

# 1 Design Approach

## 1.1 Contactless Capacitive Water Level Sensing

The strip will be placed vertically on the exterior side of the brita/pitcher to detect exact water level. Works as long as plastic is not too thick which britas fit the description.

### 1.1.1 Pros

- Low-cost
- No contact
- Small mechanical approach
- Customizable for future addons

### 1.1.2 Cons

- Need a good environment for sensor, not humid so not great inside a fridge

## 1.2 Weight based, Load

The design places the pitcher unto a load cell to measure the weight. We will calibrate it to the changes in weight.

### 1.2.1 Pros

- Highest accuracy of all designs
- Fits to many pitcher dimensions

### 1.2.2 Cons

- Need a good environment for sensor, not humid so not great inside a fridge

## 1.3 Ultrasonic

An ultrasonic sensor estimates the water level by measuring the echo time of sound waves reflected from the water surface.

### 1.3.1 Pros

- Inexpensive
- Easy implementation

### 1.3.2 Cons

- Humidity problem

## 1.4 Laser

A laser or time-of-flight sensor measures the distance from the sensor to the water surface. The measured distance is converted into liquid height and volume.

### 1.4.1 Pros

- Continuous measurements
- Non contact

### 1.4.2 Cons

- Humidity problem
- Clear line of sight

## 2 Decision Matrix

Criteria will be scored on a scale from 1 (poor) to 5 (excellent). Weights were assigned according to relative importance. The final score for is calculated as:

$$\text{Total Score} = \sum(\text{weightscore})$$

### 2.1 Evaluation Criteria

- **Cost:** Estimated hardware and implementation expense
- **Power:** Power consumption and low-power operation
- **Complexity:** Mechanical, electrical, software integration difficulty
- **Measurement Data:** Quality of information provided (Continuous water level, binary off or on, ability to track water usage)

### 2.2 Weighted Decision Matrix

Criteria (Weight)	Capacitive	Weight	Laser	Ultrasonic
Cost (0.30)	5	4	3	5
Power (0.20)	5	4	3	4
Complexity (0.25)	5	3	2	3
Measurement Data (0.25)	3	5	3	3
<b>Weighted Total</b>	<b>4.40</b>	<b>3.95</b>	<b>2.70</b>	<b>3.85</b>

Table 1: Decision matrix comparing feasible sensing approaches (1 = poor, 5 = excellent)