Executive Summary (Group 20)

Design Problem

The original design problem tasked our group with developing a modular IOT sensor system that can make window opening and closing recommendations. The recommendations are made based on indoor and outdoor environmental conditions. Each module (sensor) needed to include temperature/humidity sensors, a rechargeable battery, PCB, wireless data transfer, and a 3x3x1 inch enclosure with IPX4 water resistance. The software must include graphical sensor data, window notifications for users, ability to pair/unpair sensors, and the ability label sensors. The system was designed to help users make optimal use of their windows and save them money on electricity and natural gas as a result.

Explanation of issue

We started by splitting the project into two modules: hardware and software. Jadon and James took the helm on hardware and Yousif and Blake software, all based on our strengths. From there, we decided on a basic design. This design would consist of a microcontroller to collect and send data, power electronics to keep the computer running, a front-end application to present information to the user and back-end programming to supply data for the user. From here, we chose sub systems as our own and proceeded to divide and conquer. Jaden took on the microcontroller and sensor blocks, James had the enclosure and power electronics, Yousif the GUI and notifications, and Blake with the database and background calculations.

Both teams operated independently for several weeks of the project. Weekly meetings consisted of us coming together to discuss progress and talk over issues. After an initial microcontroller PCB for block checkoff was designed, and power electronics were designed on a breadboard, revision took place to update the PCB to include all the components. On the software side, both the application and the microcontroller were frequently updated to add additional features and connectivity.

In the end, there were numerous times throughout the project when help was required to make deadlines. We did just that, ensuring each member was always on track by picking up slack wherever it was needed. Be it simple board review or last minute assistance before a section check off, we were there for one another!

Timeline

Task	Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Documentation	Group	Section 1			Section 2			Section 1+2																							
Partner Meetings	Group	Update 1				Update 2				Update 3																					
Design Impact Assessment	Group	Initial Assessment						Final Assessment																							
Communication Evaluation	Group	Sign Up for Meeting				Meeting (20 min)																									
Hardware Research	Jadon + James			Microcotrollers, sensors, power supply, circuit design																											
Software Research	Yousif + Blake			Wireless connection, app GUI, data algorithm																											
Ordering Components	Jadon								Order Preliminary components							Order PCBS/Components														
Block Diagram and Interfaces	Group								Block allocation and submission	Finalize interface for block check offs																					
Microcontroller Circuit Design	Jadon									Begin Circuit Design		Draft Circuit Design				Finish Circuit Design				Final Tweaks if necessary		Redesign, Rebuild and Retest							
Power Electronics Circuit Design	James									Begin Circuit Design		Draft Circuit Design				Finish Circuit Design				Final Tweaks if necessary		Redesign, Rebuild and Retest							
Microcontroller Block Prototyping	Jadon											Initial Prototyping		Finish Prototype																	
Power Electronics Block Prototyping	James											Initial Prototyping		Finish Prototype																	
Microcontroller Building and Testing	Jadon																	PCB Assembly		PCB Testing											
Power Electronics Building and Testing	James																	PCB Assembly		PCB Testing											
Node connection, computation, data storage development	Blake											Initial prototyping		Cloud storage and Debugging		Block level testing															
GUI and notification development	Yousif											Initial prototyping		Data visuals and debugging		Block level testing															
Software system level testing	Blake + Yousif															Combine software experiences, implement into app															
Project System Level testing and assembly	Group																		Combine hardware and software experiences												
Final project fixes	Group																					Make sure project works									
Documentation and presentation preparation	Group																					Organize and prepare documents and presentation									

Finalize project poster and documentation	Group																											Make poster and finalize presentation/documents			
Knowledge Transfer	Group																														Transfer knowledge

Lessons Learned

After completion of this project, we have learned some valuable lessons for future projects we work on. One major lesson would be to begin planning ahead far before you begin any aspect of the project. Doing this allowed us plenty of time for issues to come up yet not to be too much of a concern as we had time due to our pre-planning to handle these issues. Another lesson learned was the ability to take the schedule of other individuals and be able to work around time conflicts to create a suitable meeting time. This was especially important as each one of us had at least 1 conflict going into this class.

An additional lesson learned would be having adequate peer review sessions. Having these saved us time and money in preventing major issues that we could have had in the future by discussing what we have completed or changed as a team. This was also done by a 3rd party being our project mentors to allow for further advice and problem searching.