DHTSimple Library

## Overview

I wrote this library because I could not find a DHT library that worked on all my applications. They either were not reliable, interferred with another library or caused my VGA monitor to blink ever time the sensor was read. The library uses only Arduino functions and is very easy to use and understand.

## Features

This library works with all known DHT sensors and should work with almost all Arduion boards. I tested it with UNO, Mega, ESP32 WROOM Dev Board, ESP32 D1 R32 and ESP8266 D1 R2 boards.

# Beer Keg Monitoring System

Build your own beer keg monitoring system that keeps track of how many glasses of beer are left in each keg. The entire system costs less than $100 for 5 beer taps.

## Features:

* Tracks number of glasses of beer left.
* Controls Beer freezer temperature
* Provides email and text message notifications.
* Provides local and remote displays via Wi-Fi.
  + Accessible anywhere in the world with Port Forwarding
* Monitors up to 8 beer taps.
* Temperature Stability +/- 0.75 degrees F
* Works with all DHT and/or MCP9808 Temperature Sensors
  + Up to 3 temperature sensors can be used.

## Introduction

Currently there are two types of systems to measure how much beer is left in the keg:

1. Flow measuring.
2. Weight of Keg.

Flow measuring systems are cheaper (6 taps about $500) but they have limited utility and you have to clean them every time you clean your beer lines (every 6 weeks).

Weight of keg systems are none intrusive, but very expensive ($1000 for 5 taps). They are not integrated with your entire system. This system measures the weight of the keg but is low cost.

## Bill of Materials

The following is the bill of Materials for the entire system:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Item | Qty | Description | Price | Total |
| 1 | 5 | Scale Plate | $ 2.50 | $ 12.50 |
| 2 | 5 | HX711 Load Cell Amplifier | $ 2.00 | $ 10.00 |
| 3 | 20 | Load Cell | $ 0.80 | $ 16.00 |
| 4 | 1 | PS2 Keyboard | $ 5.00 | $ 5.00 |
| 5 | 1 | VGA Monitor | $ 10.00 | $ 10.00 |
| 6 | 2 | DHT 22/AM2302 Sensor | $ 3.33 | $ 6.67 |
| 7 | 1 | ESP32 Breakout Board | $ 13.00 | $ 13.00 |
| 8 | 1 | ESP32 Development Board | $ 8.50 | $ 8.50 |
| 9 | 1 | VGA Breakout Board | $ 7.50 | $ 7.50 |
| 10 | 1 | PS2 Breakout Board | $ 4.00 | $ 4.00 |
| 11 | 1 | Relay | $ 2.00 | $ 2.00 |
|  |  | Total |  | $ 95.17 |

The following figure is a high level over of the whole project:

A diagram of a computer system

Description automatically generated

The beer freezer is in the pool shack which does not have Wi-Fi. To get Wi-Fi, I installed an old ESP32 board under the eave and ran a cable between the two processors. They talk to each other on a serial interface. If you have Wi-Fi where your beer is stored, you can get rid of the ESP32 board and the serial interface. If you don’t want Wi-Fi display, you can also get rid of this interface.

## Theory of Operation

The theory of operation is quite simple. The data you need is:

1. Scale reading with nothing on the scale (Empty Scale Quanta)
2. Scale reading with a full keg of beer on the scale (Full Scale Quanta)
3. Scale reading of current keg (Current Scale Quanta)
4. Weight of a full keg (Full Keg Weight)
5. Weight of an empty keg (Empty Keg Weight)

The system automatically measures the first three items, all you need to do is measure the full key weight and the empty keg weight. I just use a bathroom scale.

Reading Per Ounce = (Full Scale Quanta – Empty Scale Quanta) / (Full Keg Weight \* 16)

Current Ounces = (Current Scale Quanta – Empty Scale Quanta) / Reading Per Ounce

Glasses = (Current Ounces – Empty Keg Weight) / 12 Ounces per glass

## Software

The software is described in the software folder. There are two subfolders for the software, one for the main Keg Monitor and the other for the Wi-Fi display.

## Hardware

Check out the hardware folders for all the intimate hardware details.

## Why a Keezer?

A Keezer is a chest **Freezer** converted to a **Kegerator** which is commonly called a Keezer**.**

A Keezer has many advantages:

* They are more energy efficient.
* They have a lot of space for the cost.
* It is easy to access all the keg connectors.
* It is easy to install and remove the kegs.

Most freezers are not tall enough for the kegs with the fittings, so you need to install a frame (collar) between the freezer top and the freezer base. This is not very hard. You can find lots of articles on the internet that describe how to do this.

The advantage of the collar is you do not have to drill through the wall of the freezer to install taps, risking hitting a freezer coil. You can also drill through the collar to bring in and out wires.

You should insulate the kegs from the bottom of the freezer to prevent the beer from freezing and protect the bottom of the freezer. I used padded vinyl plank flooring which worked great.

## Lessons Learned

1. Buy solid wire instead of stranded.  Much easier to work with.
2. Use an Ohm meter to check everything out.  It can save a lot of troubleshooting time. You can get one at Harbor Freight for just a few dollars.
3. Buy the ESP32 Development Boards, instead of the UNO form factor boards (i.e. ESP32 D1 R32 or ESP8266 D1 R2).  Much easier to work with, better Wi-Fi, and faster.
4. If you need a lot of memory and pins use the ESP32-S3 development boards.
5. Use breakout boards with screw terminals, much easier and more reliable than the solder boards.

## Temperature Sensors

I initially started with DHT22 temperature sensors. I found that these sensors hung up and would not be responsive. To keep the sensors working I ran power to each sensor from a GPIO pin. When the sensor stopped working, I turned the power on and off to reset the sensor. This change solved the problem. I think the source of the problem may be a power surge when the freezer turns on and off. I have used these sensors in the past without any problems.

I decided to try MCP9808 sensors. These sensors are more accurate and work on the I2C bus. These sensors worked better in my environment. The temperature values are more stable and consistent. I modified the software to work with both DHT and MCP sensors. My final configuration is two MCP sensors and one DHT sensor. I felt that even if the I2C bus goes down I would still have one working temperature sensor.

I also installed a little fan in the freezer. I got much more consistent temperature readings with the fan moving the air inside the freezer.

You can read about the temperature sensors in hardware folder.