

# checkBin - Evaluation

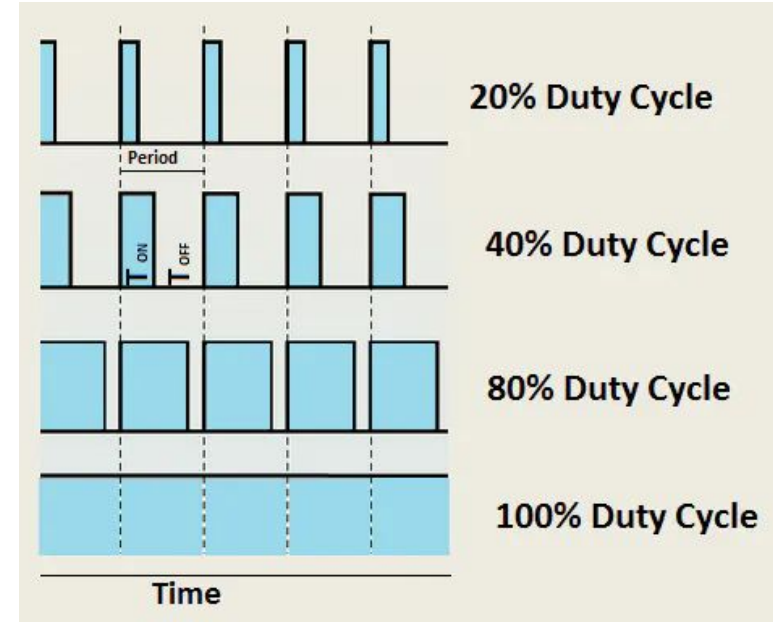
# Energy consumption

- Sensors: ultrasonic and load cell
- Actuators: OLED display and stepper motor
- Board
- Radio

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# Analysis on sampling frequency

- Continuous sampling of all the sensors
- Continuous sampling of one sensor and sensing of the other only when needed
- **Periodic sensing**



# Analysis on radio usage

- Transmit the fill level every time a new one is computed
- **Transmit the fill level every time it changes with respect to the last measured one**



# Sensors precision

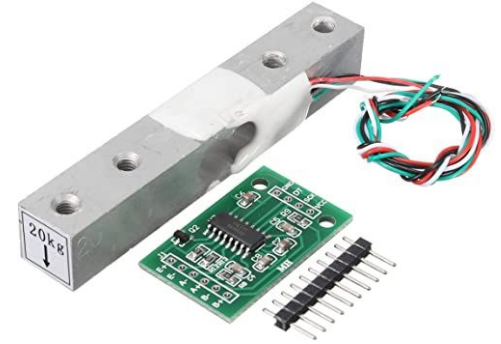


## Ultrasonic sensor

Fill level  $\rightarrow$  value between 0 and 9

Fill level step represents a range of size  $\text{bin\_height}/10$

Error percentage of the fill level: max 10% of the total height



## Load cell

Conversion formula:

$(\text{base\_value} - \text{measured\_value})/0.104$

Error:  $\sim 2\%$

# Accuracy of the system

Fill level from ultrasonic sensor	Total measurements	Detected anomalies	Undetected anomalies
0	2	0	0
1	3	0	0
2	5	0	0
3	4	0	0
4	7	0	0
5	6	1	0
6	3	0	0
7	3	1	0
8	4	0	1
9	3	0	0
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Total	40	2	1

# Network

- Bandwidth: size of the payload is less than 10 bytes
- Latency: from the sending of the message to the update in the dashboard is less than 2 seconds
- Gateway infrastructure: must cover all the bins

↓ 15:04:34 Schedule data downlink for... Rx1 Delay: 5

↑ 15:04:34 Forward uplink data message MAC payload: 31 34 7C 30 <>  FPort: 2 Data rate: SF7BW125 SNR: 9 RSSI: -87

↑ 15:04:34 Successfully processed dat... DevAddr: 26 0B A4 76 <>  FCnt: 16 FPort: 2 Confirmed uplink Data rate: SF7BW125 SNR: 9 RSSI: -87

↓ 15:04:09 Schedule data downlink for... Rx1 Delay: 5

↑ 15:04:09 Forward uplink data message MAC payload: 31 34 7C 39 <>  FPort: 2 Data rate: SF7BW125 SNR: 7 RSSI: -84

↑ 15:04:09 Successfully processed dat... DevAddr: 26 0B A4 76 <>  FCnt: 15 FPort: 2 Confirmed uplink Data rate: SF7BW125 SNR: 7 RSSI: -84