SPECIFIC GRAVITY SENSOR

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PROJECT INTRODUCTION

The goal of this project is to develop an IoT device that accurately measures a brewing liquid's specific gravity to 0.001 g/ml accuracy during fermentation. The device will also measure the temperature of the liquid. Our device will eliminate the need to open brewing containers to check on the brew, which reduces contamination risk and manual effort. Our sensor will also display real-time data, providing brewers a convenient monitoring solution.

DESIGN PROCESS AND METHOD

FLEX SENSOR

In this prototype, a bobber is attached to a flex sensor. As density increases and the bobber changes position, the flex sensor will read new data. A curve will be constructed with the sensor values and density changes, and specific gravity will be calculated from the resulting relationship.

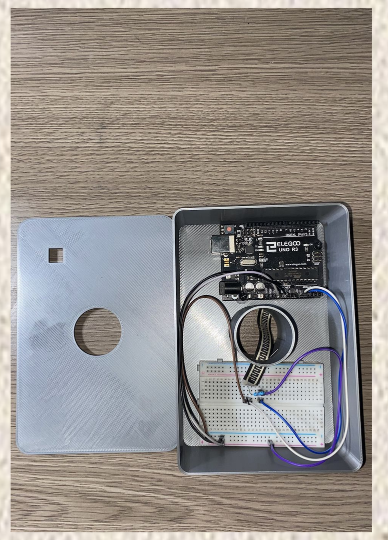

Figure 1: Flex Sensor Prototype

HALL EFFECT SENSOR

This potential solution involves a floating magnet in the brew. When brew density changes, the magnet shifts, causing the hall effect sensors to recognize the change in magnetic field. Similarly, a relationship between density and change in magnetic field will be established. Data will then be processed to calculate the specific gravity.

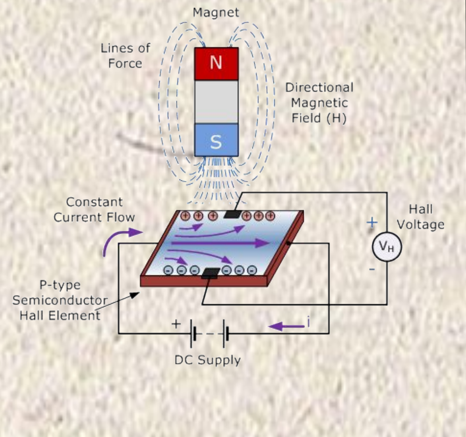

Figure 2: Hall Effect Sensor

REFRACTOMETER

We conducted experiments with laser and sugar solution. These tests revealed an average refraction rate of .5908°/gram of sugar. As sugar content increased, the laser passed through the liquid less. This trait discouraged this solution because the laser would likely not pass through a dark brew effectively.

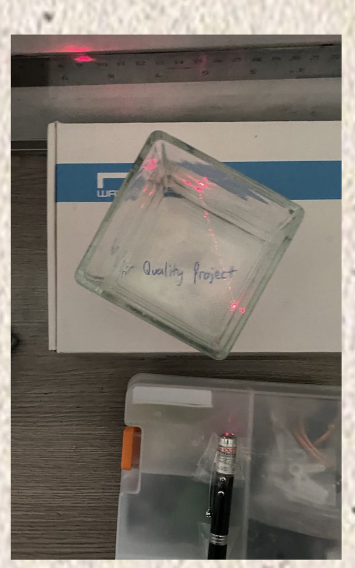

Figure 3: Refraction Testing

KEY FEATURES

- Measurement of specific gravity with .001g/ml accuracy
- Measurement of temperature with 0.1°C accuracy
- Minimum battery life of four weeks
- Real time data measurement and display
- Compatible with five gallon bucket of varying material
- Data transmission through WiFi or Bluetooth
- Easy device calibration for multiple brewing applications

FUTURE IMPROVEMENTS

- Improve prototype to be as precise and accurate as possible
- Improve prototype to be as small and robust as possible
- Store data in Google Sheets or MariaDB
- Display live data with Grafana
- Possible nutrient delivery system that works in conjunction with the specific gravity sensor

Dataflow Model

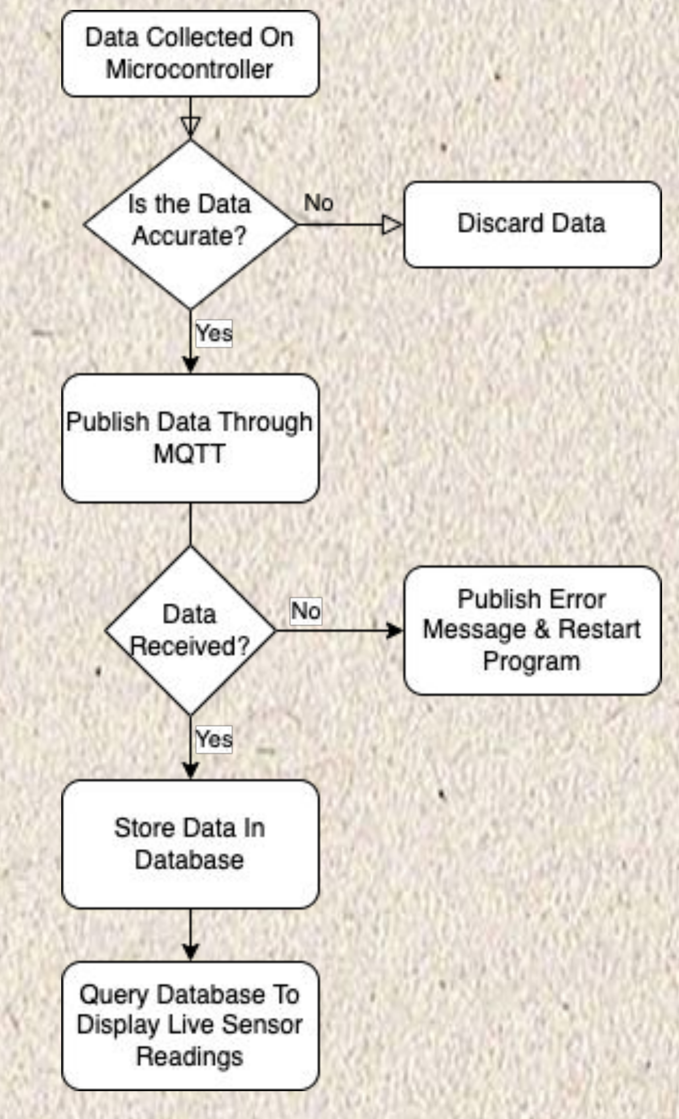

Figure 4: Dataflow Model

Thank You Dr. Winfree For Guiding This Project

Hall effect image from: https://www.symmetryelectronics.com/blog/tech-101-from-symmetry-electronics-hall-effect-sensors/