

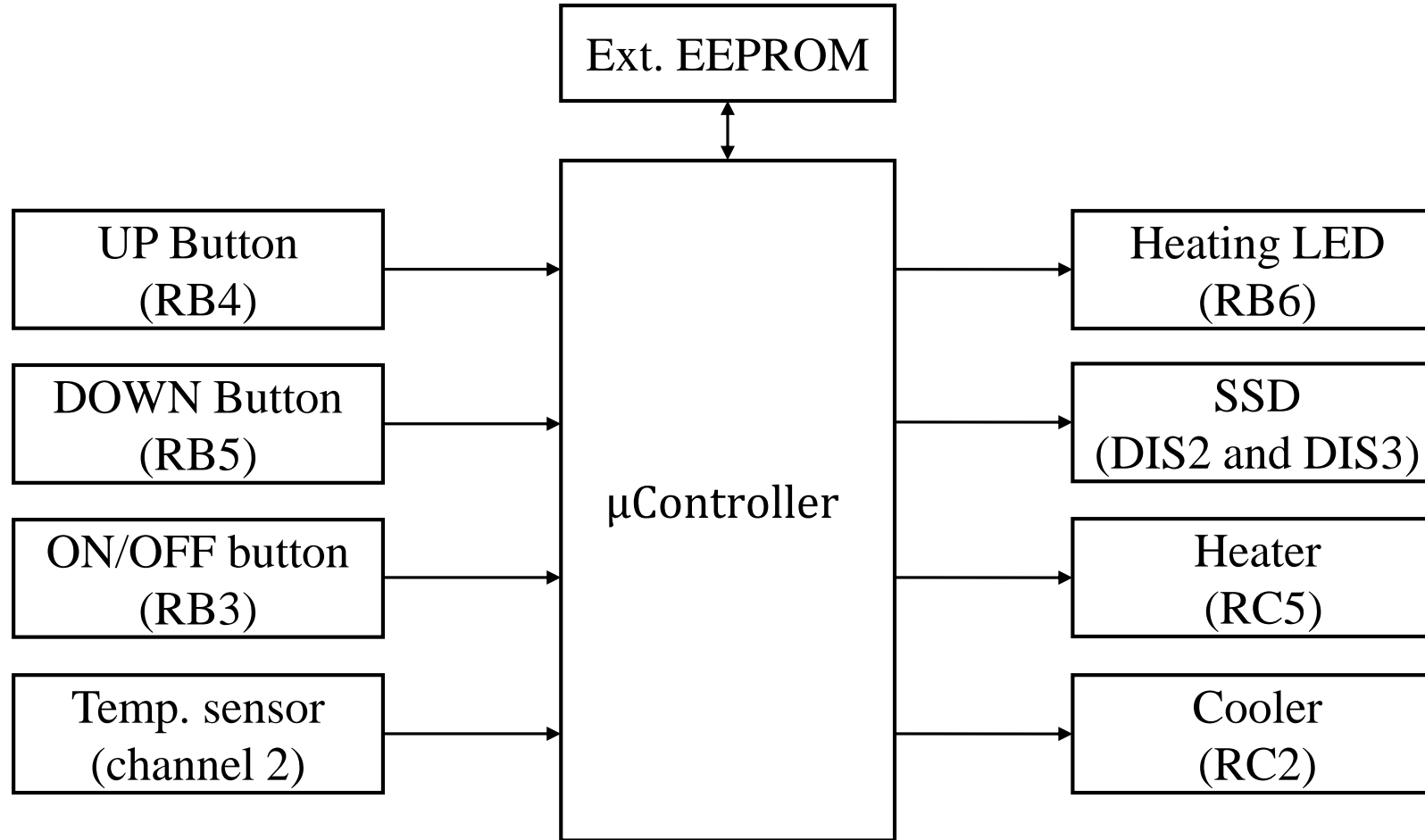
# ELECTRIC WATER HEATER

Swift Act Practical Embedded SW  
training project

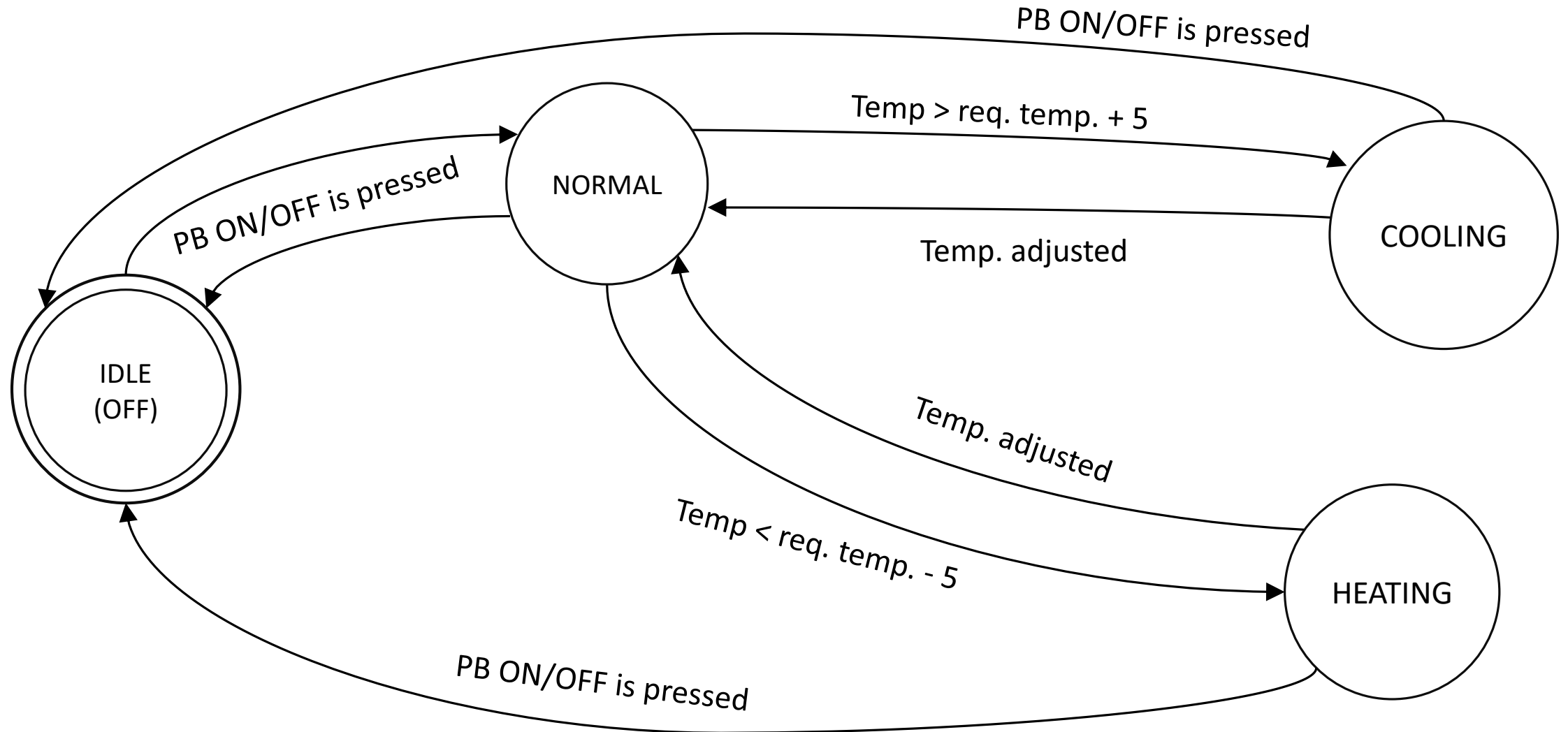
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# OVERVIEW



# ELECTRIC HEATER STATES



# NORMAL STATE

- Entered when push button ON/OFF is pressed.
- System should display the sensed temperature.  
(Cooler and heater are turned OFF)
- If push button UP or DOWN is pressed, the display blinks while displaying the set temperature.
- Another press on either push-button adjusts the temperature and saves it in the external EEPROM.
- Sensed temperature is compared with the set temperature.

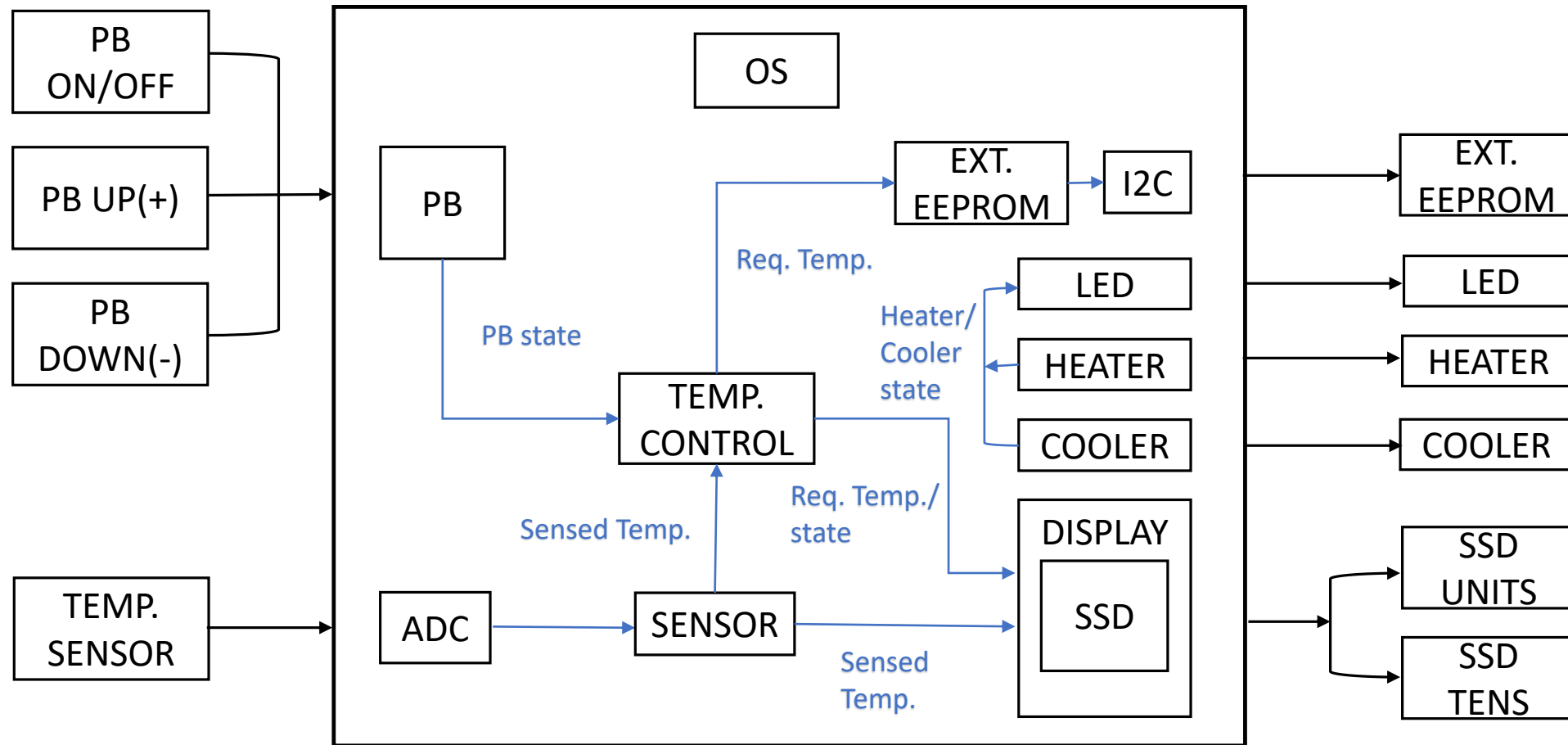
# COOLING STATE

- Entered if the sensed temperature is higher than the required temperature by five degrees.
- Cooler is turned ON.
- Heater is turned OFF.
- The sensed temperature is displayed, and the LED is turned ON.
- If push button ON/OFF is pressed, the system is turned OFF.

# HEATING STATE

- Entered if the sensed temperature is lower than the required temperature by five degrees.
- Heater is turned ON.
- Cooler is turned OFF.
- The sensed temperature is displayed, and the LED blinks.
- If push button ON/OFF is pressed, the system is turned OFF.

# BLOCK DIAGRAM



# DETAILED DESIGN

- PB
  - PB\_init
  - PB\_Update
  - PB\_getState
- tempControl
  - tempControl\_init
  - tempControl\_update
  - get\_reqTemp
  - get\_state
- Sensor
  - sensor\_update
  - sensor\_getTemp
  - sensor\_getavgTemp
- Display
  - display\_init
  - display\_update
- SSD
  - ssd\_init
  - ssd\_update
  - ssd\_setSymbol
  - ssd\_getSymbol
  - ssd\_setState
  - ssd\_getState
- LED
  - Led\_init
  - Led\_update



# DETAILED DESIGN

- Timer
  - TMR\_Init
  - TMR\_Start
  - TMR\_CheckOverflow
  - TMR\_Stop
  - TMR\_Update
- Cooler
  - cooler\_init
  - cooler\_on
  - cooler\_off
  - cooler\_getState
- adc
  - adc\_init
  - adc\_getResult
- I2C
  - i2c\_init
  - i2c\_start
  - i2c\_stop
  - i2c\_wb
  - i2c\_rb
- Heater
  - heater\_init
  - heater\_on
  - heater\_off
  - heater\_getState
- Ext. EEPROM
  - ext\_e2prom\_init
  - read\_ext\_e2prom
  - write\_ext\_e2prom

# TIMING ANALYSIS

Task	Actions	BCET (ms)	WCET (ms)	Action period (ms)	Task period (ms)
Push button	Update state	~0	~0	20	20
	Update sample	~0	~0	20	
SSD	SSD update	~0	~0	5	5
sensor	Sensor update	~0	~0	100	100
display	Display update	~0	~0	100	100
Temp. control	Temp. control update	~0	~0	20	20
LED	LED update	~0	~0	20	20
				Tick (ms)	5
				Major Cycle	100

# SCHEDULABILITY CHECK

