WowShow

Formerly known as Showerlyze

CE 186 Final Project

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Problem Statement

There is lack of **transparency and accountability** in water usage in each household's water bill.

Water is **very cheap** in the quantities used by households; therefore, it is hard to use **cost savings over the entire household** as a number to motivate households.

Stemming from this, we strive to:

- Make the water-guzzlers feel the financial burden more acutely
- Gamify it to incentivize reducing one's water usage

EBMUD water rates

Rates for Single Family Residential Accounts (per 100 cubic feet)

First 172 gallons per day (gpd)	$3.16
All water used in excess of 172 gpd up to 393 gpd	4.34
All water used in excess of 393 gpd	5.74

For reference, around 18.5 gallons (~$0.08) are used per shower in EBMUD territory right now.
748 gallons = 100 cubic feet

Motivations to solve problem

"Water will be the petroleum of the next century"

- The typical Joe **fails to link the fate of humanity decades away with their daily showers** and other water usages, making **unlikely that we will see any behavioral changes** geared towards water conservation anytime soon

- The current incentives and consequences are **too far into the future** just simply too small for households to care

Goal: Make these incentives and consequences larger and more immediate

High-level approaches

1. Accountability
   - Displaying user and household wide statistics for everyone to see
   - Offering easy metrics to split water bills
2. Trackability
   - Targeting water usage behavior that is variable across household members and can be adjusted with minimal impact; showering
   - Affixing login/sign-in mechanism to ID a person's water usage
3. Norming effects
   - "Normative incentives will cause a greater reduction than monetary incentives" -Association for Social and Psychological Researchers

Solution

WowShow is a CPS for the everyday bathroom that employs **gamification and social-norming** to reduce a household's water usage and **enhance accountability** in water wastage

Hardware   Cyber-layer   Visualization

Hardware component

Mechanical flowmeter
- Determine quantity of water used

Voice sensing device (Rockband mic)
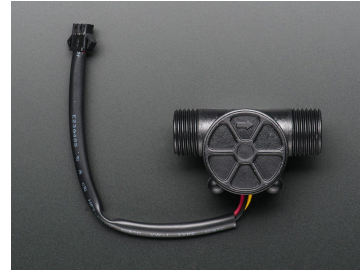- Allows user to enter login ID

DS18B temperature sensor   +   On/off solenoid valve

- Monitors user's water temperature
- Shut off shower once heated to user's preferred temp, notifies user shower is ready

Raspberry pi
- Handles information exchange between server and hardware

Hardware   Cyber-layer   Visualization

Hardware component

Temperature sensor

Solenoid valve

Flow meter

Hardware component

Wiring *to* solenoid valve

Button to begin voice recording

Ethernet to/from server

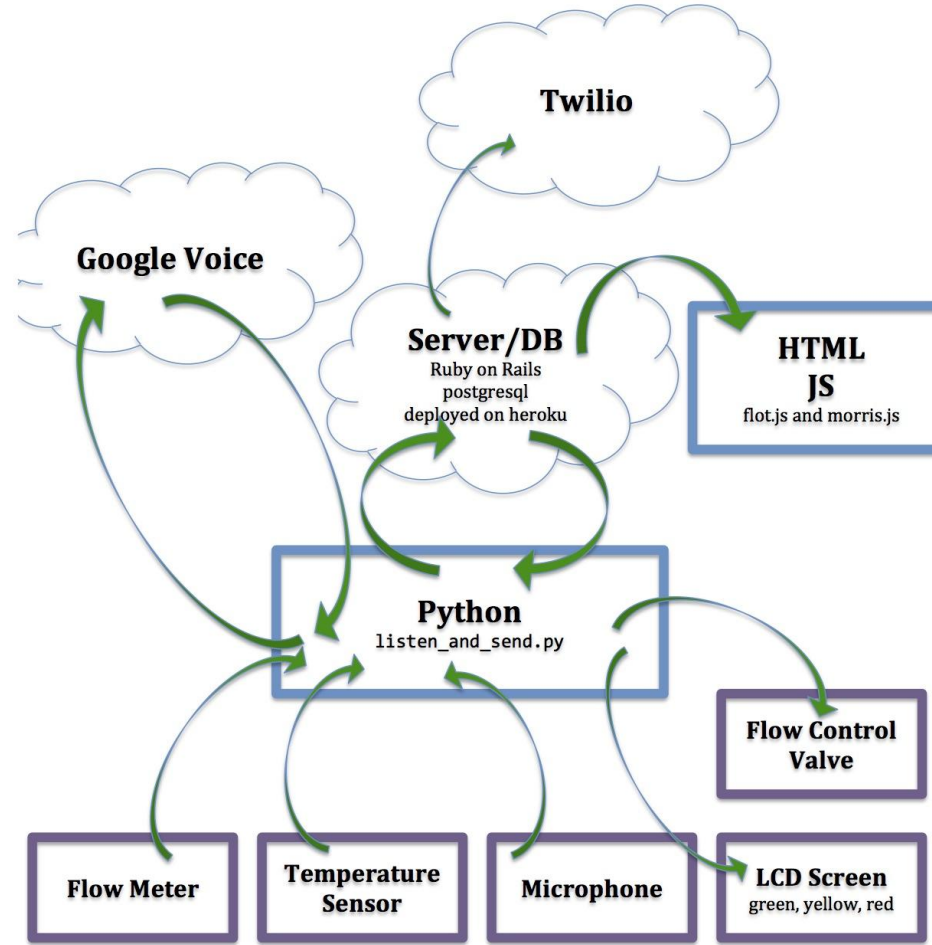Wiring *from* temperature sensor

Hardware   Cyber-layer   Visualization

Cyber-layer

1. Python script running on raspberry pi to relay data to server
   - Records voice and translates to text using google voice
   - Sends flow amount and temp every 5 sec
   - Turns on/off water when receives signal
2. Web Server saves data and sends signals to raspberry pi
   - Determines when the preferred temperature is reached and sends notification to user
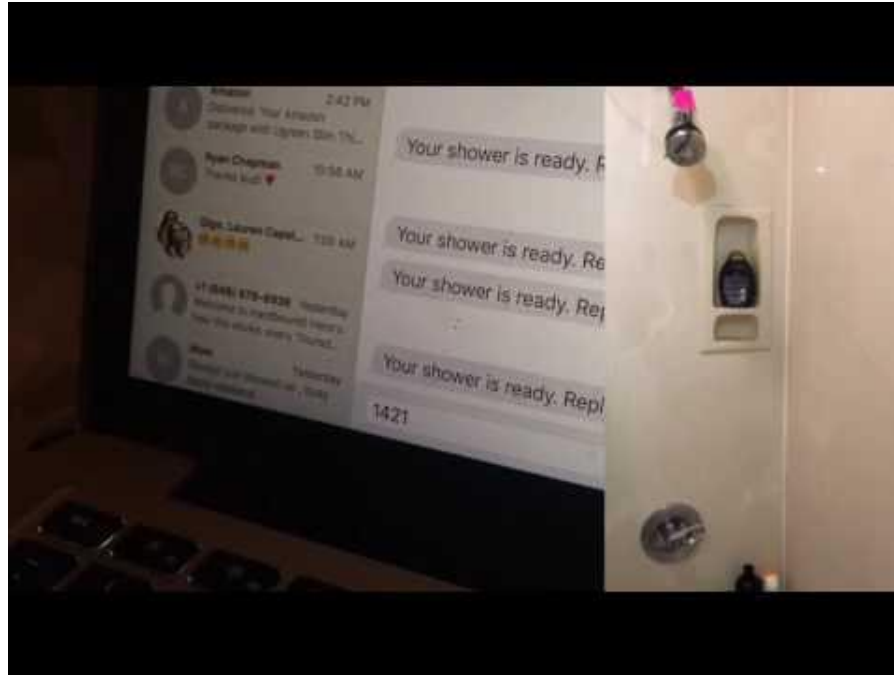   - Determines when the shower has ended

Twilio

Google Voice

Server/DB
Ruby on Rails
postgresql
deployed on heroku

HTML JS
flot.js and morris.js

Python
listen_and_send.py

Flow Control Valve

Flow Meter

Temperature Sensor

Microphone

LCD Screen
green, yellow, red

Hardware   Cyber-layer   Visualization

Video run-through

Demo time!

visit
wow-show.herokuapp.com
to try it out for yourself!

username: demo@berkeley.edu
password: demo

Impact

3 minute reduction in shower time and ~7.5 gallon reduction per shower per user

With 6 showers a week, that is a 2,340 gallon savings per head per year

In Berkeley, 2,340 households x 2.17 persons (average household size) = 5,077 gallons/house/year

With a 40% penetration rate, 46,000 households x 40% x 5,077 = **94,000,000 gal**

We also aim to make this system affordable, around $100 dollars, but with economies of scale we hope to drive it down to around $50 if mass produced. But realistically, a 5,077 gal over a year savings translates into $20, so a system like this would need to be subsidized to incentivize widespread use

Questions ?