Usability Engineering
Project Report

Smart Water System

(Analysed using IIIT-H)

Proposed by
Akshaya Karthikeyan (20171016)
And
Ananya Arun (20171019)

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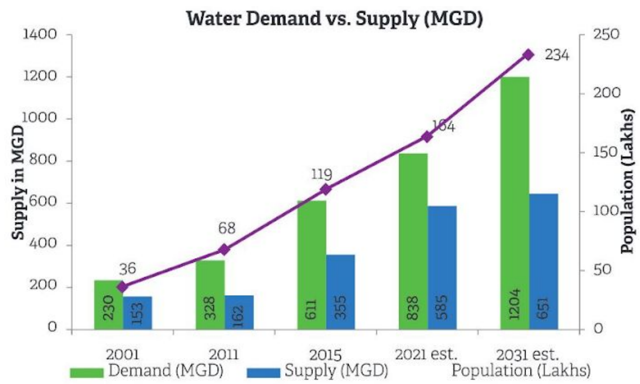
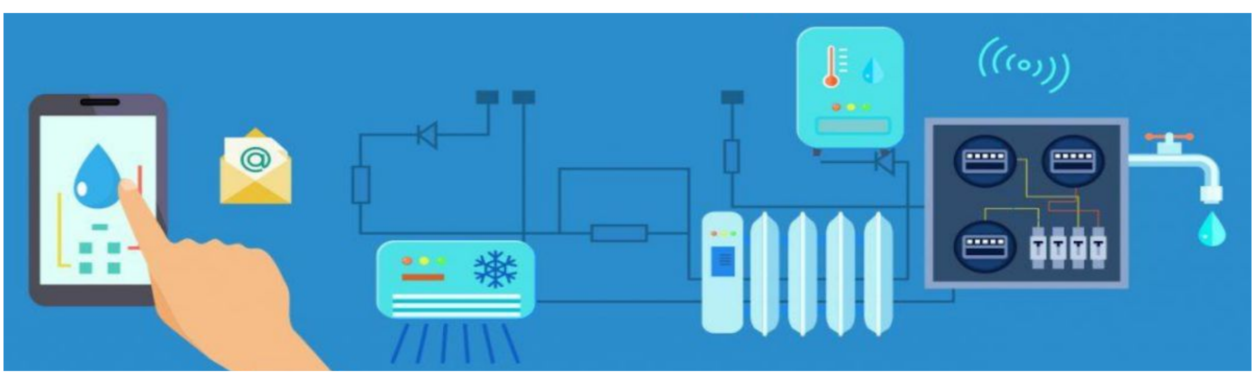
Motivation: Call to conserve water gets louder in Hyderabad

Conservation of water has been thought of as a responsibility of the government, but the role of the civilians is far more important. Hyderabad may run out of water by 2022 and the need of the hour is to have more efficient usage and consumption of water. The graph alongside indicates that the demand for water and population is growing exponentially, but the supply isn't catching up proportionally. There is a huge bridge between demand and supply, and this shall continue to widen in the upcoming years. Thus, we need to utilize the technological advancements to create better ways for water conservation.



Our Proposal: IOT Water

Today, the Internet of Things is associated with almost every luxury in our life ranging from smart cities to smart homes, traffic management system to transportation and various other fields. Thus we propose a model of using a smart water system in IIIT to help in the more efficient usage distribution and quality management of water services across campus.



In this report, we will be discussing the usability of our proposed system by analyzing its implementation in IIIT-H. That is, the system and the degree to which it can be used by it's users to achieve the goals with effectiveness, efficiency and satisfaction.

Development through Usability Cycles

We will be integrating usability cycles into the Smart Water System development process, as it will provide rigorous analysis and testing that will help us get the maximum out of usability design, analysis and testing.

Usability Cycle S1: User Profile

Target Audience: IIIT-H campus residents

Frequency of use: 24/7 daily for continuous monitoring of water

User and Task Analysis

As a part of our project we also conducted a survey to understand the end users of our system better. IIIT is a large community of people including professors, students ,interns ect who live on campus.

The structure of IIIT includes different blocks like the residential quarters, hostels, academic blocks and management blocks. Our IOT water system needs to cater to the needs of all buildings in IIIT and be efficient and easy to use for the user.

To get a better understanding of the current water usage scenario and the water quality across buildings in IIIT we collected data from different students in our campus.

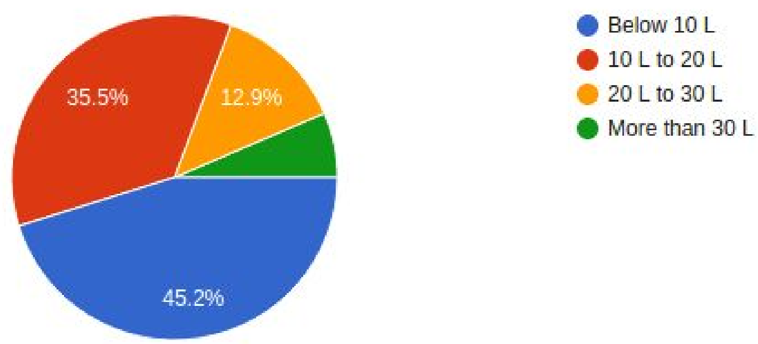
Our survey audience includes about 100 students from different batches living in different hostels like Bakul Parijaat and OBH.

We asked them various questions regarding their daily water usage and water quality according to them in different buildings.

We also collected data on how efficiently water wastage is managed in the campus at the moment.

Here is a graphical representation of our analysis for each question we asked our participants.

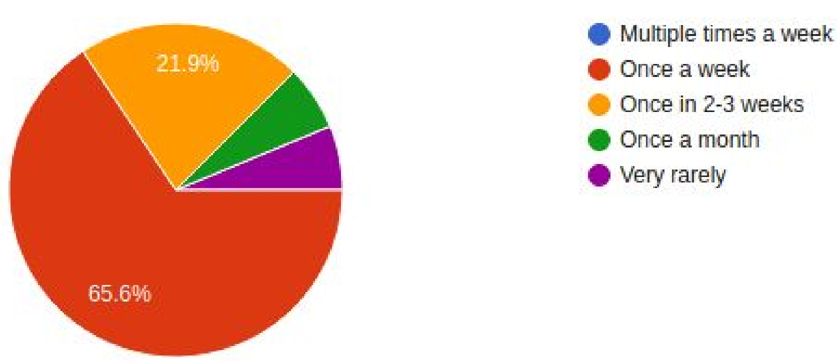
1) How much water do you think you use on a daily basis approximately ?



We see that maximum IIIT students use about 10L of water on a daily basis for various activities.

While on an average about 20L is used by students on a daily basis. Given the population of our college is roughly 1500 students and about 100 professors this gives us a rough understanding of daily water usage for various activities like brushing bathing etc.

2) How regularly do you use the washing machine ?



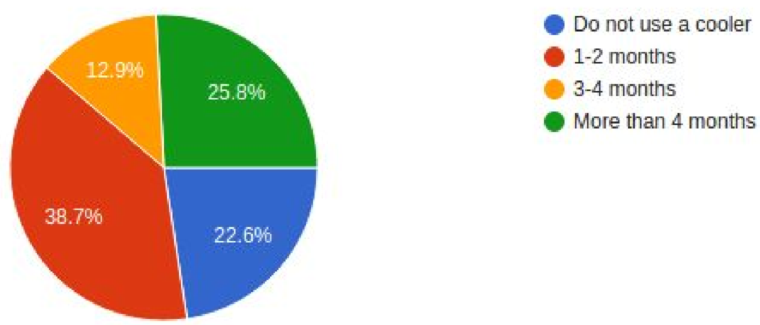
As per the responses maximum students use the washing machine almost once per week.

A cycle of the washing machines used commonly takes about 50-100L of water depending on the time slot chosen. From this we can understand and design our water distribution strategies better.

In our model which will be discussed more elaborately later on we assume there is one large overhead tank from which water distribution takes place in IIIT.

Such measurements of the distribution of water among buildings for example the different hostels will help us design our system in a user friendly manner and improve its usability.

3) How many months of the year do you use a cooler ?



Here we see that on an average IIIT students use water coolers for about 2 to 2.5 months.

An average water cooler uses about 5L of water per hour and hence assuming a person uses it for 12 hrs a day we can estimate the water usage per cooler as 60L per day.

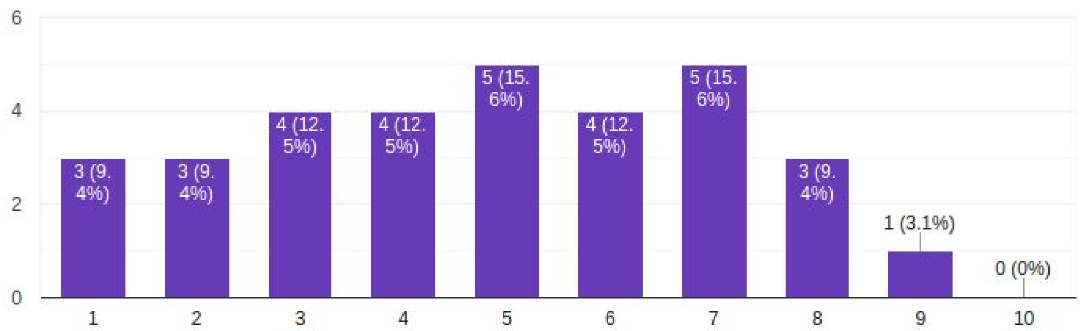
Again we want to track devices that use maximum water to understand the distribution of people in various hostels using them to make water management and distribution more user friendly.

For the next part of our survey to understand water quality across various buildings we asked our participants to rate water quality on a scale of 1 to 10 for firstly their hostels then for Vindhya and lastly for Himalaya and KCIS blocks.

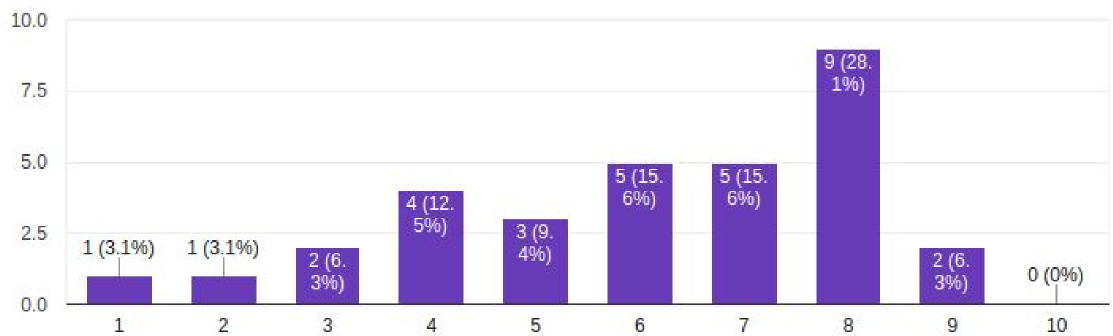
Here are the results we obtained

The results are tabulated wrt percentage of people who voted for a certain quality value.

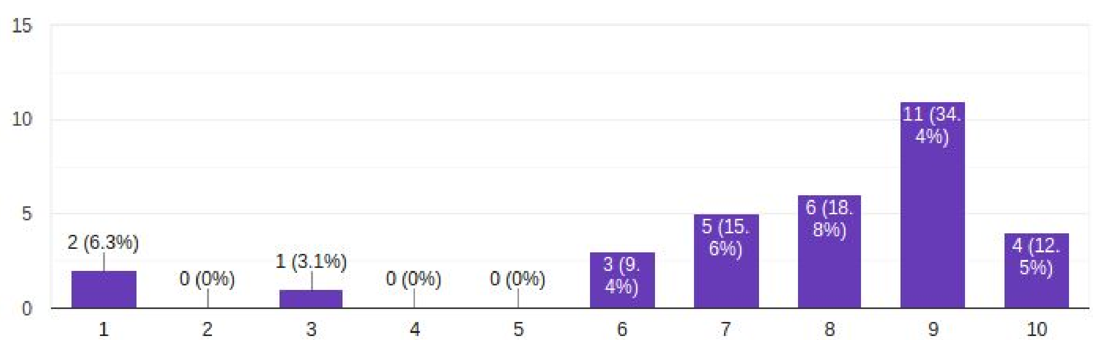
4) For hostels



5) For vindhya



6) For Himalaya and KCIS blocks



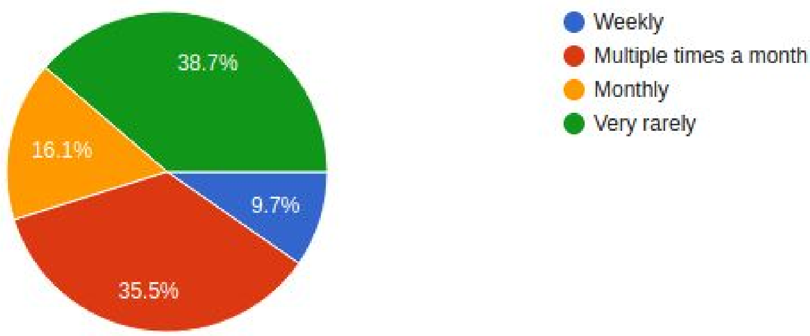
From the analyses of the response we received for this part of our survey we can see that most students feel the quality of drinking water is poor in all hostels and good in KCIS and himalaya blocks. The analysis also seems to suggest that the quality of water in vindhya is not as good as KCIS but better than hostels.

Looking at the current situation we can improve the usability of our model and try to achieve equal good quality drinking water supply across all buildings in IIIT.

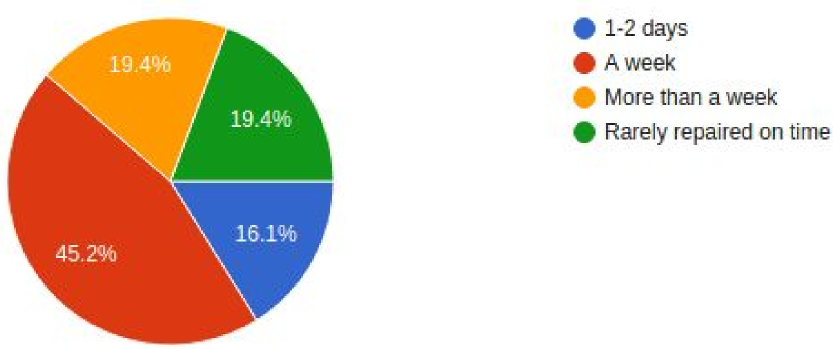
To do so we will need to analyse the underlying reasons for these differences arising. Whether it is the old water pipes or bad coolers causing this problem. After finding the causes we propose an action plan to fix it.

We then moved on to understand how water management and repairs are being handled at the moment. We asked our participants to answer the following questions regarding how frequently they notice any leakages and how often they get repaired.

This was the result:



From this we can conclude that the majority of the people notice leakages on an average of once per month.



This analysis regarding how frequently leakages are repaired shows that it takes a little more than a week on average to repair a leakage once detected.

One main problem for this delay in fixing the leakage is mainly due to lack of proper communication between the residents i.e. the students and the official bodies that take care of these repairs. With our IOT system we can ensure problems regarding any maintenance are relayed faster and in real time to all users of the system and the concerned authorities can be notified as soon as possible. This will facilitate sooner repair of leakages and help in water conservation and management. The IOT system will try to bridge the gap between its users and hence increase the overall efficiency and usability.

Usability Cycle S2: Goal Setting

Understanding the goals

The 4 main goals of our project initially are to address water conservation, water management, wastewater management and water quality testing.

We elaborate these 4 here.

Water Conservation

It is important for reservoirs and overhead water tanks to have sensors and equipment which are specially designed to display the level of water present in it. With the help of these sensors, the water level in the reservoir or the overhead tank can be sent to our server at regular intervals. This data can be used to calculate the amount of water used on a daily basis. This entire process of determining the water level in the reservoir and then reflecting it on to the main server will surely help in managing water consumption.

Smart Water Management

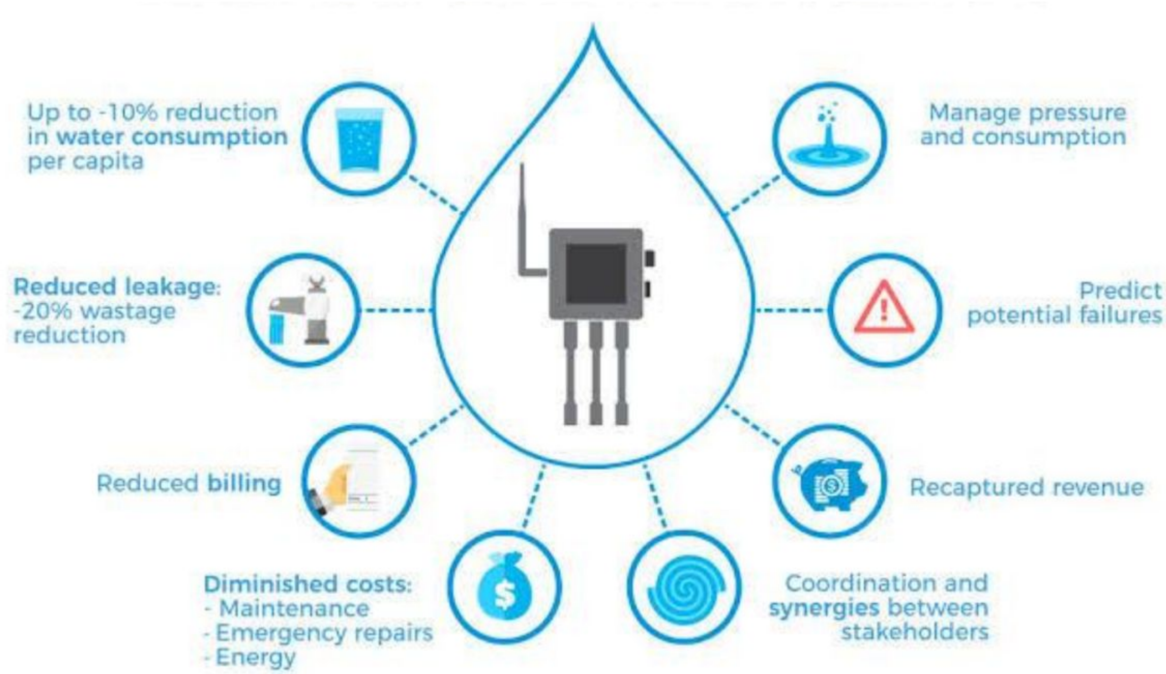
In urban areas, keeping a record of water consumption and managing revenue/ billing is extremely challenging. This issue can be solved using IoT which will keep a record of people using water on a particular day. We can analyze the data and the weather conditions to find ways to diminish costs on maintenance, emergency repairs and energy. This will also surely improve coordination and synergies between stakeholders.

Wastewater Management

Another challenge in water management is to predict potential failures and monitor leakages, water quality and the flow of water through different channels. IoT can help IIIT water systems in all these areas. Sensors installed at various places in the water system can detect the temperature changes, water leakage, chemical leakage, and pressure level in it. These sensors will then collect the information and send it to the main server. This will ensure that the service engineers solve the issues quickly. Another advantage is that it can detect and calculate the amount of chemical residue present in the water.

Water Quality Testing and Analysis

The internet of things can be used for measuring and monitoring the data captured and drawing real-time analysis of water testing in industries like manufacturing, energy etc. IoT can also be used for public utility companies in the field. The readings are provided to the end users with the help of water testing meters and sensor devices. The end user can get information like Total Dissolved Solids (TDS), Bacteria, Chlorine, Electrical conductivity, etc.



SNAC

We used the SNAC analysis to understand the stakeholders, needs , alterables and constraints of our system better to define clear objectives we want to achieve.

Stakeholders - IIIT residents, Employees of the water quantity/ quality management, Employees of the water revenue management

Needs - Managing water consumption and pressure, Predicting potential failures, Minimizing water leakage/ wastage, Getting good quality water for drinking/ other activities, Keeping a record for accurate billing/ revenue purposes, Increasing coordination between the stakeholders, Diminishing cost of maintenance, emergency repairs and energy

Alterables - Ways in which water is measured and delivered between different buildings of IIIT, Threshold for warnings

Constraints - The fixed water supply that is given to IIIT, The number of people it needs to be distributed to

Objectives

After using SNAC we list out our objectives as follows.

Measure and monitor - Installation of sensors in all water tanks that measure and monitor the water.

Analyze - The Smart Water System and data collected is segregated and analyzed for optimization.

Improve revenue - Reduce cost of installation, cost of acquisition and consumption.

Improve efficiency - Control loss with meters and pressure management system, increase accessibility and appropriateness.

Communicate - Have a utility network with good user experience/interface that collects and stores data of water usage, which the stakeholders can view

Usability Cycle S3: Prototype

A prototype of the system is implemented by using two sensors:

- water flow monitoring device
- TDS monitoring device.

These are installed in water heads, water coolers etc to understand the ease of installation of the devices, how well it's working and transmitting the data about the water. This will give a good idea about how well the system can be implemented.

We took data from the **CVEST research group** to understand these devices better and we have explained their working and analysis as per our study below.

These can be used in our IOT system to track water levels and TDS levels.

Devices and Sensors

Water Flow Monitoring Device

Calculation of water flow rate quantified (Litres/Minute), through a pipe using Water Flow Sensor.

Overview of the device

Major components of the device: Waterproof sensor, microcontroller, Server using Wifi

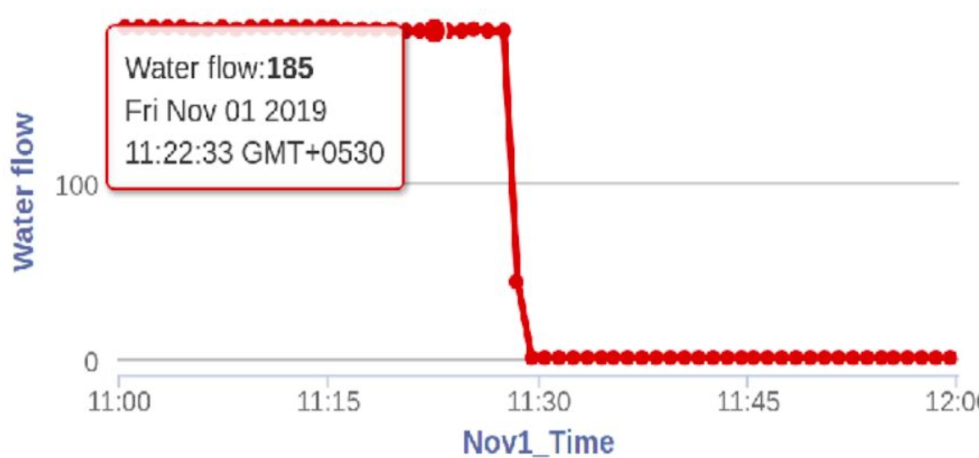
fig: Sensor

Conceptual Flow: When water flows through the valve (of water flow sensor) it rotates the rotor. The speed of rotation of the rotor depends upon flow of water and this change is calculated as output as a pulse signal by the Hall effect sensor (due to voltage difference). Thus the rate of flow can be measured. This measured value in L/min is sent to oneM2M server and thingspeak for every minute.

Data Visualization/ Analysis Framework: The data obtained can be zero or nonzero, zero implies that there is no flow of water through the pipe, which implies that the respective motor is turned off and a nonzero value explains about the flow of water through the pipe at that instance of time(per minute). This then can be checked by users using the webpage.

Created At (Time)	Entry_ID	Water_Flow(L/Min)
2019-11-01 10:52:30 IST	2789	0
2019-11-01 10:53:30 IST	2790	0
2019-11-01 10:54:30 IST	2791	50
2019-11-01 10:55:30 IST	2792	187
2019-11-01 10:56:31 IST	2793	186
2019-11-01 10:57:30 IST	2794	187
2019-11-01 10:58:30 IST	2795	187
2019-11-01 10:59:30 IST	2796	187
2019-11-01 11:00:30 IST	2797	187
2019-11-01 11:01:30 IST	2798	187
2019-11-01 11:02:30 IST	2799	187
2019-11-01 11:03:31 IST	2800	187
2019-11-01 11:04:30 IST	2801	187
2019-11-01 11:05:30 IST	2802	186
2019-11-01 11:06:30 IST	2803	186
2019-11-01 11:07:30 IST	2804	187
2019-11-01 11:08:30 IST	2805	186
2019-11-01 11:09:30 IST	2806	187
2019-11-01 11:10:30 IST	2807	187
2019-11-01 11:11:30 IST	2808	187
2019-11-01 11:12:30 IST	2809	187
2019-11-01 11:13:30 IST	2810	187
2019-11-01 11:14:30 IST	2811	187
2019-11-01 11:15:30 IST	2812	187
2019-11-01 11:16:30 IST	2813	186
2019-11-01 11:17:30 IST	2814	186
2019-11-01 11:18:30 IST	2815	186
2019-11-01 11:19:30 IST	2816	186
2019-11-01 11:20:30 IST	2817	185
2019-11-01 11:21:30 IST	2818	185
2019-11-01 11:22:33 IST	2819	185
2019-11-01 11:23:30 IST	2820	185
2019-11-01 11:24:30 IST	2821	185
2019-11-01 11:25:30 IST	2822	186
2019-11-01 11:26:30 IST	2823	185
2019-11-01 11:27:30 IST	2824	185
2019-11-01 11:28:30 IST	2825	43
2019-11-01 11:29:30 IST	2826	0

Data retrieved from server



Graph showing flow rate wrt time

Water Flow data of a week

<u>TDS Monitoring Device</u>

This device is used to monitor the TDS(Total Dissolved Solids) of drinking water in a water cooler and check whether the water is fit for consumption.

Overview of the device

<u>Major components of the device:</u> Waterproof sensor, microcontroller, server, wifi

<u>Conceptual Flow:</u>

- Measures the TDS of a given drinking water system:
  - The sensor contains two pins with a fixed distance between them. They act as electrodes one being positive and the other being negative.
  - When suspended in an electrolyte , electricity flows between them creating a voltage difference. This voltage difference is calculated and with it, the electrical conductivity is measured.
  - The electrical conductivity is then used to calculate TDS. With the formula *TDS = 0.5 * Electrical Conductivity*
- Checks whether the water is potable according to the TDS value from the sensor
- Then the data is uploaded to a server so that range values can be maintained.
- This then can be checked by users using the webpage before they consume the water.

- Also if the quality of water is less for a long period of time, respective authorities will be notified.

Data Visualization/ Analysis Framework:

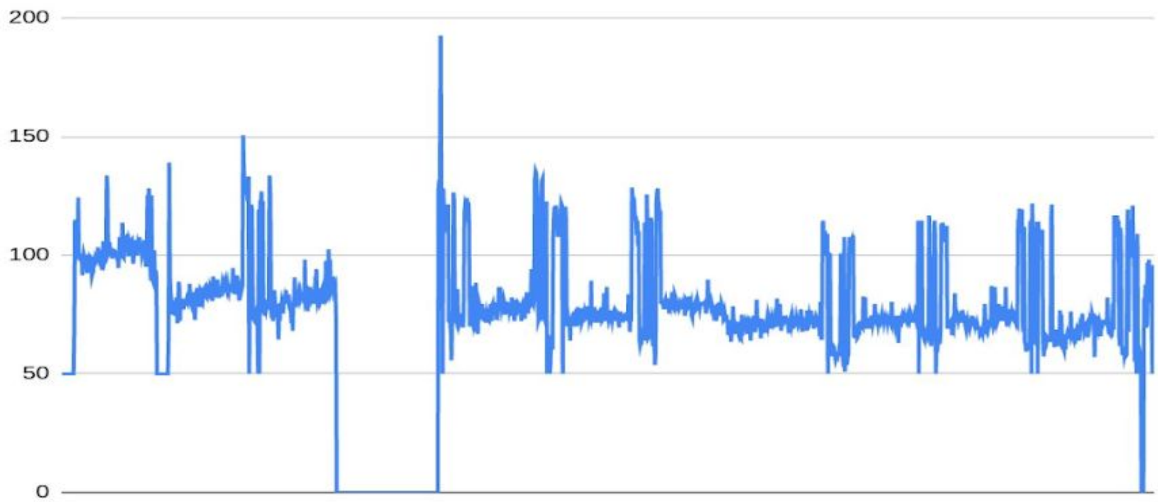


Fig: The graph of TDS vs time. The graph contains a minor fluctuation due to a log in the R.O water filter's pipe connected to the water cooler.

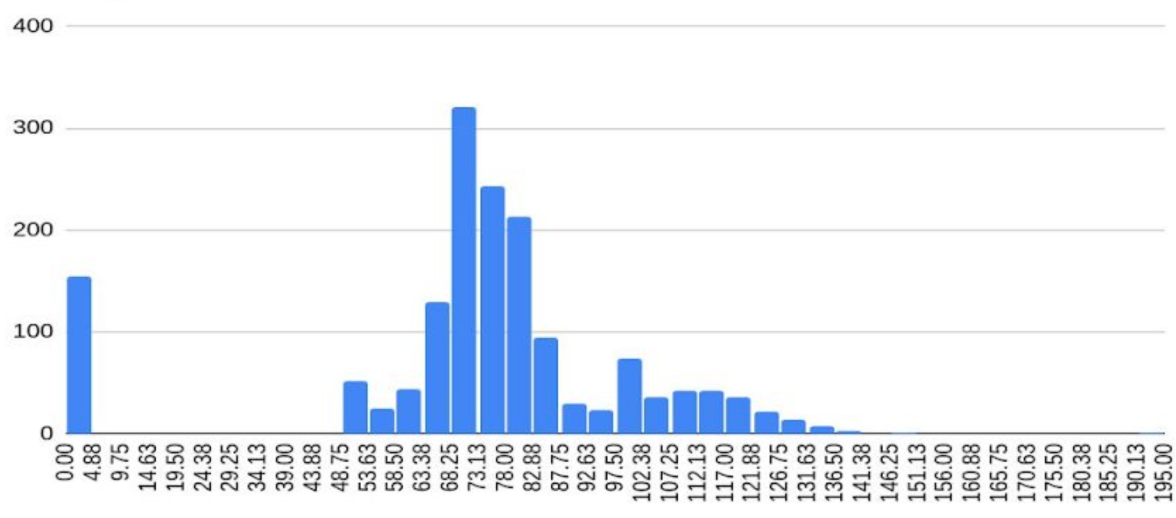


Fig: The distribution of TDS values

These are measurements acquired from two types of sensors. We can similarly install various other sensors like water level sensor, pH sensor, turbidity sensor etc for getting other forms of data.

Usability Cycle S4: Design

Now since we have implemented the prototype and realized that this is a feasible solution, we will next plan the implementation and design the User Interface.

We shall now demonstrate the working of our proposed IOT system by using the example of IIIT hyderabad.

We desire to use our system to mainly help in the following 3 areas :-

1. Automatic meter reading for water level detection
2. Leakage detection
3. Water quality monitoring

   We mainly want to inform users regarding this data in real time in an efficient manner.

Assumptions made about our model :-

- Users
  - Students - 1500 students living in 4 different hostels - Bakul , Parijaat, Kadamb nivas and OBH.
  - Professors - 100 faculty members living in the faculty residence area along with their family members
  - Along with the residential blocks we also consider that our IOT water management system caters to the needs of the KCIS block, Nilgiri, Vindhya and Himalaya academic blocks.
- Blocks

  Roughly, our system consists of the following buildings to manage and each of these buildings will be managed as a unit of its own depending on the water usage and requirement there.

  - Parijaat - residential block
  - OBH - residential block with attached mess (2 messes)
  - Bakul - residential block

- ➢ Kadamb Nivas - residential block with attached mess (2 messes)
- ➢ Nilgiri - Academic block with 3 floors
- ➢ KCIS - Research block with an auditorium and 4 floors
- ➢ Vindhya - Academic cum research block (biggest building in IIIT)
- ➢ Himalaya - Academic block with 3 floors and classrooms

❖ <u>Levels of Hierarchy</u>

We assume there is a manager/owner of the main server of our IOT system and he/she will be responsible for its working configuration and maintenance.

There will be a head person in charge for each hostel and building who will be notified regarding water levels , water quality and repair management for that particular building. This person will also have access to individual user data of all the people living in that building.

The head incharge of each building will also have access to schedule routine refills of the tank automatically as and when required. This access will not be given to other users of the building to avoid confusion.

Benefits for our users

The users of this app will continuously be notified regarding water levels in their block and different blocks of IIIT.

They can raise a ticket and inform the head incharge of a building if the notice water level drops to ask for or schedule a refill. This way time is saved and water gets refilled automatically at the earliest.

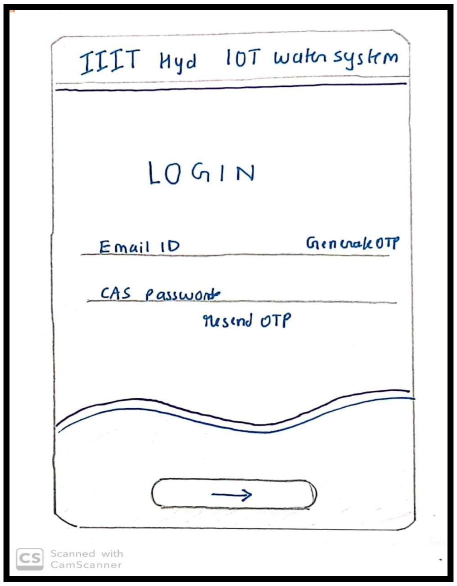
Users can also access all TDS measurements to assess water quality in different blocks of IIIT. At any given time they have access to the standard allowed value of TDS too.

They can raise issues and complaints through the app if water qualities are bad and this would be notified to all users. The concerned authorities can also take action quickly to fix the problem.

Apart from reports regarding bad water quality, users may raise issues regarding leakages detected etc as well. Once raised the concerned authorities are notified immediately and such issues are fixed. This system of raising requests through the app ensures fast action and repair which inturn ensures less water wastage.

Wireframes/ UI

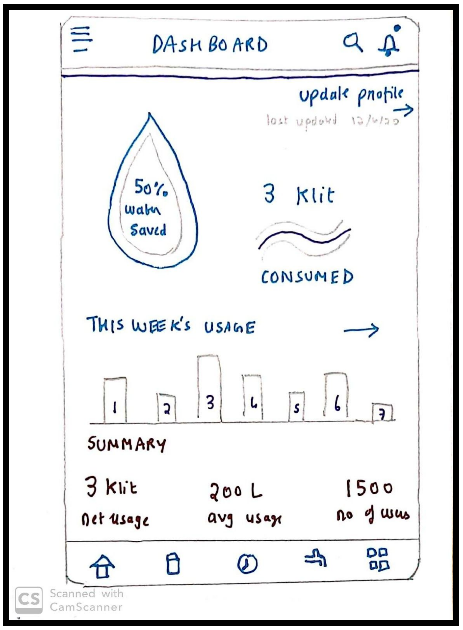
We have designed some wireframes for the app to show how we want the look and feel of our app to be from a users point of view.



Log-In Page

First the user is required to log in using his/her CAS authentication which is provided for all students/teachers in IIIT. This ensures data security for our app.

The Dashboard

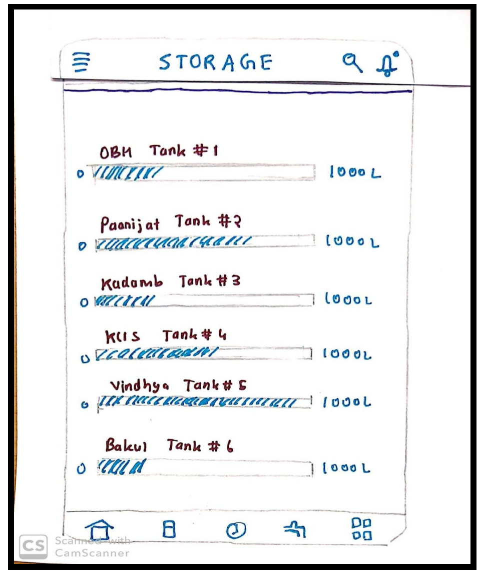


On logging in the user is taken to the dashboard. On the top of the dashboard we have a menu along with a search button and notifications icons.

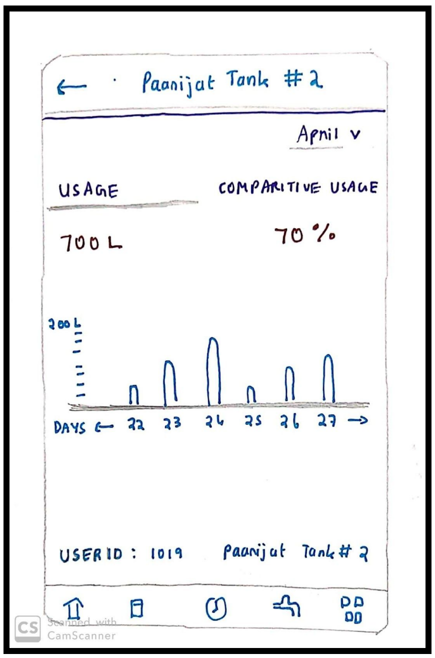
The dashboard keeps track of how much water is being used in the users block and how much has been saved relative to usage before that app. It also tracks the week's usage of water for a better understanding of the user.

On the bottom of the dashboard are links to home, storage, control, TDS and users section which will be discussed in detail soon.

Storage Section

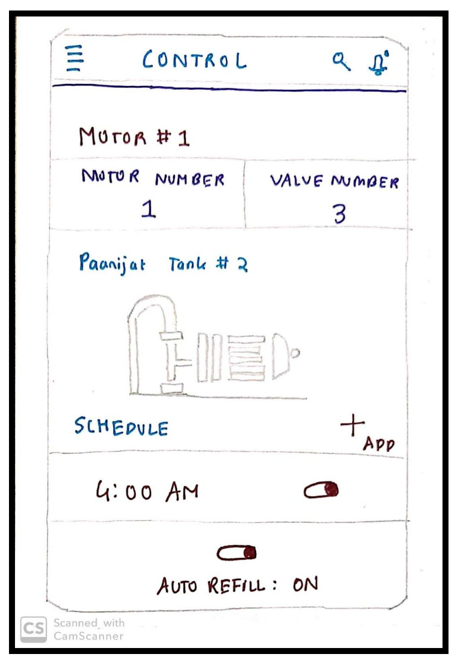


This page of our app shows the water levels in the different buildings. We visually show a user how full or empty a tank is so that the user can take the required action accordingly with least effort.



On clicking on a particular tank, the user is taken to that tanks page which gives more elaborate details as shown below. It shows water usage for a particular month and day as selected in that building/tank,

Control Section



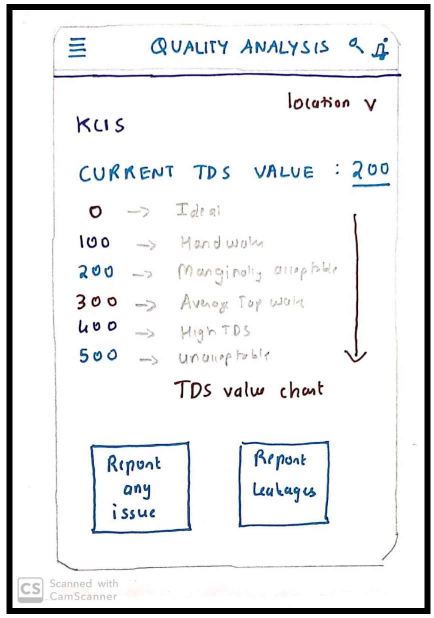
In the control section of our app a user can choose and remotely control motors of various tanks. This access is given only to the people incharge of the building though.

Using the ON OFF toggle one can set or schedule a routine refill of the tank as and when it gets empty.

This reduces dependence on someone to take care of this task as once set the app does it for us.

Quality Monitoring Section

In this section of our app a user can see a chart of desired TDS values and their implications and then select the tank for which he/she wants to measure the TDS value for.



There is provision for our users to also lodge complaints regarding anything that needs improvement here.

This will be sent as a notification to all other users using the system.

Once the complaint is reported like leakages detected etc the concerned people are notified immediately to ensure repair is done within days and this inturn minimises the water wastage.

Usability Cycle S5: Analysis

Next, we will analyze the model systematically using usability principles and cognitive/psychological factors to realize how effective it is.

Usability principles

Usability is defined as the "degree to which a product or system can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use." (ISO 25010) We will be analyzing the usability and effectiveness of this system systematically.

Appropriateness Recognizability

Defined as the "degree to which users can recognize whether a product or system is appropriate for their needs."

As we saw from the survey conducted, the residents of IIIT-H are not finding the water usage and quality satisfactory. Us being a computer science institute, our way to tackle this problem should be technologically advanced.

This system is also not only limited to water conservation, but helps in various ways as already mentioned. Hence, this model has a high degree of appropriateness recognizability.

Learnability

Defined as the “degree to which a product can be used by specified users to achieve specific goals of learning to use the product with effectiveness, efficiency, freedom from risk and satisfaction in a specified context of use.”

After the installation, the sensors measure various characteristics of the water and send the data using WiFi/ bluetooth to the server.

A web application is created to display the data stored in the server in a well organized manner. This provides a high degree of learnability as the app is intuitive and simple.

Operability

Defined as the “degree to which a product has attributes that make it easy to operate and control.”

The users can operate the application easily as it’s hosted and can be viewed around the clock. It’s minimalistic and intuitive. There is no requirement for technical knowledge as everything is simplified and delivered on the app.

They can also take up further research using the data by web-scraping from the application.

User Interface Aesthetics

Defined as the “degree to which a user interface enables pleasing and satisfying interaction for the user.”

While creating the app, the main aim is to maximize user experience and user interface quality, as most of the interaction happens over here.

The data is displayed using visually attractive methods such as pie charts, graphs and colorful histograms. It's visually pleasing and easy to analyze as well.

Accessibility

Defined as the "degree to which a product can be used by people with the wide range of characteristics and capabilities to achieve a specified goal in a specified context of use."

The application is accessible to anyone having WiFi/ ethernet, and using the campus's central authentication system (CAS).

This applies to all the residents and staff of IIIT-H. In case an outsider needs data, for example plumbers or water management organizations, a special account can be offered to them by the authorities of IIIT-H who also have access to the main server where all the data is stored.

Psychological/ cognitive factors

Physical Saliency

- Simple: The system is simple as users only have to log-in to the application to view all the details. The user interface is minimalistic and visually appealing.
- Standardized: All the options are intuitive as the app is designed using the same format that's used in most popular web applications.

Cognitive Perspectives

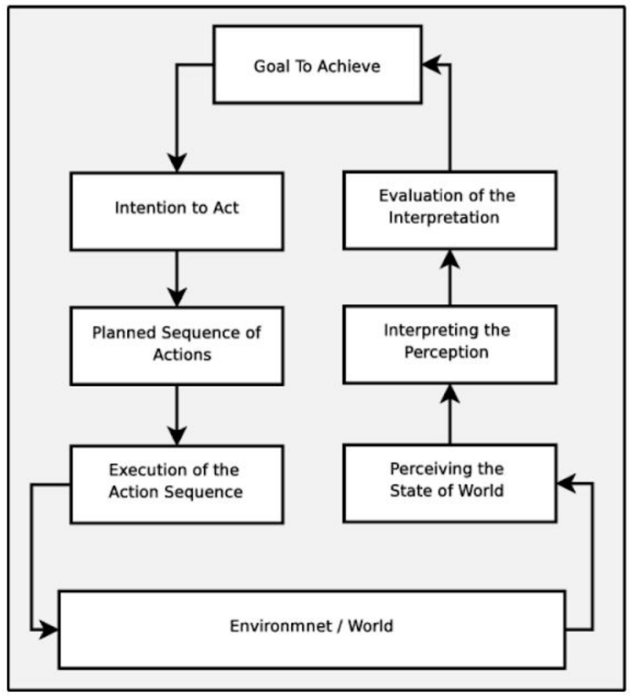
Both the web application and the sensors give constant feedback.

- The sensors continuously relay data to the server.
- The web application gives feedback after every user's action to indicate whether they are going closer to their desired section.
- Alerts
    - The web application sends signals when the water level or quality is too low.

- Visual and audio alerts are sent to the water management authorities when a leakage is detected or the toxicity in the water is too high. As the severity of the issue increases, the alerts will become more attention grabbing.

Seven Stages of Action

The gap between the bridge of execution and the bridge of evaluation is minimized using the 7 stages of a



1. **<u>The Goal:</u>** To receive certain information about the water, say, water quality.
2. **<u>Intention to Act:</u>** The user logs-in to the app with the intention of finding water quality.
3. **<u>Planned Sequence of Actions:</u>** The user plans on clicking appropriate options that direct towards water quality.
4. **<u>Execution of the Action Sequence:</u>** The user clicks on the appropriate options. In this case, "menu icon" and then "water quality".

   <u>Environment/ World:</u> The app receives the request. The frontend relays this request to the backend, retrieves the data and displays it appropriately.

5. **<u>Perceiving the State of World:</u>** The user perceives that the web application changed its page and displayed the next set of appropriate options and data in a visually appealing manner.
6. **<u>Interpreting the Perception:</u>** The user interprets the progress and decides whether it was what they expected.
7. **<u>Evaluation of the interpretation:</u>** Then, the user views the data displayed and gathers all the information. Their goals are achieved and the user is satisfied.

Other factors

Security

The system is secure because the entrance is permitted through the central authentication service(CAS) of IIIT-H.

Consistency

The data is consistent as all the measurements taken by the device is directly transferred to the server through WiFi/ bluetooth. The data stored in the backend of the application will match with what is displayed on the frontend. This can be acheived by using appropriate web development principles.

Usability Cycle S6: Improvements

No system is perfect and hence our system too is prone to errors and faults which we try to identify and fix in this iteration.

Error Protection - The installation of the devices was not tedious, but some fluctuations due to errors if noticed has to be improved. The data received in the server is stored consistently. Therefore, if the devices' hardware is slightly improved, the system will become more accurate and implementable.

Error Prevention - Once an error has been found and fixed we try to prevent such errors in the future by ensuring our model is robust.

Usability Cycle S7: Participatory design

Since no matter how vigorously the system is developed, the user's opinions are what matters the most. Hence, the web application has a feedback section that'll accept reviews from its users. This will be considered during improvement and maintenance of the model at every iteration.

Usability Testing

The key difference between usability testing and traditional testing (bug testing, acceptance testing etc.) is that usability testing takes place with actual users of the product. Few volunteers are asked to use the Smart Water System web application and give reviews and opinions. These are considered while designing in the next iteration.

Control **-** The control groups are created with equal distribution of all its users: students, faculty, management faculty etc. Tasks are distributed uniformly across these groups. The level or skill required by an user to operate these devices is observed to maintain the balance for both novice and expert users.

Quantitative usability testing **-** Various tasks are assigned to the users, and the ease with which they achieve them is observed. Task success and Time on task are two metrics used.

Comparative Usability Testing **-** Used to compare the efficiency and appropriateness of the designs created against other applications.

Explorative Usability Testing **-** The users explore the features that they require or want improvement upon.

Reliability and consistency - The data of what's measured, transferred to the server and projected on the application must be consistent. Encryption while browsing or other transferring tasks must be reliable, safe and secure.

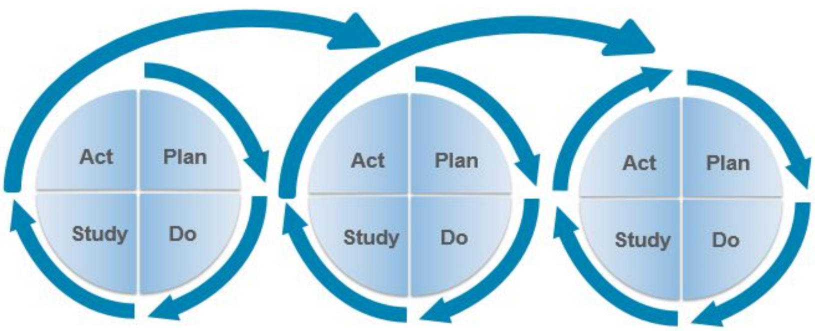
Reducing errors - When the devices have errors in measuring, there will be unusual readings. This will alert the management organization to fix it.

Usability Evaluation **-** Final product is created and tested before the official launch. User's opinions are given maximum value.

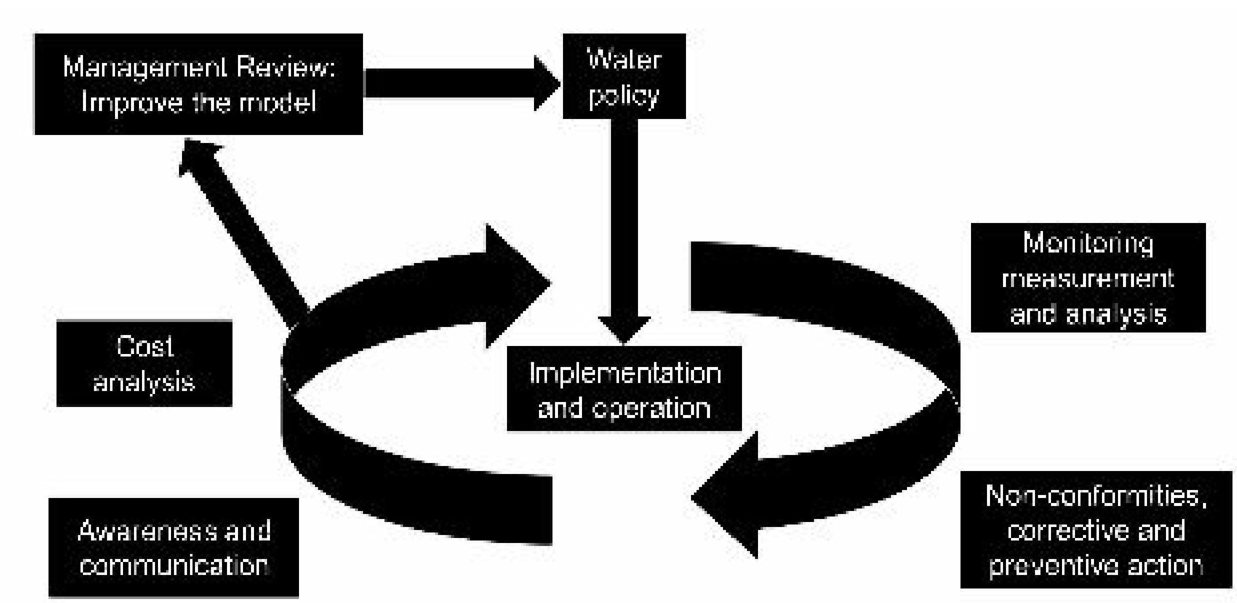
Manipulation and Simulation Check

The feedback from the users during the experiment is collected. Their behavior before and after is analyzed. Other factors that might have affected the experiment are looked for and considered.

Usability Cycle S8: Iterative design



The iterative design is shown using the flowchart below. This will help in continuous improvement of the model. It will also aid in maintenance and keeping up with technological advancements.



The system is first developed and installed. During the implementation various measurements and analysis are made. This, along with the reviews from its users are gathered and analyzed to make improvements and better designs at each iteration. We will be using the 6 sigma process to improve the system at each iteration:

Using Six Sigma Methodology (DMAIC)

6 sigma is a product or system improvement technique used commonly in software and usability engineering to come up with and maintain efficient models that are developed after thorough analysis of constraints in a way which ensures high satisfaction for the users.

D: **Define** the solution and understand its various dependencies

M: **Measure** the various qualities of the water

A: **Analyze** the Smart Water System and how water usage has changed/become better after implementation

I: **Improve** the solution and implementation for better results in water conservation and distribution across campus.

C: **Control** the wastage of water by reducing it and maximizing its usage

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Impact of our solution

Our solution is scalable and accessible to all users, and will benefit in:

- Water conservation
- Wastewater management
- Smart Water Analysis
- Water quality tracking

It is a New solution for improving water management and maximizing its efficient use.

Used in Big communities for Tracing usage of water as doing so manually in a big campus like ours is challenging and IOT helps track water consumption better

It is Efficient!

Through IoT sensors, not only can we conserve valuable resources and provide quality water but also meet demands of the people adequately and make our lives convenient.

It is Accessible!

All the stakeholders can view the data collected by the sensors and take actions accordingly

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References

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- Sensor data from CVEST Research Group
- https://smartwatermagazine.com/blogs/parija-rangnekar/how-can-iot-help-water-management-system
- https://sensus.com/internet-of-things/smart-water/

We truly hope to see our solution implemented one day!!

We would like to thank Priyanka ma'am and Raghav sir for giving us the opportunity to work on this project. We had fun compiling data, understanding this problem and coming up with a solution as this is a problem we can relate to and face on a daily basis.

Thank You !!
