Umbrella Weather Stand

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Abstract

We present an umbrella stand which connects to a weather station. The base of the umbrella stand lights up when the weather is rainy or soon to be rainy. The weather station and umbrella stand connect via a server to which both are linked.

All data is stored in an online database which allows for quick data analysis and visualization based on past and current weather data. The most recent weather station data is also displayed on a website.

Our Approach

Unlike weather stations found online, our project takes advantage of the real time data generated by its own weather station and packages it in a way that is useful to the user. Essentially, it informs the user when it is about to rain or ing, so that they can remember to take their umbrella.

Even if the user does not remember their umbrella, they can be reminded by a text message. A website displays the current weather data in an easy-to-read format. The server controls whether an alert is sent to the phone reminding them to take their forgotten sunglasses or umbrella, if they leave their Bluetooth network on a day the weather station system recommends them.

Our project consists of three main components: the weather station, server, and umbrella stand. The connections between them are shown in the above figure.

Umbrella Stand

The main physical component of the project is the umbrella stand. It has three main components making up its structure. The body is made up of a 15 cm tall cylinder with both top and bottom removed. It holds the umbrella upright.

The body of the umbrella stand sits in the rim of the top of the base, the bottom of which holds a force sensor on which the umbrella sits.

The force sensor in the top of the base and in the bottom of the umbrella stand connect to a Raspberry Pi in the bottom of the base. The Raspberry Pi connects the force sensors and LEDs in one circuit. Also, an Xbee sensor allows the Raspberry Pi to communicate with the weather station. Wifi is then used to store all data in a remote database.

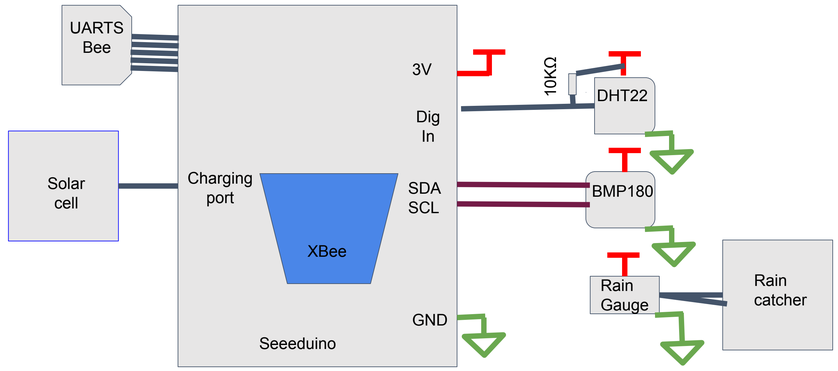
Weather Station

Our weather station consists of several sensors connected to a Seeeduino Stalker Board v3. The Seeeduino is a modified Arduino, but smaller and equipped to be solar powered.

The Seeeduino is powered by a 1200 mH LiPo battery, connected to a solar cell, which recharges it.

Other sensors used include a rain gauge, to answer the simple but necessary question “is it raining?” If it is, the blue LED in the base of the umbrella stand will light up.

In case it is not yet raining, but may soon, a DHT22 humidity sensor and a BMP180 pressure sensor help the system calculate the likelihood of rain in the next few hours.

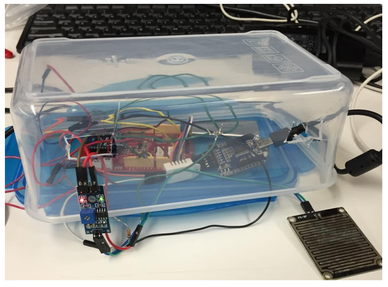


On the communication side of things, the weather station has a UARTSbee. This gives it a microUSB port which enables the code to be updated.

Additionally, for intrasystem communication, the XBee is set up on the Seeeduino board. There is a matching XBee on the Arduino shield on the Raspberry Pi. The XBee’s communicate up to 300 feet apart over the “Zigbee” IEEE 802.15.4 standard with a 250 kbps data rate, more than adequate for our needs of sending simple sensor data. The lowest power consumption chips were chosen, 50 ma @ 3.3V.

Because this is an outside weather station where only one of the sensors can handle getting wet without frying, we have adapted a container so that it can easily handle the sensors various needs.

The rain gauge is outside of the container, right, while the Seeeduino and solar cell are inside the clear-lidded container.



Software

The third component is a server and online database for the information. The server collects the information transmitted by the Xbees on the Arduino Shield of the umbrella stand and on the Seeeduino, interprets it, and writes it in a user-friendly interface. This enables the user to be able to see the details of the weather rather than looking at the lights on the umbrella stand. It also generates graphs of readings from the past day or so.

The site umbrellastand.info displays the temperature in Farenheit and Celsius, the pressure (in kilo pascals), relative humidity, and whether or not it is currently raining.

This is more useful than having just an app for Android phones, because it can be loaded on all kinds of phones as well as on computers, whichever is more convenient for the user.

Conclusions

Our project is useful in determining whether an umbrella is necessary, saving the user from the misfortune of being caught without it. It also functions as a very local weather app.

Future additions to this project may measure factors like wind speed and wind chill, which would contribute to recommendations for a jacket or a windbreaker.

On the flip side, based on the temperature, the umbrella stand weather station may be adapted to recommend shorts.

Technology wise, the project could also be adjusted to display the weather information on the umbrella stand itself.

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