ECE 342 Executive Project Summary

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1. Reflection

The purpose of this project is to design and implement a contact-less temperature scanner that is intuitive to users while retaining all of the functionality requirements set forth by the customer. Our goal was to design a temperature scanner that is operated by one person who can obtain the temperatures of many individuals without requiring them to interact with the system, similar to the common handheld temperature devices seen in local hospitals and businesses today. There were five customer requirements that needed to be considered before starting the design process, with one additional requirement that was chosen by our team. The system needed to be accurate,meaning it needed to be able to achieve a temperature reading within ±1°F of a standard thermometer reading. The scanner must alert the user when they have a fever for temperatures at or above 100.4° F. Additionally, the system needs to be intuitive for users, meaning users should be able to successfully operate the system with no instruction. Lastly, the scanner should require no contact to function,and must log users information for the last 24 hours. The additional requirement set forth by our team was to enable the temperature scanner to communicate wirelessly with a computer or smart-phone through the use of a micro-controller that is capable of IoT radio communications.

Throughout the entire design process, our team's assumption was that a handheld system operated by only one individual was still meeting the design requirement of no-contact based on the reasoning that many individuals can obtain their temperatures in a completely contact-less fashion. We opted to use a medical grade infrared (IR) temperature sensor made by Melexis Technologies, a small configurable thermometer capable of I2C communications and an accuracy of ±0.36°F(0.2°C). An Arduino Nano IoT 33 would be responsible for interpreting the IR thermometers output,driving a speaker and LCD screen, logging user data, and communicating wirelessly to smart-phones that were connected to its local network. Simple prompts on the screen would obtain login information from the user, which is inputted by a simple numeric remote and an on-board IR receiver, also to be operated by the individual controlling the device.Once a temperature is read for a unique user, they are not only able to view their temperature on the LCD screen, but also log in to an app that will display their temperature, view their history, and even export their temperature data to an Excel file. Our team wanted to design this system to be portable, so we planned for a handheld enclosure that can be easily transported. Additionally, we included a 3.7 V rechargeable lithium polymer battery with a boost converter that outputs 5V to power the entire system.The enclosure would possess a micro-USB port to charge the battery, a trigger button,

two scan buttons to view previously recorded temperatures on the LCD screen,as well as various openings for the components that needed to be seated externally.

Shortly after ordering the components and PCBs, our team discovered that the buttons on the enclosure of the system violated the no contact requirement. To improve our system, we chose to eliminate the trigger button by conducting temperature readings automatically.We also eliminated the scan buttons, restricting temperature history to the app connected to the micro-controller.However, we were unable to alter the remote that enables users to input their user ID due to time constraints and the finalized PCB design. Once constructed, we found the power block was not successfully powering the Arduino. The boost converter was outputting 5V, but the Arduino remained off for the duration of testing that day. The final design eliminated the battery and the boost converter, and replaced them with USB power from a laptop. The cause for the power issue remains unknown. Once the entire system was powered and tested, a curve was implemented on the temperature outputs to reflect more accurate temperatures by using a distance sensor.Temperatures are less accurate as an object moves further away, therefore a curve produces an accurate reading from various distances, guaranteed to be at least 30 cm from the object.

2. Key Lessons Learned

- Lack of experience can lead to various implementation issues, no matter how seemingly flawless the design may have been
- It's important to obtain at least two of each component before soldering and testing a design. Otherwise, much time is wasted on waiting for new components to ship, and if you are really unlucky, the company will be sold out of the components you need.
- PCB design should include multiple contingency plans, such as using jumpers to act as a switch to isolate certain systems
- PCB implementation should have an intermediary step, whether it be soldering header pins in through-holes and testing on a breadboard, or incrementally soldering components one at a time and testing them individually. This is due to the extreme difficulty that comes with desoldering a component with three or more pins.
- Flexibility and creativity are crucial skills when developing last minute back-up plans
- Staying organized with documents in the beginning and building things such as the BOM incrementally will help save time in the end.

3. Gantt Chart

Seen below is the Gantt chart used as a timeline for development of SmartTemp.

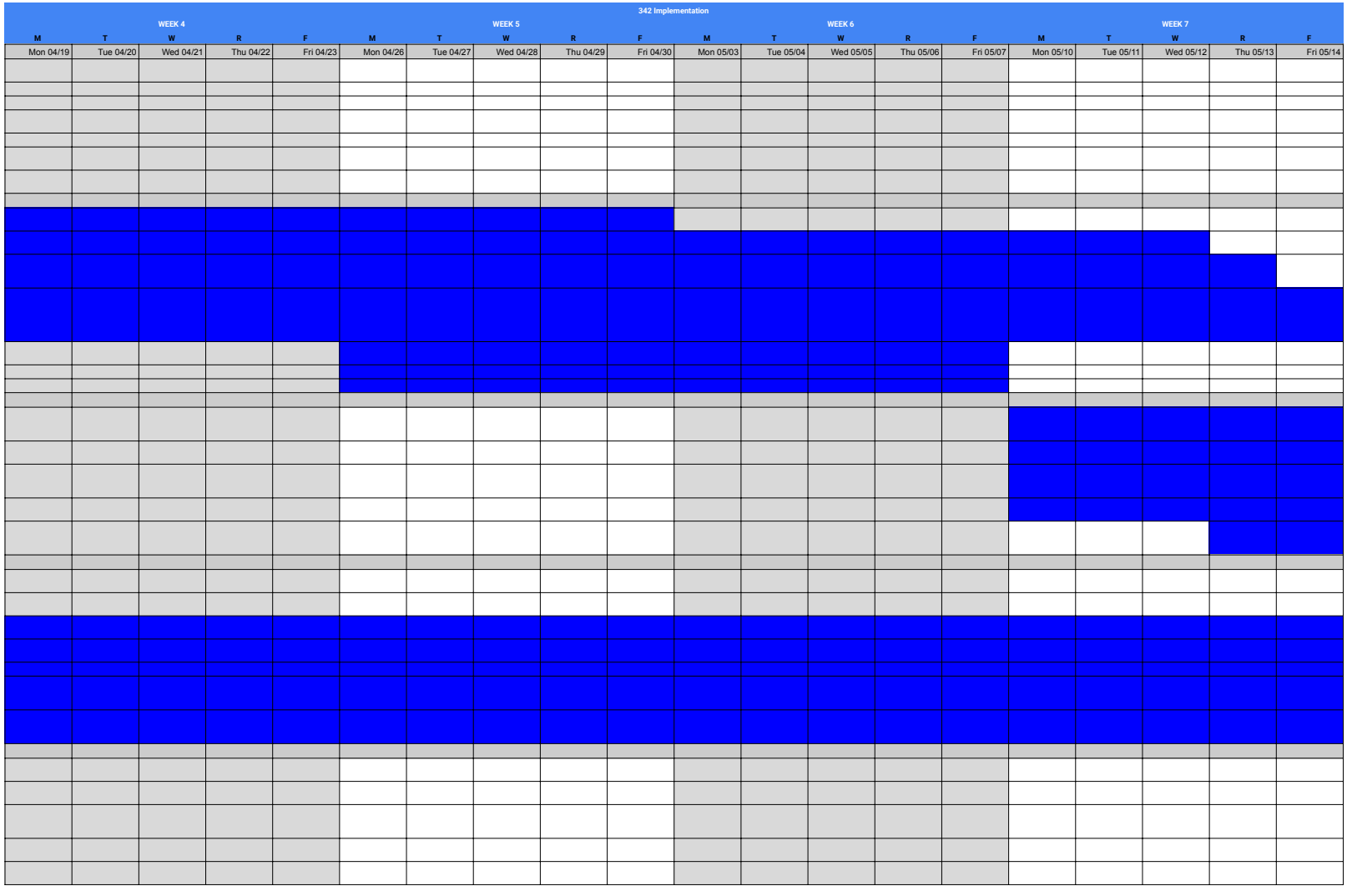
342 FP GANTT CHART

PROJECT TITLE Temprature Scanner
PROJECT MANAGER(S) Paige Barylsky, Faaiq Waqar, Jeffrey Unrein

COMPANY NAME: Oregon State University
DATE: 4/7/2021

WBS NUMBER	TASK TITLE	TASK OWNER	START DATE	DUE DATE	DURATION (H)	PCT OF TASK COMPLETE	342 Project Planning														
							WEEK 1					WEEK 2					WEEK 3				
							M	T	W	R	F	M	T	W	R	F	M	T	W	R	F
1	**Project Conception and Planning**						Mon 03/29	Tue 03/30	Wed 03/31	Thu 04/01	Fri 04/02	Mon 04/05	Tue 04/06	Wed 04/07	Thu 04/08	Fri 04/09	Mon 04/12	Tue 04/13	Wed 04/14	Thu 04/15	Fri 04/16
1.1	Engineering Requirements	Faaiq	4/5/21	4/5/21	1.5	100%															
1.2	Project Timeline	Paige	4/7/21	4/9/21	2	100%															
1.3	Research	Jeffrey	4/7/21	4/16/21	2	100%															
1.4	Bill of Materials & Budget	Faaiq	4/7/21	4/16/21	4	100%															
1.5	Block Diagram	Paige	4/7/21	4/9/21	2	100%															
1.6	Circuit Schematic	Jeffrey	4/12/21	4/16/21	5	100%															
1.7	Repository Setup	Faaiq	4/7/21	4/9/21	2	100%															
2	**Implementation**																				
2.1	SPICE Simulation	Jeffrey	4/19/21	4/30/21	0	0%															
2.2	LCD Display Software	Faaiq	4/19/21	5/12/21	0	100%															
2.3	Radio Communication Software	Faaiq	4/19/21	5/13/21	0	100%															
2.4	Temperature Reading Software [Microcontroller]	Faaiq	4/19/21	5/14/21	6	100%															
2.5	Enclosure Design	Paige	4/26	5/7/21	12	100%															
2.6	Build Circuit	Group	4/26	5/7/21	9	100%															
2.7	PCB Design	Paige	4/26	5/7/21	14	100%															
3	**Testing**																				
3.1	Oscilliscope Measurements of Device	Paige	5/10	5/19/21	0	0%															
3.2	Distance Testing	Jeffrey	5/10	5/19/21	1.5	100%															
3.3	Testing User Information and Storage	Faaiq	5/10	5/19/21	5	100%															
3.4	Testing Readings	Jeffrey	5/10	5/19/21	6	100%															
3.5	Radio Communication Testing	Faaiq	5/13	5/19/21	3	100%															
4	**Documenting**																				
4.1	Design File Documentation	Faaiq	5/24/21	5/28/21	10	100%															
4.2	Final Project Report	Paige	5/24	5/28/21	8	100%															
4.3	Bill of Materials Document	Jeffrey	4/7	5/28/21	1.5	100%															
4.4	Datasheet Repositories	Faaiq	4/5	5/28/21	2	100%															
4.5	Time Sheet	Paige	4/5	5/28/21	0.5	100%															
4.6	Schematics and Code Repositories	Faaiq	4/5	5/28/21	6	100%															
4.7	Weekly Progress Report notetaker	Jeffrey	4/7	5/28/21	9	100%															
5	**Project Presentation**																				
5.1	Project Portfolio	Paige	5/24/21	5/28/21	12	65%															
5.2	Showcase Presentation	Faaiq	5/24/21	5/28/21	8	85%															
5.3	Executive Project Summary	Paige	5/24/21	5/28/21	3	100%															
5.4	Developer Guide	Jeffrey	5/24/21	5/28/21	10	100%															
5.5	Project Summary Video	Faaiq	5/24/21	5/28/21	6	50%															

3/12/18


342 Implementation
WEEK 4
WEEK 5
WEEK 6
WEEK 7
M T W R F M T W R F M T W R F M T W R F
Mon 04/19 Tue 04/20 Wed 04/21 Thu 04/22 Fri 04/23 Mon 04/26 Tue 04/27 Wed 04/28 Thu 04/29 Fri 04/30 Mon 05/03 Tue 05/04 Wed 05/05 Thu 05/06 Fri 05/07 Mon 05/10 Tue 05/11 Wed 05/12 Thu 05/13 Fri 05/14

342 Testing					342 Document/Present									
WEEK 8					WEEK 9					WEEK 10				
M	T	W	R	F	M	T	W	R	F	M	T	W	R	F
Mon 05/17	Tue 05/18	Wed 05/19	Thu 05/20	Fri 05/21	Mon 05/24	Tue 05/25	Wed 05/26	Thu 05/27	Fri 05/28	Mon 05/31	Tue 06/01	Wed 06/02	Thu 06/03	Fri 06/04