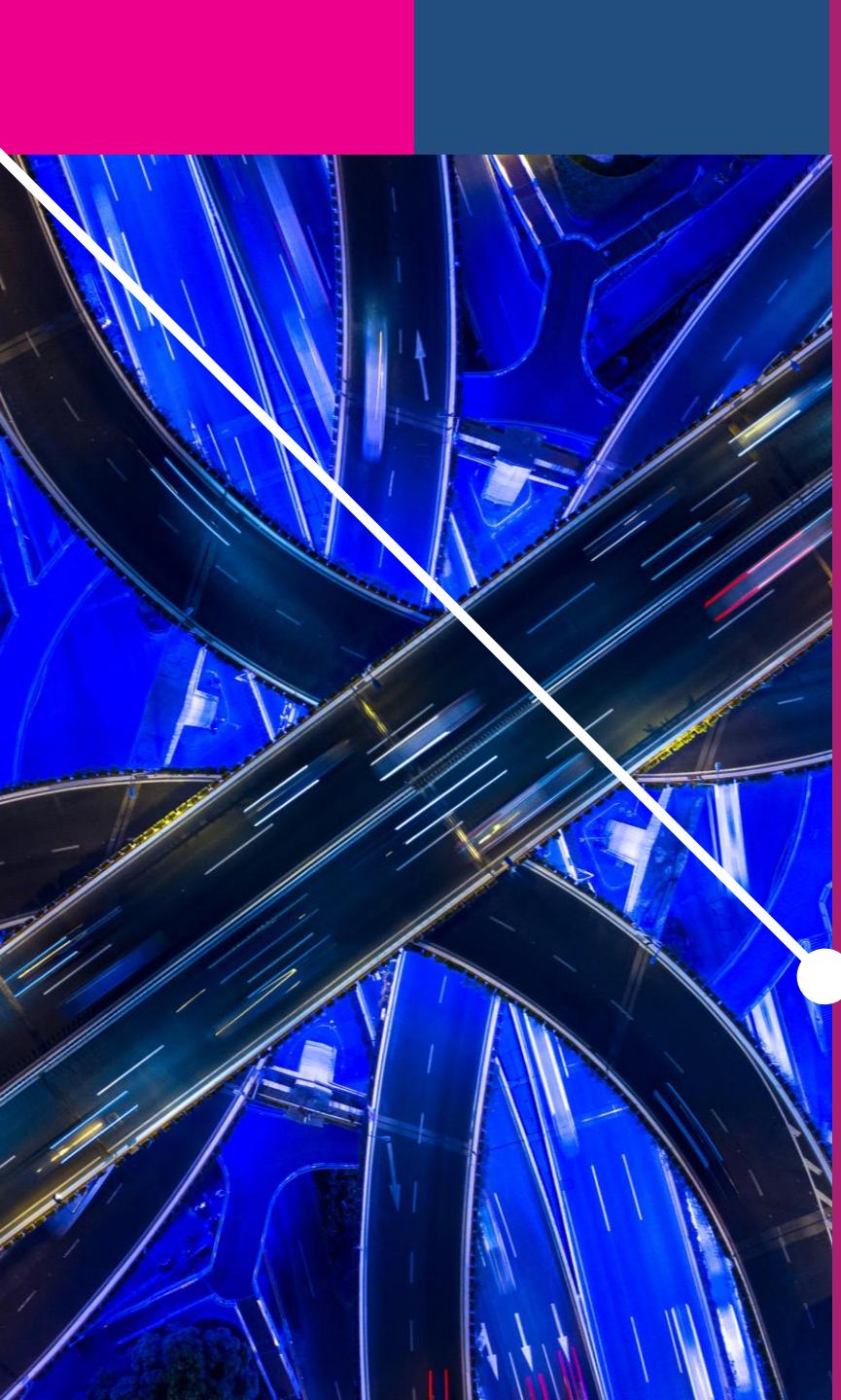


SYSTEM DESCRIPTION

- PI controller in Arduino
- Air heater simulator
- Thingspeak to monitor room temperature
- GUI to read and write to Arduino (to control air heater)

SYSTEM SKETCH DIAGRAM

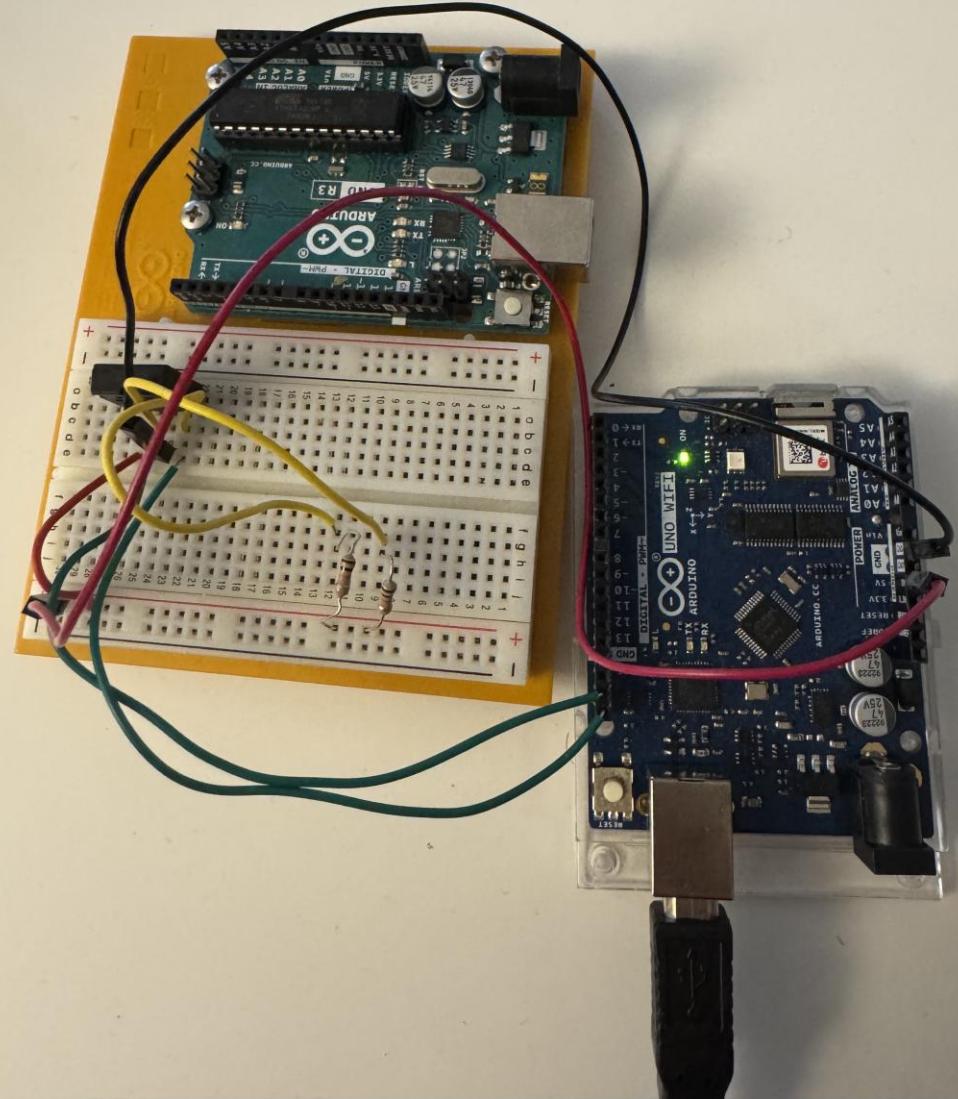




Method

- An Arduino program is used to mathmatically simulate a real Air heater.
- Arduino is used to implement PI-controller.
- Low pass filter was not needed since it is a simulator .
- PWM pins are used in addition to RC filter to get out Analog output of Arduino.
- Arduino wifi ref 2 was used to send data to Thingspeak using wifi.
- GUI in visual studio is created as HMI- human machine interface.
- Communication between GUI and Arduino is through Thingspeak.
- The communication includes reading and writing PI setting from user and showing results.

AM2320 Digital Temperature and Humidity



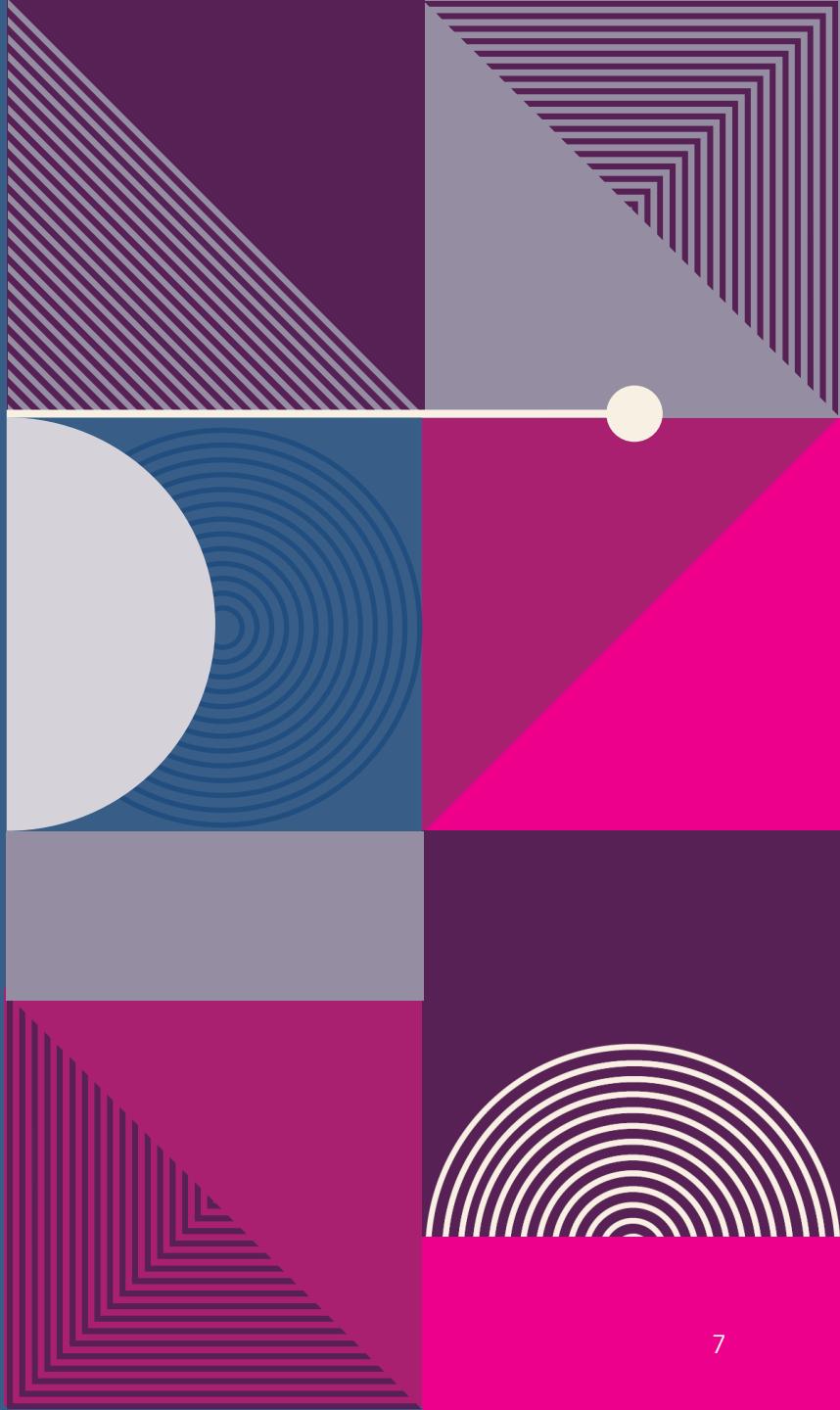


DEMO

ARDUINO PI-CONTROLLER

The setpoint is achieved.

The input (u) is between 1-5 V

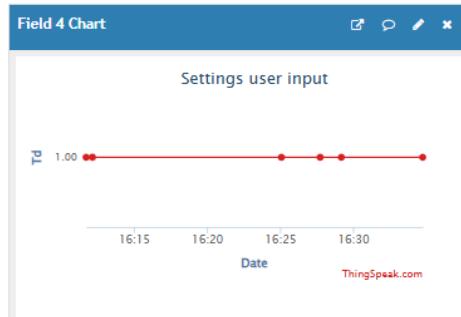
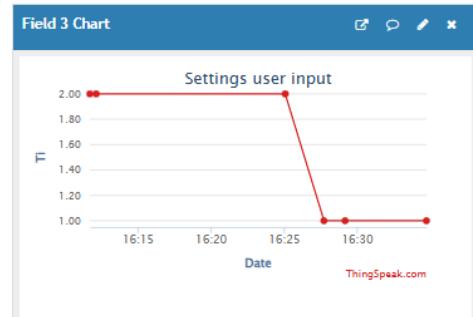
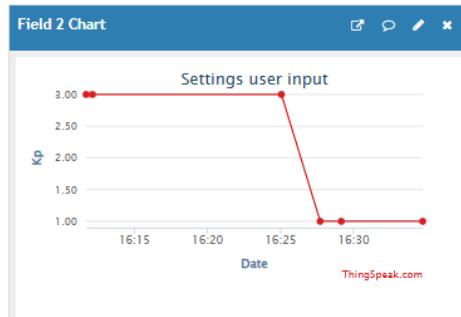
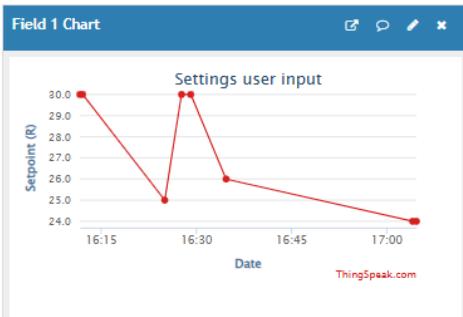


```
Output Serial Monitor X
Message (Enter to send message to 'Arduino Uno WiFi Rev2' on 'COM5')
622.90, r=26.00, Tout=26.00, u=1.286
623.00, r=26.00, Tout=26.00, u=1.286
623.10, r=26.00, Tout=26.00, u=1.286
623.20, r=26.00, Tout=26.00, u=1.286
623.30, r=26.00, Tout=26.00, u=1.286
623.40, r=26.00, Tout=26.00, u=1.286
623.50, r=26.00, Tout=26.00, u=1.286
623.60, r=26.00, Tout=26.00, u=1.286
```

THINGSPEAK

Channel Stats

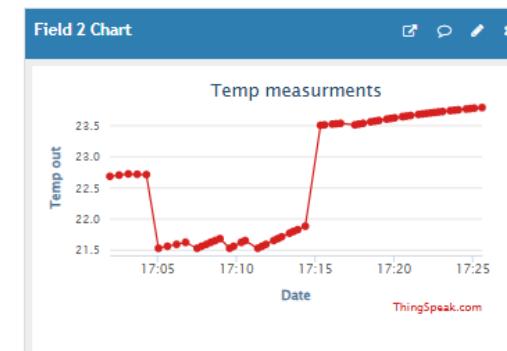
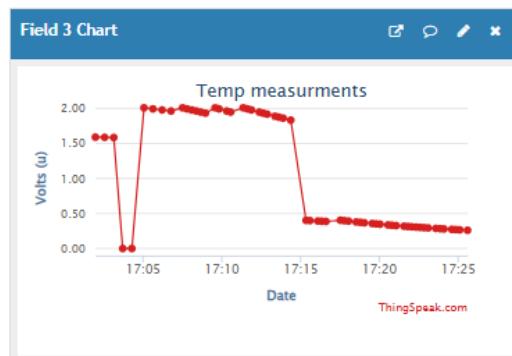
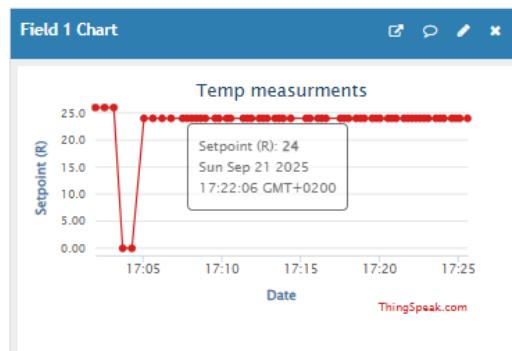
Created: [about 4 hours ago](#)
Last entry: [about 2 hours ago](#)
Entries: 9



Channel for Writing

Channel Stats

Created: [a day ago](#)
Last entry: [about 2 hours ago](#)
Entries: 1111



Channel for Reading

GUI- VISUAL STUDIO

Air heater temperature control

Temperature settings

Temperature [C] setpoint (R) °C

Temperature now °C

PID settings

K_p

T_i [s]

T_d [s]

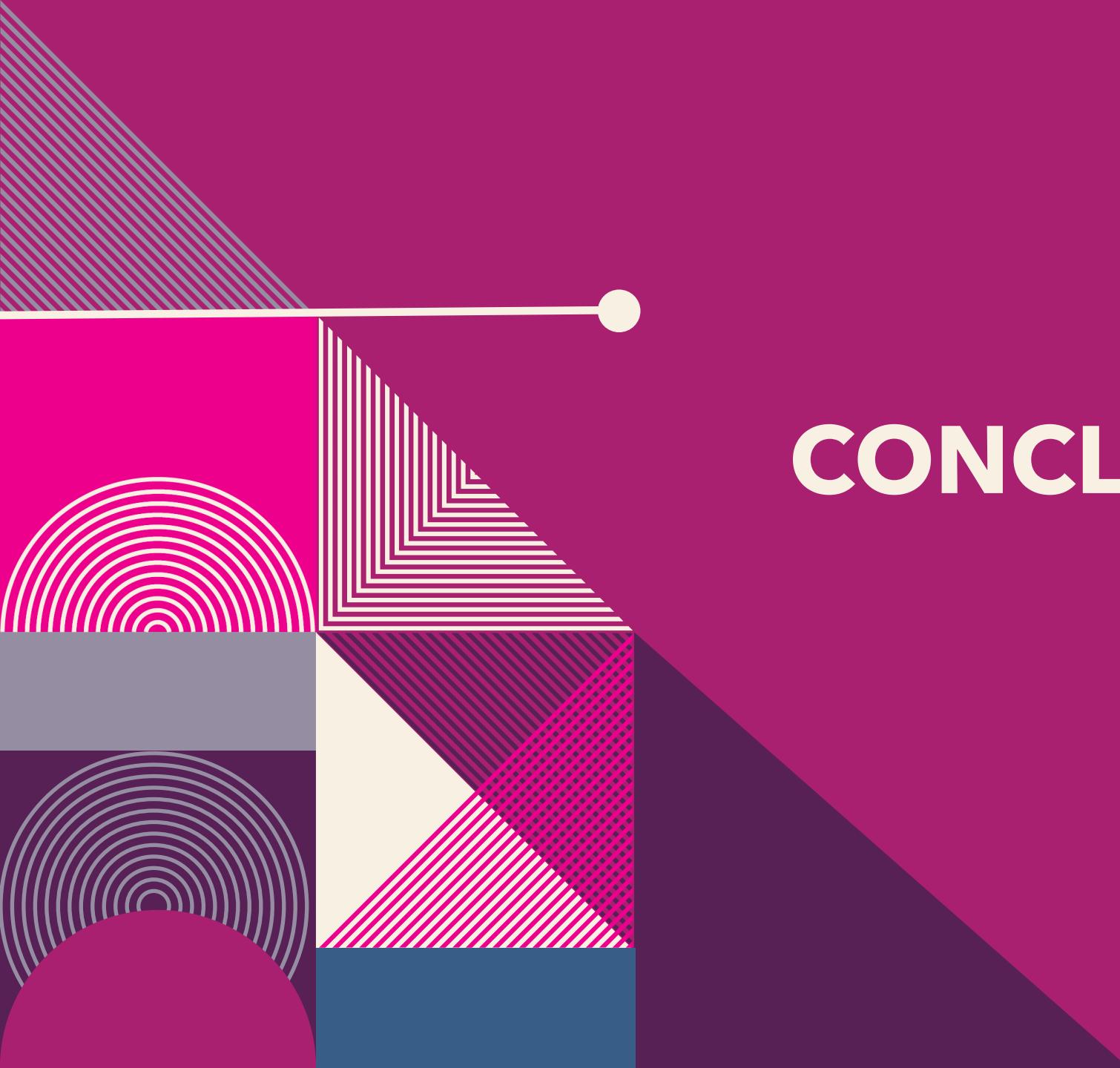
Temp Setpoint [C] °C

Temperatur now

```
{"channel": {"id": 3083643, "name": "Temp measurments", "latitude": "0.0", "longitude": "0"}, Time: 21.09.2025 15:24:08, Setpoint: 24.00000, Temp out : 23.75471,Volt (u) : 0.27995 Time: 21.09.2025 15:24:38, Setpoint: 24.00000, Temp out : 23.76752,Volt (u) : 0.27332 Time: 21.09.2025 15:24:53, Setpoint: 24.00000, Temp out : 23.77368,Volt (u) : 0.27012 Time: 21.09.2025 15:25:08, Setpoint: 24.00000, Temp out : 23.77969,Volt (u) : 0.26700
```

The graph displays three data series over a period from 21.09.2025 15:24:08 to 21.09.2025 15:25:38. The Y-axis represents temperature in °C, ranging from 0 to 25. The X-axis represents time. The blue line represents the Temperature setpoint (R) [°C], which starts at 0 and rises sharply to approximately 24°C around 15:24:38. The orange line represents the Temperature out [°C], which follows the setpoint closely, starting at 0 and reaching approximately 24°C around 15:24:38. The red line represents Volt (u), which remains at 0 throughout the entire time period.

Close

An abstract graphic on the left side of the slide features a white line segment extending from a small white circle at the top right towards the center. Below this, a large white square contains several geometric patterns: concentric circles in shades of pink and grey, a series of nested white triangles pointing upwards, and a diagonal band with a grid pattern. The background of the slide is a solid dark red.

CONCLUTION

