
SAPIENZA
UNIVERSITÀ DI ROMA

# Introduzione

Let's brew! - IoT project
IoT Tee/Coffee machine with remote control and data reporting.

# System overview

- STM32F4 board controls the boiler
- PC running python server as gateway
- ThingsBoard on remote server

Hardware:

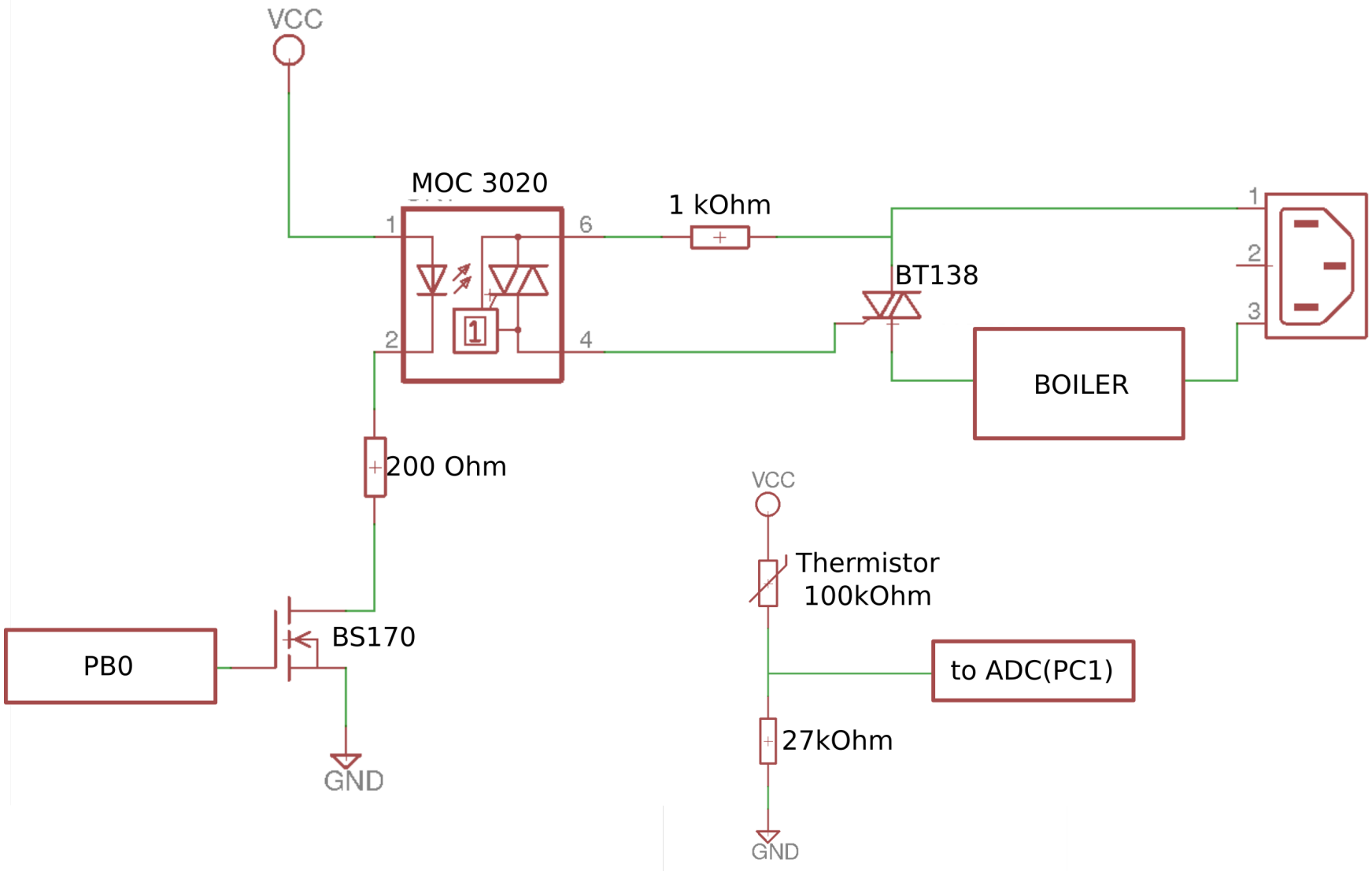
- optocoupler
- triac to control the AC power
- 1000 Watts of power!

# Sensors

Voltage divider to measure temperature:

- NTC Thermistor 100k
- ADC to sample the divider voltage
- Resistor equations to find the NTC resistance
- Beta equation to find the temperature

# CIRCUIT


VCC
MOC 3020
1
2
6
4
1 kOhm
BT138
1
2
3
BOILER
200 Ohm
PB0
BS170
GND
VCC
Thermistor
100kOhm
to ADC(PC1)
27kOhm
GND

# CIRCUIT

Software features:

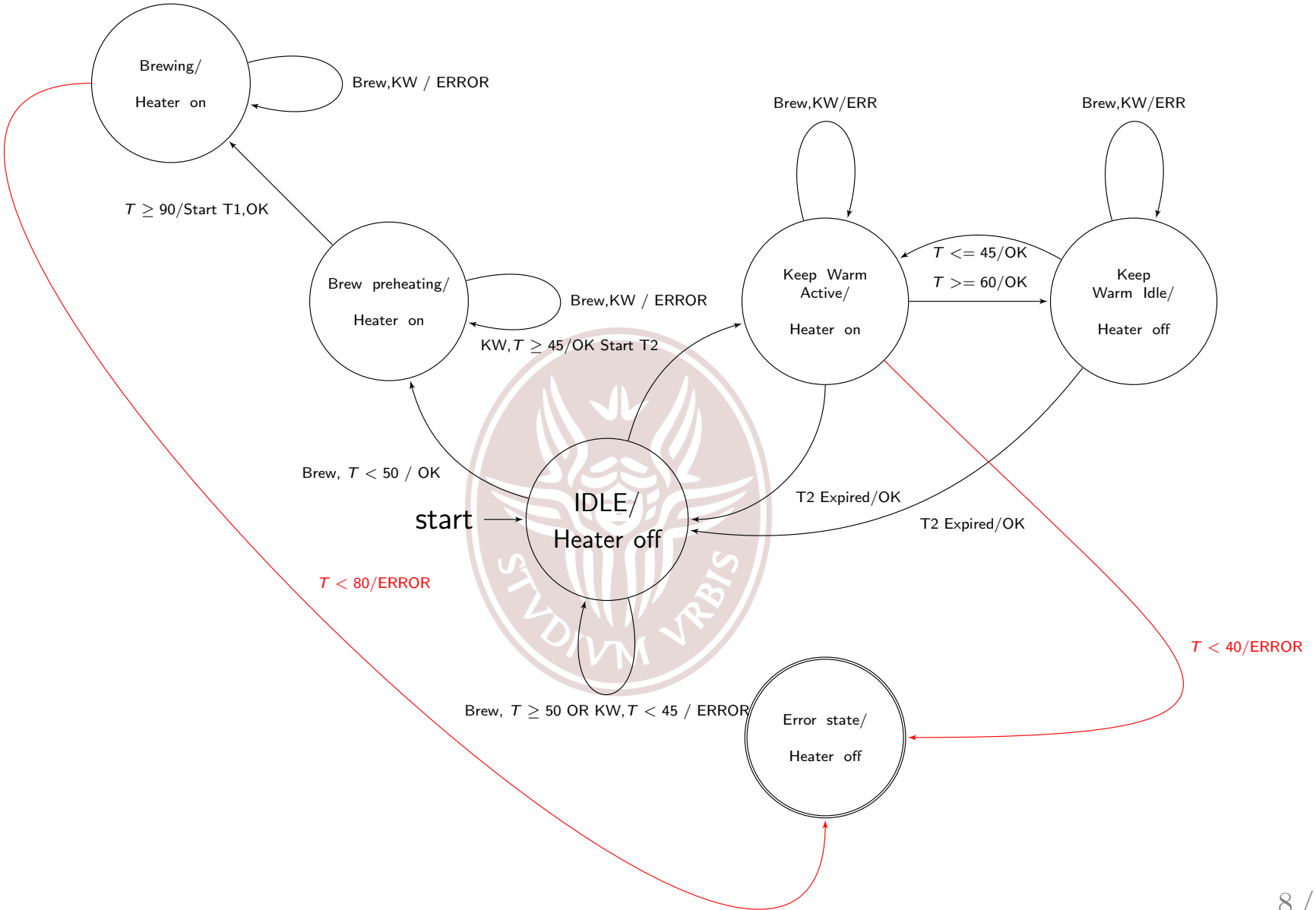
- FreeRTOS
  - threads
  - timers
  - mutexes
- HAL
  - UART - DMA
  - Bluetooth
  - ADC
  - GPIO

# HTCPCP Server

The board implements a HTTP - like stateless server.
The server can handle the following requests:

- Brew
- KeepWarm
- Status
- Abort

# SERVER FSA


Brewing/
Heater on
Brew,KW / ERROR
T ≥ 90/Start T1,OK
Brew preheating/
Heater on
Brew,KW / ERROR
KW, T ≥ 45/OK Start T2
Brew,KW/ERR
Keep Warm
Active/
Heater on
T <= 45/OK
T >= 60/OK
Brew,KW/ERR
Keep
Warm Idle/
Heater off
Brew, T < 50 / OK
start
IDLE/
Heater off
T2 Expired/OK
T2 Expired/OK
T < 80/ERROR
T < 40/ERROR
Brew, T ≥ 50 OR KW, T < 45 / ERROR
Error state/
Heater off

# Board code

- Controller Class - C++
- Request string parsing - C++
- FreeRTOS interface - C
- FreeRTOS thread functions - C
- Hardware configuartion - C

# Python server

The python server enables both bluetooth functionality and acts as serial gateway to push information to ThingsBoard.

- Uses MQTT
- Polls via serial using Status command

# ThingsBoard

- Hosted on premises on remote server
- Gathers data via MQTT
- Displays information:
  - Temperature
  - Usage statistics
  - Time to operation completion
  - Power consumption statistics

# The end.

Thank you!