CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

35715

Project Title

A Low-cost, Easy-to-Install, Internet-Enabled Shower Usage Monitor as a Nudge Engine for Residential Water Conservation

Preliminary

Abstract

Objectives/Goals

Water conservation is a pressing national and global concern, and due to the ongoing drought in our state Californians are under increased pressure to conserve water.

In my project I am specifically targeting the reduction of water used for showering, because the EPA estimates that each year 1.2 trillion gallons of water is used for showering. Since shower durations vary a considerable amount even amongst individuals living in the same household, it is an attractive target for conservation efforts. Many people are installing shower timers, automatic shutoff valves and gray water systems to cope with the scarcity and increasing cost of water. However, these products require costly plumbing, and cause inconvenience which leads to disuse after an initial period of experimentation.
I have invented a low-cost, easy-to-use internet-enabled device that takes a completely novel approach to solving this problem. Instead of the forceful measures taken by devices such as shutoff valves, my device introduces a gentler approach that consists in nudging people into reducing their shower durations.

My engineering goal is to construct a device that will keep track of a person's daily shower durations over long stretches of time, and make that information available in a graphical format on smartphones. Much like a pedometer that helps people burn off calories, my device will help people reduce their shower durations by providing quantitative insights into their conservation efforts.

Methods/Materials

I constructed two different implementations of my design: (1) fully-automatic system that determines shower durations using an electret microphone, and a humidity sensor, and (2) push button based system that relies on user input. I implemented the internet, sensor data handling and other computing functionality on a Raspberry Pi using Python and Google Charts. I used pull-down circuits and an analog-to-digital converter chip to interface the R-Pi to the physical world.

Results

I tested my system near a shower over several weeks, and verified that shower durations are logged correctly and displayed on demand, in calendar graphs on iPhones and other smart devices.

Conclusions/Discussion

I invented, built and tested an internet-enabled shower usage monitor that nudges rather than forces people into reducing water consumption.

Summary Statement

By combining inexpensive hardware components (e.g., R-Pi) and free open software tools and packages (e.g., Python, Google Charts) I have created a finished product that has the potential to reduce the amount of water used for showering.

Help Received

I would like to thank my brother for teaching me Python programming, and my teacher Mrs. Mackewicz for her helpful advice. I would also like to thank my parents for purchasing the necessary materials and for encouraging my work on this project.