

The Award Winning

Malibu Rotary Club Surfwriter

May 4, 2016

Official Newsletter of the Rotary Club of Malibu
Malibu Rotary Club President David Zielski

Edited by Dr. John W. Elman

Pictures by Dr. John W. Elman and Harvey Mudd Global Clinic

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Check [Calendar](#) on Malibu Rotary website www.maliburotary.org

- **Rotary International Website: www.Rotary.org**

- Rotary District 5280 Website: www.rotary5280.org/
- RI President (2015-2016) K.R. Ravindran
 - Rotary District 5280 Governor (2015-2016): D.J. Sung

Engineering students from Harvey Mudd College in Claremont show how they are able to provide a system to Raincatcher Executive Director David Zielski for Low Cost Monitoring of Raincatcher installations in Africa and around the world to the comforts of his home office in Malibu



Harvey Mudd College Assistant Professor of Engineering Brian Bryce Ph.D, (L) and his undergraduate engineering students (L to R) Nithya Menon, Jozefa McKiernan, Cassandra Burgess, Michael Lertvilai, Senghor Joseph and Heather Seaman were given an assignment to solve a problem that RainCatcher Executive Director David Zielski (R) had in monitoring the water levels in RainCatcher water tank installations in rural locations in Kenya, Uganda, India, Haiti and in the Navajo nation located in Arizona. The Raincatcher headquarters is in Malibu, California. The students explained how they solved the challenge when they were the featured speakers of the Malibu Rotary Club meeting May 4, 2016. David Zielski is the Malibu Rotary Club President.



Low-Cost Monitoring of Remote Rainwater Catchment Tanks



Advisor: Brian Bryce | Michael Lertviriat, Jozeta Wickertman, Nitya Winton, Heather Coleman



Project Statement

The RainCatcher Clinic Team will design, build, and test a device to monitor and report the performance of rain catchment systems in Kenya, Uganda, and the Navajo Nation.

Motivation

RainCatcher is a non-profit organization working to tackle the global issue of clean water access through installing rainwater catchment systems. These systems make water accessible to people who would otherwise have to spend hours walking to retrieve water from other sources. The data that our device provides will allow RainCatcher to improve the reliability of their systems and better survey the impact of their work.

Goals

- Measure tank water volume
- Transmit data
- Locally store data
- Allow retrieval of stored data
- Process and visualize the data

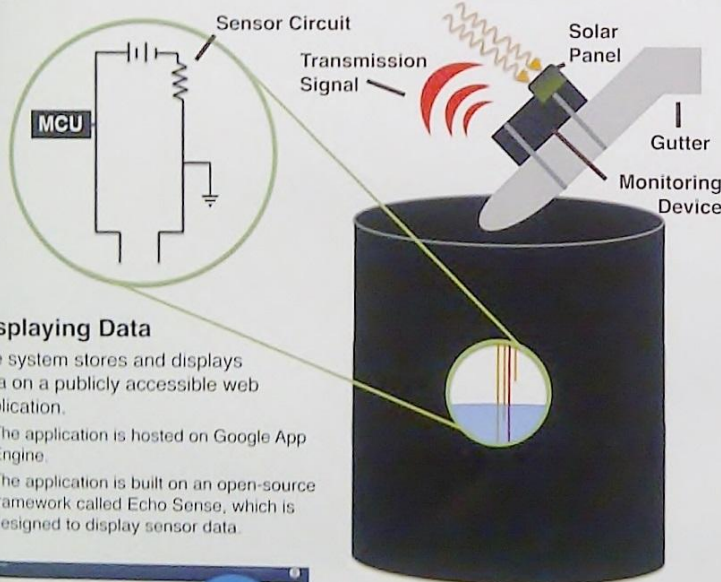
Constraints

- Minimize cost
- Minimize possibility of theft
- Operate under adverse weather conditions
- Operate on self-sustaining power system
- Operate for the lifetime of the tank

Measuring Water Level

The device determines the volume of water in the tank using an inexpensive waterproof sensor.

- A collection of wires is connected to a microcontroller and extends into the tank at different heights.
- The software on the microcontroller calculates the height of the water in the tank based on which circuits are closed and which are open.



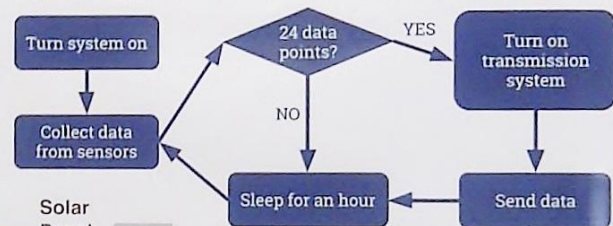
Displaying Data

The system stores and displays data on a publicly accessible web application.

- The application is hosted on Google App Engine.
- The application is built on an open-source framework called Echo Sense, which is designed to display sensor data.



System Operation to Minimize Power Consumption



Communicating Data

The system is designed to send data from remote tank locations to RainCatcher using the following steps:

- A GSM module sends SMS messages via locally available cell networks to a mobile phone.
- This Internet-connected mobile phone relays data to the web.
- The web application receives, parses, and stores collected data.

Storing & Retrieving Data

The device is designed to store data for local access in case of unexpected power down or lack of cellular service.

- Data is stored locally at the tank site on an Electrically Erasable Programmable Read-Only Memory (EEPROM).
- Each device is equipped with an infrared transceiver for manual data retrieval.

Powering the System

The system operates on self-sustaining and renewable energy.

- A solar panel collects solar energy and recharges supercapacitors each day.
- Supercapacitors store and deliver energy to the device using a switch-mode power system.

Protecting the System

The system is protected from adverse weather conditions and theft.

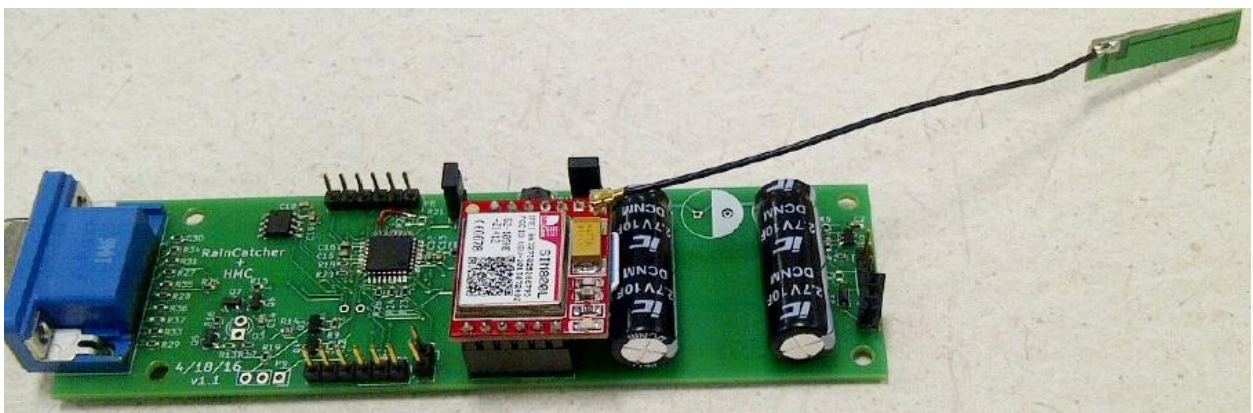
- A sealed PVC pipe protects the electronic components and deters theft.
- The housing system is securely clamped to the downspout.

Professor Bryce said he presented the problem of remote water monitoring in an environment that lacked electricity and economic resources as a project to his class Harvey Mudd engineering students at the beginning of the academic year. It was up to the students to collaborate and solve the problems by the end of the academic years.

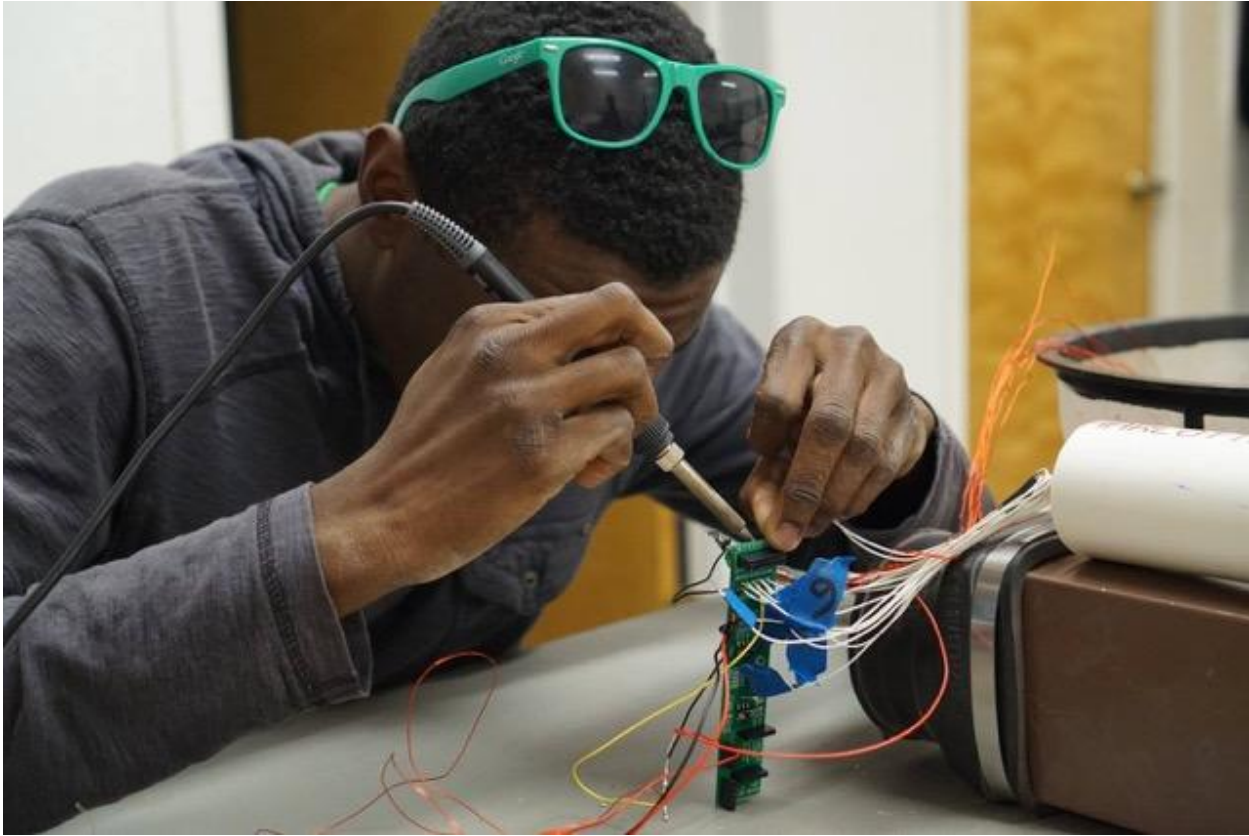
The goals of the project were to measure tank water volume, locally store data, allow retrieval of stored data, process and visualize the data, and transmit the data. The constraints were to minimize cost, minimize the possibility of theft, operate under adverse weather conditions, operate on self-sustaining power system (many places where the tanks are located have no electrical power, and operate for the lifetime of the tank, and since Raincatcher guarantees its tanks and system to last 10 years, that is the goal in the monitoring system.

What the students came up with elegantly simple and efficient. Their target cost for each monitoring system was and incredibly low \$30.00. They knew the lower the cost, the more people would be able to get clean water. The system would not only measure the depth of the water in each tank but the water in the gutter leading to the tank.

They used the principal that since water conducts electricity it can be used to complete an electrical circuit and if they put a lead into a tank of water the circuit would only be completed at the level that the water was. They designed circuit board below, and decided that the most efficient source of power would be solar energy which would be stored in capacitors rather than batteries, because of the long life of a super capacitor compared to battery and the low power needed for their project, which would only power up once per day.



They put 9 leads into a tank to measure water levels.



Engineering student Senghor Joseph is seen soldering circuit board to be used for Raincatcher monitoring installation

The only installation Raincatcher has in the United States is on the Navajo Nation in Tolani Lake and the team of six students went there to test the monitoring system.



This report from Harvey Mudd Global Clinic explains the project Here is an Executive Summary of the project as you requested along with a few of the best photos from our visit to Tolani Lake.

Low-Cost Monitoring of Remote Rainwater Catchment Tanks Harvey Mudd College Global Clinic Team 2015-2016

April 9, 2016

The 2015-2016 Harvey Mudd Global Clinic is sponsored by RainCatcher, a non-profit organization working to address the issue of access to clean water through the installation of rainwater catchment systems in regions of Kenya, Uganda, and the Navajo Nation. These systems make clean water accessible to people who would otherwise have to spend hours walking each day to retrieve water from other sources. RainCatcher strives to deliver highly reliable water systems, but the large number of communities that they now serve poses a challenge for staff members who must periodically check that each rain-catching system is functioning properly. These visits

are both costly and time consuming. To address these issues, RainCatcher has asked the Harvey Mudd Global Clinic team to design and build a monitoring system to communicate the water level of their rainwater catchment tanks at regular intervals. This monitoring device will allow RainCatcher to better understand and survey the impact of their work, as well as improve the reliability of their systems.

The Global Clinic Team has designed and constructed a monitoring device that can remotely report the water level inside a tank, the presence of water in the gutter, and whether the tank site is currently experiencing rain. These data can help RainCatcher determine whether their systems are functioning as expected, and detect maintenance issues such as broken taps, clogged gutters, and other potential problems. The monitoring device is powered by solar energy so as to be self-sustaining and usable in any geographical location. The team has designed the system to last for ten years, the lifetime of RainCatcher's systems.

The cost-sensitive nature of this project has motivated the Global Clinic team to reduce the costs of the monitoring device wherever possible. The current cost of the raw electronic and housing materials meets the aggressive cost target of thirty-five dollars per unit if materials are acquired in a volume of 100 units or more. The team is currently researching options that will minimize manufacturing and assembly costs, which are not covered in the current cost estimate.

The monitoring system operates by collecting hourly data on the water level in its associated tank, as well as the presence of water in the downspout and on the roof. Before sending this data, the device stores this data on a local memory chip. Once per day, the monitoring system sends the data from the past 24 hours via the cell networks to an Internet-connected mobile phone. In turn, this phone posts the collected data to a web application which displays the data in graphical or list format. The data can also be retrieved from this application to display on other websites. In the case that the cell signal is too weak to transmit data, the device

also has a manual retrieval system which allows a RainCatcher staff member to retrieve the historical system performance records via an infrared transceiver.

In early March, the team visited a RainCatcher tank site in the Navajo Nation. On this trip, the team successfully demonstrated that a prototype device could collect and transmit data to the web application. The team recently sent a prototype to Kenya which was specifically designed to test data transmission. This prototype successfully transmitted data over the Kenyan cell networks to the web. In Claremont, CA, the team has shown that the current prototype can be self-sufficiently powered for several consecutive days with solar energy and local energy storage. Currently, the team is conducting long-term testing of their final prototype. The full specifications of the

prototype along with manufacturing data will be delivered to RainCatcher by May 6, 2016.

In June the students are flying to Kenya to test devices there. Most of the students are seniors and will be going on to separate places as they continue they begin their professional careers in engineers. They can all be proud of the contributions they made as students to help bring clean water to third world countries.

Other News and Guests at Last Malibu Rotary Club meeting

Bianca Torrence announced that her son Dave, who is the current indoor American record holder in the 1000 meters race, had a good enough time last month to qualify to by on the American Olympic team. David's events are the 800 meter, 1000 meter, and 1500 meter.

There was more discussion about the Malibu Rotary Club sponsored 1st Annual Malbu Turkey Trot (see below).

Bill Wishard represented the Malibu Rotary Club at the Rotary District Convention in San Diego and will be talking about showing pictures from at the Malibu Rotary Club meeting May 11..

Several Rotarians will be going to the May 14th District Assembly in Carson.

Guests

A guest at the May 4 meeting of the Malibu Rotary Club was **Brad Myers**, who is program officer for Hilton Foundation which is a major sponsor of Raincatcher, and who was at the meeting to hear the presentation by the Harvey Mudd students, whose contribution to Raincatcher should make Raincatcher contributions go further and help more people. Other than the students and professor Bryce Brad was the only guest at the meeting.

Malibu Rotary Club Preliminary Meeting on Turkey Trot Run-Walk-A Malibu Rotary Club Fund Raising Event to be Held Thanksgiving morning at Trancas Beach



The Malibu Rotary Club is planning a fundraising, and health promoting, event on Thanksgiving morning, November 24 at Trancas Beach—The First Annual Malibu Turkey Trot. It will be a 5 K Run and Walk, with the 5K run starting at 7:00 a.m. and a shorter family walk starting at 8:30 a.m.

The Malibu Rotary Club meeting April 27 was led by Malibu Rotary Club President-Elect Delvin Glymph, who contributed a rough draft of a logo that might be used for publicity and event T-Shirts. At the May 4 meeting he had even a better picture, which will be tweaked a little more and we'll hope to have show next week.

The idea of having the Malibu Turkey Trot run comes from Bianca Torrence, whose son David Torrence is professional runner specializing in 1500 meter runs. Cities across the country have Turkey Trot runs on Thanksgiving—making people not feel guilty about over indulging in the dinner they will consume later in the day.

There is a Topanga Turkey Trot—in fact there are three—a 5k run, a 10k run, and 15k run—all in the trails at Trippet Ranch in Topanga State Park. The event field is limited and sells out.

An even bigger local Turkey Trot is the Los Angeles Turkey Trot, which has a course starting at L A City Hall, past Disney Hall, skyscrapers down closed city streets. They raise money for the Midnight Mission and have a pretty impressive array of stuff all the participants get for an inexpensive entry fee.

Both the Topanga Turkey Trot and Turkey Trot-LA have hilly courses. The Malibu Turkey Trot offers a level course adjacent to the beach.

Preliminary meetings had been held with a person, Beth Neal, who is familiar with putting on these type of events. At some point we are hoping she can speak to the entire Malibu Rotary Club.

At the Malibu Rotary Club meeting various jobs for club members and others were discussed. Several people would be looking into T Shirt prices (Delvin, Jack Sherrer) and Jack would work on getting sponsors, and Delvin and Carlye (who wasn't present) in charge of volunteers—any many volunteers are needed for such an event. Bianca said that she would work on getting water donated by such places as Vintage Grocers, CVS and Pavillions. Fees charged to participants were tentatively going to be \$40.00 for adults and \$20.00 for children. David Zielski was out of town, but we believe he reserved a domain website MalibuTurkeyTrot.org for this run/walk event.

Rotarians attending the April 27th Malibu Rotary Club meeting felt that sponsoring the Malibu Turkey Trot was a viable idea and with everyone doing his/her job, and with the right publicity this should be a successful event.

Bill Wishard's Pictures from the Rotary District Conference The Past Week End in San Diego

Bill Wishard represented the Malibu Rotary Club at the Rotary District 5280 Conference held April 28-May 2 at the San Diego Mission Bay Hilton. Celebrating DG DJ Sun's year there was a lot of fun had by all. Bill will have more to show and tell at the next Malibu Rotary Club meeting May 11.



District Governor DJ Sun and Sanjay Khanna from India, who was sent as a representative Rotary International President, proved to be a great speaker with a great sense of humor when he showed up with DJ as a Sumo wrestler as part of the Friday night festivities.

Malibu Rotary Club Supports RainCatcher

David Zielski, Executive Director of Raincatcher makes regular trips to Uganda and Kenya for new Raincatcher installations and maintenance of those previously intalled.. More about Raincatcher can be see on it website Raincatcher.org. A link to Raincatcher video is on the Maliburotary.org website. The direct link to the video is at:

<https://www.youtube.com/watch?v=59rzOcM-RL0&list=UUFetq8NgjhXhtkVf0idcQUg>

Calendar (for details on these programs see Calendar on maliburotary.org)

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- **May 11 2016**
Next Regular Malibu Rotary Club Meeting May 4 at Pepperdine Graduate Campus Room LC 152 with fellowship at 11:30 a.m. and meeting at noon. Bill Wishard's Pictures from the Rotary District Conference in San Diego
 - **May 18 2016**
Cheryl Bradford—Teen Challenge of Southern California
Teen Challenge of Southern California has been reaching youth & adults with no-cost adult residential drug & alcohol recovery services since 1963. Teen Challenge of Southern California provides youth, adults and families an effective and comprehensive Christian faith-based solution to life-controlling problems such as drug and alcohol addiction. Come join us as we help others find hope, health and recovery!