SMART WATER CONTROL SYSTEM

ECTE350 - Engineering Design and Management
Autumn Session Report - Deliverable 2

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1 Executive Summary

(essence of report without fine details, not a background or introduction)

Daedal has been tasked with the development of a User Interface for the Smart Shower system designed by Enware. Additionally, research will be conducted to identify possible methods for energy generation from the water supply.

The following report details the design process and methods to be used to complete these tasks.

2 Figures and Tables

2.1 List of Figures

2.2 List of Tables

Contents

3 Introduction

As technology has advanced and society is becoming more interconnected online via media platforms and data sharing, markets have been identified which can extend this to physical hardware.

The collection of data that relates to physical resources in the home is made more accessible now due to the IoT movement and in part, the subsequent lower cost to implement such systems.

The integration of not only data gathering, but additionally the actuation of physical hardware (2 way communication) will lead to improvements across many facets of life.

Enware currently supplies a turn-key solution for controlling water to showers and sinks. It comprises of rotary sensors in replace of taps, which govern the actuation of valves to control water flow. Due to the smooth and easy operation of the sensors, people living with arthritis can gain a small but significant improvement in their quality of life. ADD ANY OTHER BENEFITS HERE. Daedal has identified, by using Enwares' existing hardware, the team can focus resources on the development and integration of a web/app based UI and associated sensors. The benefits that remote actuation and data gathering provide, include but not limited to:

- Preheat of shower prior to entering
- Monitoring time in shower. Identifies if leaks are present or possible accident in shower.
- Limiting temperature. Minimises the possibility of burns in young children and older people.

Additional to the implementation of a UI and sensors, Enware has identified a gap in the market for a battery powered Smart Shower. The current product requires a connection to mains power which limits it to new builds and large renovations. Daedal will undertake research and testing of energy generation methods, with the target of determining if a battery powered Smart Shower is feasible. If it is determined that substantial energy can be harvested, following efforts will go into removing loads from the mains (sensors and wifi modules).

The innovation that the software project provides, are a low cost and compatible UI that is tailor made for the Enware Smart Shower. By undertaking research on energy generation, this frees up Enwares' resources to continue running a business and providing services to customers that immediately result in profit. If a suitable amount of energy can be generated, a battery powered Smart Shower that can be retrofitted, will be the first product of its kind (as of time, livinshower provided a product on kickstarter but it is unclear if it went to market).

4 Market Research

4.1 Market and Customer Analysis

4.2 Competitors

There are many smart shower systems available on the market which varies in 'smart' functions depending on the price tag. Not a lot of shower systems offer the whole package including water usage monitoring and shower profiling which is the key points to our project for our aimed price.

4.2.1 Moen U Digital Shower Controller

The Moen U Digital Shower Controller is a two outlet unit with LCD screen controller. The controller can be connected via wifi and is outlet powered. Shower system can be either voice controlled via Amazon's Alexa, Google assistant or through an phone application for remote activation. Shower settings (temperature, flow rate, etc.) can be saved.

https://www.moen.com/products/U_by_Moen_Shower/U_b_Moen_Shower_terra_beige_2outlet_digital_shower_controller/TS3302TB

Price: $912 USD

4.2.2 The KOHLER K-527-0

The KOHLER K-527-0 offers a wide range of customisation, setting of a timer, changing the temperature and switching spray patterns via controller. There's also a touch button-operated integrated diverter, which toggles between water outlets and can run them simultaneously or separately. Other features include the selectable water-saving feature, selectable outlet delivery. For added safety, KOHLER includes a high temperature limit setting.

https://www.amazon.com/KOHLER-K-527-0-Prompt-Digital-Interface/dp/B005ECLTZO

Price: $390 USD

4.2.3 Livin

The Livin shower system can be controlled using voice (Amazon Alexa or Google Home) or through a phone application. Shower can be warmed up beforehand (remote activation) and water flow will pause to save water. The phone app tracks water usage, temperature and shower duration. Offers shower profiles with different settings. Livin Shower can be installed by user with simple hand tools. Also it is compatible with most of the single-handle type valves in the market. System runs on battery.

https://www.kickstarter.com/projects/livinlife/livin-shower-redesigned-in-a-smart-way

Price: $609 USD

5 Product Design

5.1 Overview

5.2 Hardware

5.2.1 Overview

Daedal is focused on researching and developing the possibilities of thermoelectric and hydroelectric generation. As Enware's current solution is directly supplied from the electrical grid. Thus Daedals approach to creating a system using the energy produced through showering, to explore if it's feasible to internally supply the system. This is to be achieved through Thermoelectric generation, using the temperature difference between inlets and outlet as well as using the moving water to create hydroelectric generation.

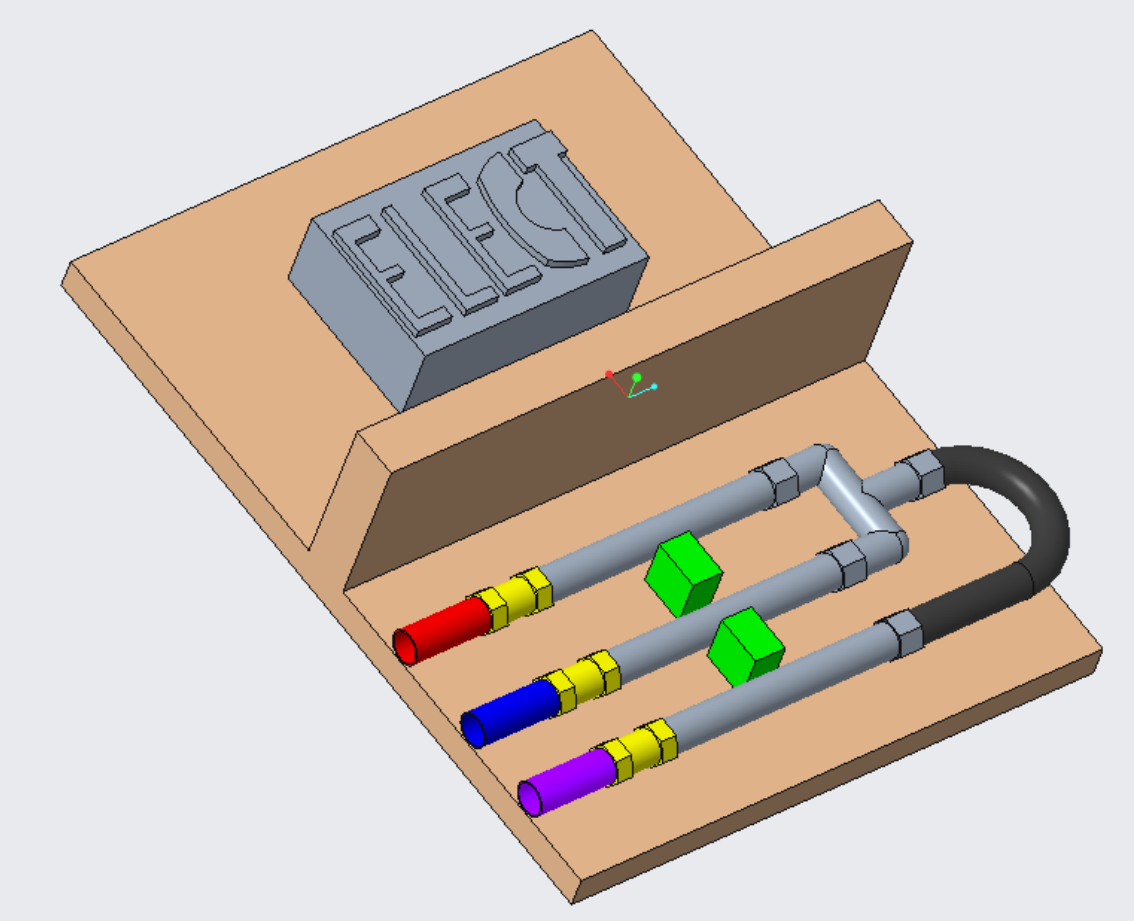
Below highlights information of thermoelectric & hydroelectric generation, how the electricity created is to be tested along with design schematics & testing procedure and expected outcome of the results.

5.2.2 Background

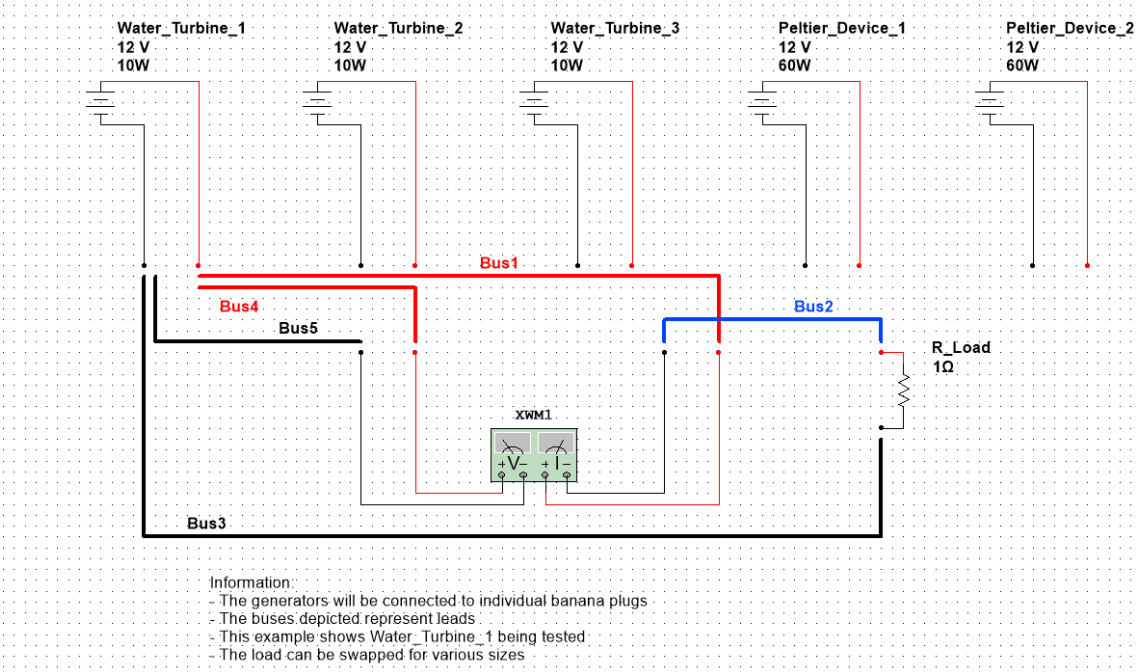
5.2.2.1 Thermoelectric Generator

5.2.2.2 Turbine Generator

5.2.3 Design of Test Rig



5.2.4 Electrical Schematics



5.2.5 Testing Procedures

5.2.6 Expected Outcomes

During our testing we expect electricity to be generated. To the exact amount generated, as well as pressure lost in the shower system is unknown, thus the need for the testing. Daedal is predicting the simple designs above will not be enough to make the system independent of the electrical grid. From these test will be able to determine the feasibility of making the system independent of the electrical grid by increasing the amount of generators to achieve this.

Dependant of results, Daedal will aim to create a solution for making the system completely or partially independent of the electrical grid creating a more sustainable product.

5.2.7 Summary

5.3 Software

5.3.1 Overview

5.3.2 Server Setup

5.3.3 Interface Design

5.3.4 Interface Functions

5.3.4.1 Function 1

5.3.4.2 Function 2

5.3.4.3 Function etc

5.3.5 Data Design

5.3.6 Data Functions

5.3.6.1 Function 1

5.3.6.2 Function 2

5.3.6.3 Function etc

5.3.7 Summary

6 Project Analysis

6.0.1 Performance Against Plan

6.0.2 Budget Analysis

6.0.3 Workshop Audit

6.0.3.1 Saftey Considerations

7 Sustainabliity and Ethics

7.1 Sustainabliity

In this day and age, Sustainability is an important part that's considered in all areas of creation of product.

As modern technology is evolving into a sustainability focused mindset. So does our design. With consideration into materials used and also the aspect of water usage is included in the design. These considerations are due to the importance of conserving Earth's natural resources.

At Daedal our aim is to focus on making the system designed by Enware independent of the electrical main system, that the system currently operates off. Daedal aims to research and develop a possible method in reducing the systems electrical dependance on the grid. This is achieved by generating electricity from the water passing through the shower plumbing and temperature difference between the pipes. By creating the system to be independent of the electrical grid, it will reduce the amount of electricity used, reducing the impact on natural resources.

The results of the hardware system will determine if it is feasible to remove the system off the electrical grid. If it is not, Daedal aims to reduce the burden the system creates, and reduce the electrical usage of the overall system.

7.2 Ethics

In terms of social sustainability, it is a focus of Enware's as a company, and therefor ours. We aim to develop our product to benefit those that are mentally or physically disadvantaged. This is to be done by assisting Enware and their direction of interest with a wireless application control of their system. This is to work alongside Enware's current control methods and offer a more modern method of controlling the shower, along with Enware's control method.

Enware have developed tap sensors to visually assist with determining the temperature of the water output. Daedal aims to further this by controlling the temperature and pressure from a wireless application. This aims to give further assistance and clarity to those disadvantaged. Also can assist those caring for the disadvantaged by giving them a way to easily control and adjust the water of the shower from outside of the shower itself.

8 Conclusions and Recommendations

References

[1] Michel Goossens, Frank Mittelbach, and Alexander Samarin. *The LaTeX Companion*. Addison-Wesley, Reading, Massachusetts, 1993.

[2] Albert Einstein. *Zur Elektrodynamik bewegter Körper*. (German) [*On the electrodynamics of moving bodies*]. Annalen der Physik, 322(10):891–921, 1905.

[3] Knuth: Computers and Typesetting,
`http://www-cs-faculty.stanford.edu/~uno/abcde.html`

9 Indiviual Performance Reviews

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9.2 Quang Hung Pham (1234567)

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10 Appendix

10.1 Appendix A

10.2 Appendix B

10.3 Appendix C