

# EN3240: Embedded Systems Engineering

## Assignment 2 — IoT Project

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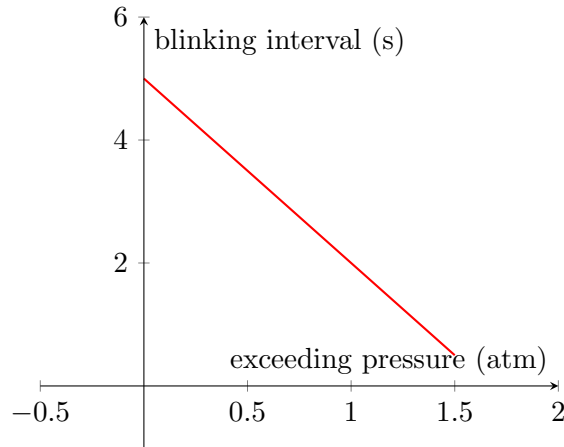
### Implemented algorithm for calculating blinking interval

The selected warning limit ranges for each weather parameter and the corresponding exceeding ranges are included in the Table 1.

Table 1: Defined ranges for weather parameters

Weather parameter	Selected warning range	Corresponding exceeding range*
Temperature	$10^{\circ}C$ to $45^{\circ}C$	$0^{\circ}C$ to $35^{\circ}C$
Pressure	$0.5atm$ to $2atm$	$0atm$ to $1.5atm$
Wind speed	$0km/h$ to $100km/h$	$0km/h$ to $100km/h$

\*The exceeding ranges are based on the respective warning ranges. More specifically, when calculating the corresponding exceeding ranges for each parameter in Table 1, the maximum (definitive) exceeding value is obtained by reducing the lower limit of the respective warning range from its upper limit. The minimum exceeding value is achieved when the current parameter value reaches the defined warning limit at the time of consideration (i.e. the lower bound is therefore always zero). Consequently, the minimum and the maximum of each exceeding range is linearly mapped to  $5000ms$  to  $500ms$  respectively. As an example, for pressure,



Therefore, the blinking interval for a given exceeding value for pressure (within the defined range),  $y_p$ , could be obtained via,

$$y_p = 5 - 3x_p \quad (1)$$

where  $y_p$  is in seconds and the  $x_p$  (exceeded amount in pressure) is in atm. Similarly, for temperature,

$$y_t = 5 - (9/70)x_t \quad (2)$$

and for wind speed,

$$y_w = 5 - 0.045x_w \quad (3)$$

In addition, if two or more weather parameters exceed their respective warning limits and thereby, each produces a blinking interval separately, the minimum blinking interval would be considered to send to NodeMCU.

$$BI_{NodeMCU} = Min(BI_t, BI_p, BI_w) \quad (4)$$

where  $BI_{NodeMCU}$ ,  $BI_t$ ,  $BI_p$  and  $BI_w$  refers to the blinking interval to be sent to NodeMCU, blinking interval from temperature, blinking interval from pressure and the blinking interval from the wind speed.

**Example case** Consider the following data in a given scenario,

Table 2: Example data for a given time

Weather parameter	Selected warning value	Current value	Blinking interval (ms)
Temperature	$30^{\circ}C$	$34^{\circ}C$	4486
Pressure	$1.2atm$	$1.1atm$	N/A
Wind speed	$5km/h$	$15km/h$	4550

Therefore,  $4486ms$  will be sent to the NodeMCU as the blinking interval.

Further, if at any time, any of the current weather parameter exceeds the maximum respective exceeding limit, as an example: when the current temperature is  $46^{\circ}C$  and the warning limit is set to be  $10^{\circ}C$  and thus, exceeds the warning limit by  $36^{\circ}C$ , the blinking interval would immediately be assigned with the value of  $500ms$ .