Team 30

ECE44x

1. Executive Summary

According to the United States Environmental Protection Agency, the average family wastes 9,400 gallons of water annually due to leaky pipes [1]. A smart water flow sensor was proposed to monitor and help isolate leaks in household water pipes. A water flow sensor will be used to gather data on the desired line and then store it in the system. The microcontroller will transmit that data using a Wi-Fi signal to an HTML page. The output data will also be given in near real-time on an LCD that will be located on the product itself. The smartphone application will be designed to check daily consumption and monitoring. Since household water lines are pressurized, the only time flow should be detected is when a water fixture is on, or there is a leak.

A water flow sensor is needed to calculate the amount of water flowing through the pipe and measure the flow of water. We need to make sure that we achieve our project without having any issues with testing each block. We will have to use 8 or 9 blocks for our project design. We need to develop our skills in engineering such as coding and designing circuits. We need to have knowledge of programming languages to adapt with technology. We will use Arduino uno for our project in which we will connect the water sensor directly to the Arduino. Also, we need to have a good enclosure to contain all the components, such as HMI, PCB, microcontroller, and power supply.

The design of the product is being critically assessed by each of our team members. This will give us a better understanding of the design and a better finalized product. Each step in the project will be reviewed and revised as needed to ensure that the final product is robust. The electronic portion of the project will be built and tested through a breadboard prototype. This will allow the team to also design and test circuits to incorporate into the PCB design. The circuit will include the integration of the Wi-Fi module, microcontroller, AC-DC converter, DC-DC converter, LCD display and user buttons.

The team will also be working on the software of the project simultaneously to ensure that flashing and testing can begin once a prototype is built. The microcontroller code will be in testing stages first to start the on-board logic that needs to occur. This includes reading data from the sensor, storing a limited amount of data, parsing that data, doing calculations, output to the LCD display, sending data over network, and allow for user-controlled buttons that change how the system works. The computer program will begin testing once the microcontroller firmware has been built to a point where data can be parsed and sent out to the network that it is connected to. This data will be displayed in a computer program that gives the user an interface to view this data and monitor their household’s water consumption.

2. Project Timeline

The figure below shows the proposed timeline for the different phases of the project. The design phase would primarily take all of fall term which would lead winter term into the building and testing phase. This phase might extend slightly into spring term but will eventually reach the polish phase. During the polish phase, the team will finalize the assembly, verification and presentation materials of the project.

Project Timeline

Project Title:	Smart Water Flow Sensor
Project Managers:	Carlos Beleno, Christian Ovchinikov, Mohammed Al-Khalifa

Task #	Task Title	Task Owner	Deliverable	Start Date	End Date
1.0	Intro to Shareholder	[All]	E-mail	10/3/2022	10/7/2022
1.1	Market Research	[All]	Product Proposals	9/30/2022	10/10/2022
1.2	Product Selection	[All]	Product Selection	10/10/2022	10/10/2022
1.3	Project Document Draft	[All]	Section 1 Submission	10/10/2022	10/14/2022
1.4	Module & Block Definitions	[All]	Definition of Individuals' Workload	10/14/2022	10/21/2022
1.5	Component Research	[All]		10/16/2022	10/28/2022
1.5.1	Microcontroller Research	Christian	Microcontroller Proposal	10/16/2022	10/28/2022
1.5.2	Sensor Module Research	Mohammed	Sensor Proposal	10/16/2022	10/28/2022
1.5.3	Wi-Fi Module Research	Carlos	Wi-Fi Module Proposal	10/16/2022	10/28/2022
1.5.4	HMI Module Research	Christian	LCD Display Proposal	10/16/2022	10/28/2022
1.5.5	Power Supply Research	Carlos	Power Supply Proposal	10/16/2022	10/28/2022
1.5.6	Onboard Data to HTML Research	Carlos		10/16/2022	12/1/2022
1.6	Circuit Simulations	[All]		10/30/2022	11/11/2022
1.7	Component Selection	Christian	Bill of Materials for Ordering	11/6/2022	11/11/2022
1.8	Engineering Requirement Definitions	[All]	Engineering Requirement Submission	11/13/2022	11/25/2022
1.9	Ordering of Components	[All]	Order Confirmation	11/25/2022	12/1/2022
2.0	PCB Prototype	Christian	Testable Design of Product	1/9/2023	1/27/2023
2.1	HTML Page Development	Carlos	Data transmitted to HTML	1/9/2023	4/21/2023
2.2	Power Supply Prototype	Carlos	Testable Design of Power Supply	1/22/2023	2/3/2023
2.3	PCB Testing	Christian		1/27/2023	2/3/2023
2.3.1	PCB Design	Mohammed	Design Files for Manufacturing	2/3/2023	2/10/2023
2.4	3D Modeling of Enclosure	Carlos	Design Files for Printing	2/6/2023	2/17/2023
2.5	Microcontroller Programming	[All]		2/12/2023	3/24/2023
2.6	System Testing	[All]		2/19/2023	3/24/2023
2.7	PCB Ordering	Christian	Order Confirmation	3/19/2023	3/24/2023
2.8	3D Printing of Enclosure	Carlos	3D Printed Enclosure	4/3/2023	4/7/2023
2.9	Preparation for Exposition	Carlos	Expo Poster, Presentation Materials	4/3/2023	4/21/2023
3.0	Software Debugging	Carlos Christian		4/3/2023	5/19/2023
3.1	System Assembly	[All]		5/21/2023	5/30/2023
3.2	System Verification	[All]		5/30/2023	6/9/2023
3.3	Product Reflection	[All]	Possible Improvements on Future Revisions of Product	6/11/2023	6/16/2023

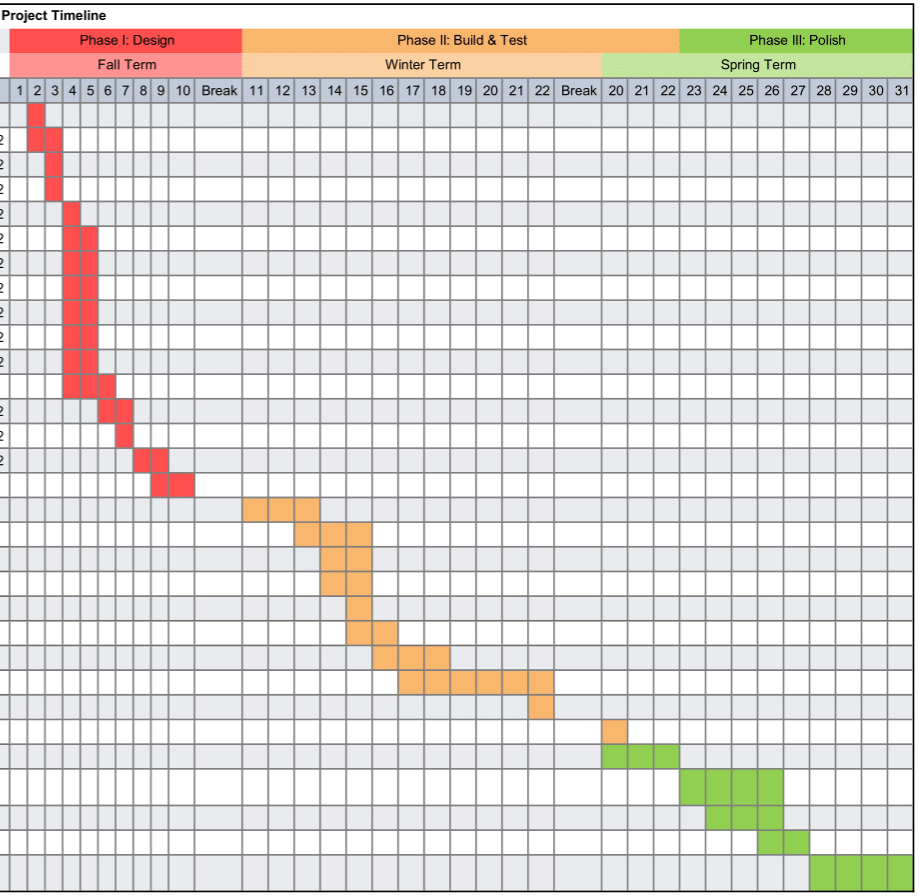

Fig. 1. Project timeline created at the initial stages of the project.

3. Lessons Learned

Throughout the development of our smart water flow sensor project, our team learned valuable lessons in various aspects, including global impacts, technical improvements, and teamwork.

In terms of global impacts, we recognized the potential of integrating our sensor with local and national water management systems to optimize water distribution and consumption on a larger scale. We also learned the importance of adapting and deploying our technology in developing countries, where water infrastructure is often less reliable. These lessons illustrated the significance of our project in addressing global water scarcity challenges and promoting sustainable development.

Technically, we identified several potential improvements for future iterations of our smart water flow sensor project, such as using a more advanced sensor, upgrading the microcontroller, and implementing a dedicated phone application. These technical lessons will help us develop a more precise, energy-efficient, and user-friendly product that provides a comprehensive solution for monitoring and managing water consumption.

Regarding teamwork, we understood the importance of collaboration, clear communication, and shared responsibility in delivering a successful project. We found that having a structured project management process, assigning tasks based on individual strengths, and using a unified file-sharing system were essential for efficient teamwork. These lessons emphasized the value of effective teamwork in completing complex engineering projects and ensuring the delivery of a high-quality product.

In summary, our team learned crucial lessons in global impacts, technical enhancements, and teamwork throughout the smart water flow sensor project. These insights will be invaluable in guiding us towards creating more efficient, sustainable, and impactful solutions in future projects.