

Technology has the ability to alleviate some of the brewer's responsibilities while improving the quality of the final product through precision and automation. And while implementing technology can get very expensive, there are a plethora of low cost, do-it-yourself options that don't require an advanced degree in computer sciences. What follows is four projects that have already or will hopefully be introduced into my personal brewing system. It is my goal to not only let you know what's possible, but to inspire you to include some of the options in your brew house.

In addition to the different sensors and peripherals, there's two common items among these projects: Arduino microcontrollers and Raspberry Pi computers. Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board (<http://arduino.cc/en/Guide/Introduction>). Depending on what features you require and your skillset, Arduino boards range in price from \$10 to \$80 (<https://www.sparkfun.com/categories/242>). The Raspberry Pi is a credit-card sized computer that was developed by University of Cambridge's Computer Laboratory professors who were disappointed in the lack of knowledge that their students had when it came to lower-level aspects of computing (<http://www.raspberrypi.org/about/>). Raspberry Pi computers cost about \$40 (<https://www.sparkfun.com/categories/233>), but require additional items such as microSD cards, HDMI cable, Ethernet cord or Wi-Fi dongle, keyboard, mouse, power supply, etc. While the Raspberry Pi is equipped with general purpose in out pins, I've found that Arduinos are the better option for sensing things and translating that data into commands. However, the Raspberry Pi great for gathering that data and displaying it multiple ways.

The first project that I'm going to speak about is probably the next one that I'll personally implement. It is an automated watering device for my hops. At its core, it is an Arduino powered moisture sensor consisting of two galvanized nails. When the measured resistance between the two nails reaches a certain point, a relay is activated that powers a submerged pump to water the monitored plant. Ideally, a photocell and temperature sensor would be added to the Arduino and all of the sensor data would be logged to a Raspberry Pi that could display that data on a webpage. I've seen some examples of this scrape the Internet for weather forecasts and delay watering if rain is expected soon or send you random tweets from your plants to let you know how they're doing.

The one system that I've been able to successfully add is a knockoff (<http://www.homebrewtalk.com/f51/howto-make-brewpi-fermentation-controller-cheap-466106/>) BrewPi (<http://www.brewpi.com>). It consists of a Raspberry Pi, Arduino Uno, two temperature sensors, a relay, and a self-wired outlet. BrewPi allows you to program fermentation schedules that include a diacetyl rest and cold crash. It logs the temperature of your fermentation chamber and beer and displays it on a website that you can view on your local area network. I added

VPN capabilities to my Raspberry Pi so that I can check in on my fermenting beer while away from home.

Raspberry Pints (<http://rasberrypints.com>) is a digital tap list that displays the beers you have on tap on a screen and is powered by a Raspberry Pi. You enter the SRM, IBU, Name and Tasting Notes, and ABV so that guests have more to go off of than just a name. Flow meters connected to an Arduino board can be added to keep track of the amount of beer that has been served. It's also possible to make it a public site that people outside of your local area network can see what you have on tap.