A Smart Toaster For The Future

Group Number: 16

Group Members:

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Project Narrative Description:

For this year's Senior Design project our group came up with the idea of building a Smart toaster. When it came to coming up with this kind of idea we ask ourselves: "What is a very simple commonly used item that we can make more intevated?" We considered a few different items such as a mailbox and microwave in which we settled on toaster. The premise behind this toaster is that it will be much more advanced than a stranded toaster but not quite as big and bulky as a toaster oven. In addition, it will provide more advanced features that you typically will not see in a household toaster.

There are many different designs of toasters or toaster ovens on the market. One can simply research toasters on a search engine and find a list of them available for purchase. The problem with these designs is that usually one needs to spend a few hundred dollars to buy a toaster that has a timer or a dial to control temperature. Even with a purchase such as that it does not meet the standard that a small traditional toaster has as far as its lightweight design and portability. There does exist however smart toasters that are capable of doing the things we described however it is not widely known and expensive to make.

Motivation:

There are two major motivations for this project. The love of toast & an open market. We all like toast for breakfast. So why not build a project that revolves around it. Almost every household has a toaster, so this can have a major impact on an industry that is stuck in the past.

Building the first advanced smart toaster is an opportunity to hit an open market. Research on amazon shows that there isn't any advanced toasters in the market. In an age where almost every product has a smart option, it's a shame there isn't a smart toaster. So to capitalize on it, we are going to build the first advanced one for the toaster industry.

In addition we also wanted to create a product that would be fun yet challenging and innovative. As a group with electrical engineering, we wanted a project that wouldn't require much programming. The programming that is required we will handle it almost ourselves and complete what needs to be done. In an age, where every device has a smart functionality, we think a smart toaster has it turn to the spotlight.

Goals & Objectives:

A standard toaster has dial on it to control how close the metal prongs are to the burners. The common misconception is that that dial is a timer. Toaster ovens have timers and temperature gauges but are much bigger, pricier, and usually require a preheat. For our toaster we will be implement a digital timer that is controlled by a number pad as well as a gauge to control the temperature. As electrical engineers, we will design our own PCB, DC to AC power converter, and sensors in order to make the toaster more efficient and innovative.

As some extra stretch goals, we would like the sides of the toaster to easily be removed in order for the toaster to be easily cleaned. The problem with some toasters nowadays is that they only have removable tray at the bottom but nothing to clean in-between the sides. In addition, we will be putting s sensor inside to be able to detect whether or not the toast is being overcooked. If the toast is being overcooked, it will automatically shut down the burners.

As an extra design innovation we will also be implementing a smartphone application for the taster. This app will be able to control certain aspects of the toaster such as: powering on or off, temperature readings, and time left on the toast. In case a user steps away to do another task, he or she will have a safety kill switch on their phone to eject the toast.

Function of the Project:

The project would function as follows:

1. Set the temperature of the toaster using either a dial or numberpad

2. Set the timer of the toaster using a dial or numberpad

3. Place toast in the toaster and pull spring loaded prongs down.

4. Monitor the toast through visual or through the smartphone app.

5. If the toast is ready either hit the eject button on the taster, the button on the smartphone app, or simply wait until the timer runs out.

Analysis of Competitive Products:

Checking Amazon & Ebay there is clearly an open market for a real smart toaster. Most of the smart toasters on the ecommerce store lack smart features that consumers acquire today. Most do not have apps, none have advanced LCD displays, none have specific temperature dials.

The most advanced feature these toasters offer is an LCD display which shows different browning levels. On top of that, most of the smart toasters are expensive. Most start around $100 for a typical 2 slice toaster. One article was found however where someone created an app that allows a user toast his or her from their smartphone. Ther project appeared to be in development but nothing has really come out of it.
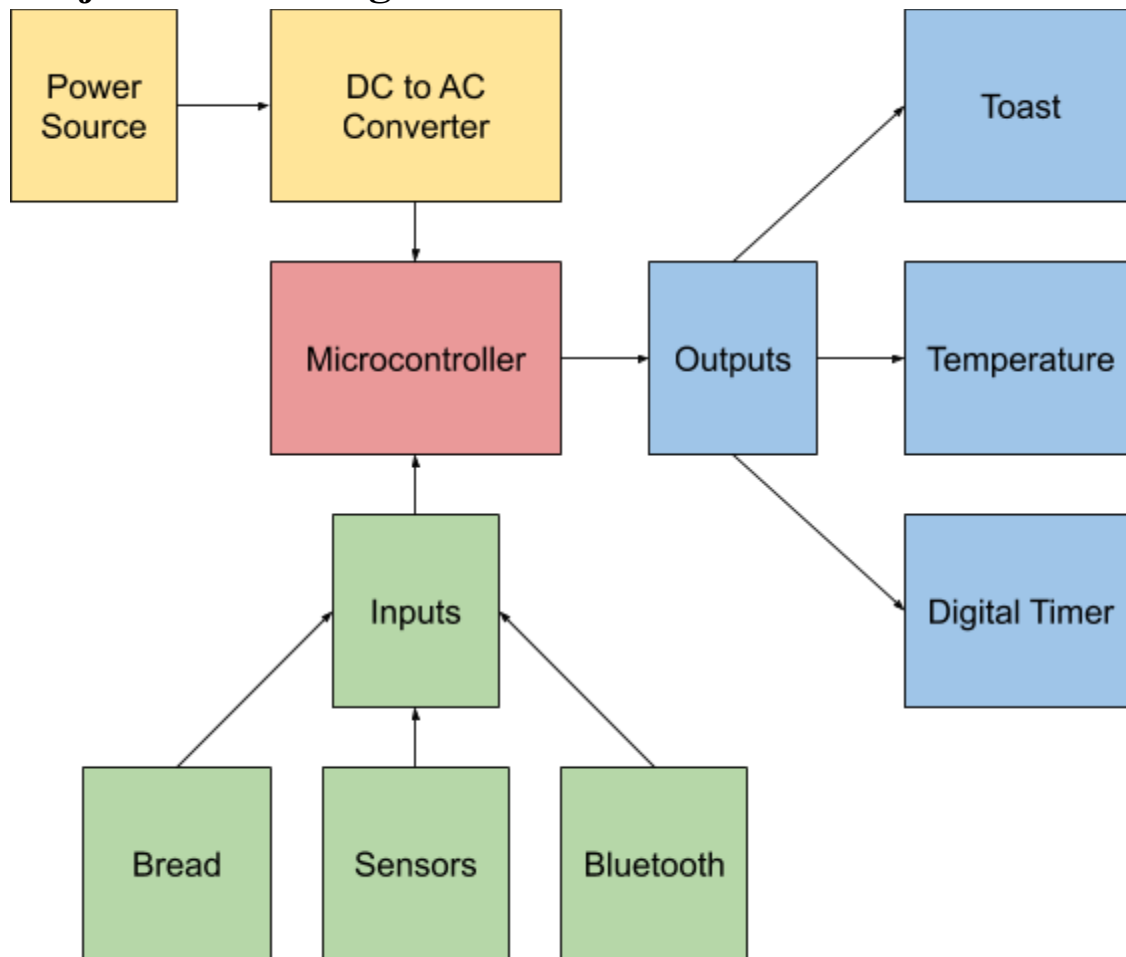
Project Constraints:

- Budget - Having a larger budget would allow for more testing

- Time - This will be researched and built under a year. Some products take years to develop and perfect

- Availability - Each member is busy with school, work, clubs, and hobbies. This will restrict meeting times and amount of time spent on the project.

- Manufacturing ability - We do not have access to industrial equipment like larger companies do

- Size - We would like for the product to still be of a standard toaster size (thus smaller than a common conventional and toaster ovens), thus it will be difficult to add all of our goals onto the project with such limited space, while still making it safe and efficient.

- Power - Must be able to toast bread to desired crispiness while still allowing the toaster itself to be safe to touch.

- Dial/Numpad - Must be user friendly and allow to user to utilize all aspects of the toaster.

- Sensors - Must be allowed to take a specific input, either time or crispiness, and eject the toast once the user inputted desired goal is met.
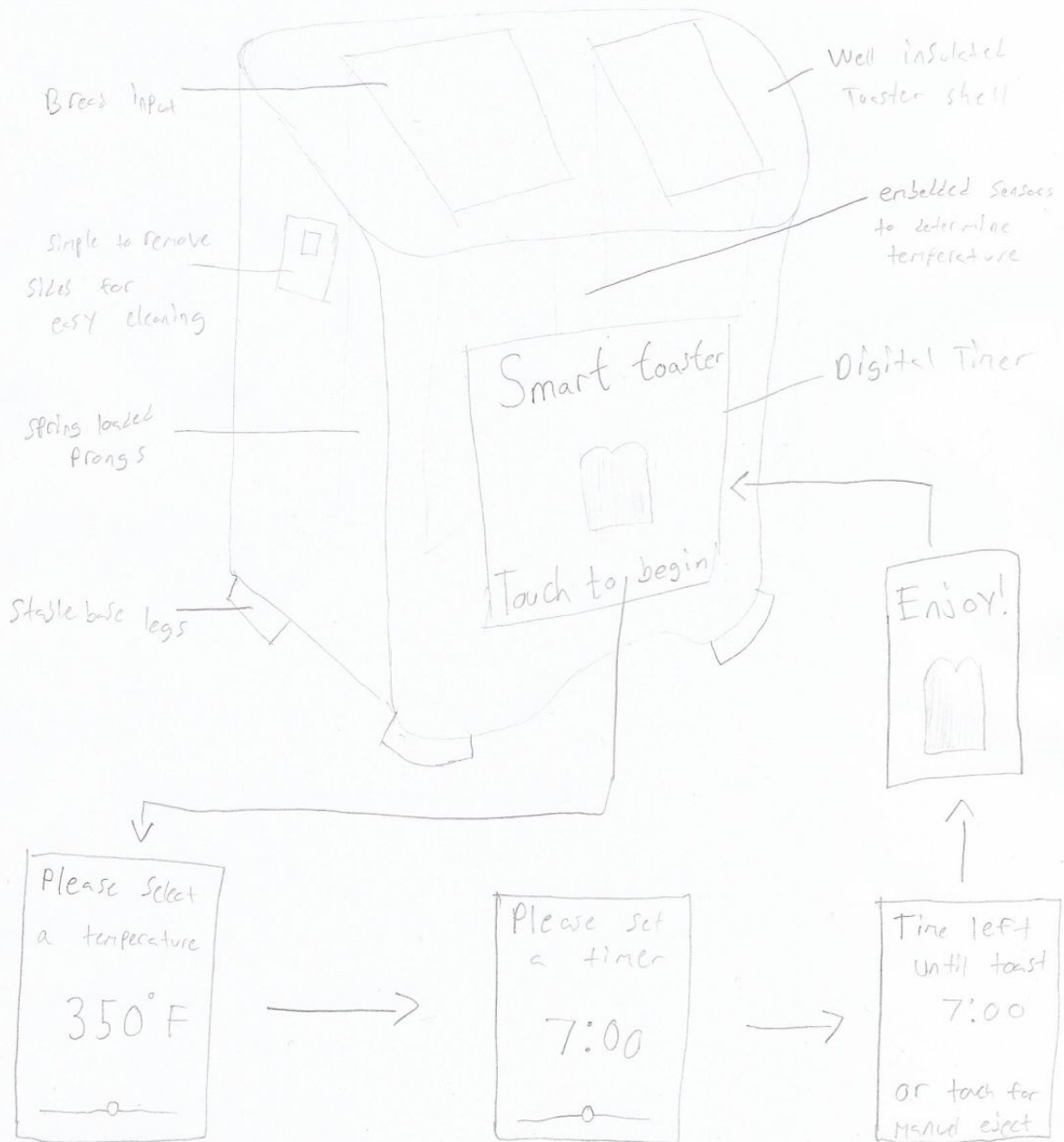
Related Standards:

- Fire - With any electrical project, the risk of random sparks from overloaded or incorrectly placed wires is always something that could occur. This could lead to fire hazards in the home which is something that needs to be avoided. That is why we must be very knowledgeable in designing this project or else it could greatly injure ourselves or others in the process.
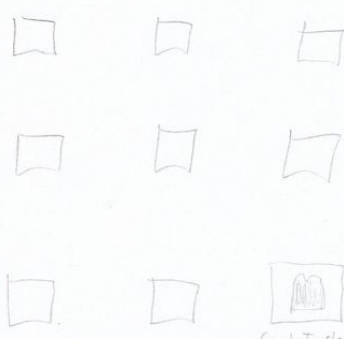
- Overheating - Toasters naturally get hot if not insulated correctly, and sense we are adding various electrical components to make a more advanced toasters, this risk increases significantly. To aid this we must well insulate the toaster to make sure it is safe to operate the touch pad even if the toaster is currently active.

- Overcooking - It is immensely possible one could forget that they are currently toasting bread in the toaster. If no timer is set, then the continuous toasting process could lead to not only potentially fire, but a complete waste of bread, thus a waste of potential profit. To aid this we are thinking of connecting a mobile app that could go along with the toaster. In this case even the smell of burnt toast could alert a person and they can remotely eject the toast via the app to keep a safe distance from the toaster. Hopefully it never has to come to this though since we would like to include sensors as well to determine if the toast is overcooked. If this occurs, the sensors will let the toaster know and the burners will be shut down automatically.

Project Block Diagrams:

Smart Toaster

Bread Input

Well insulated Toaster shell

embedded Sensors to determine temperature

Simple to remove sides for easy cleaning

Smart toaster

Digital Timer

Spring loaded prongs

Touch to begin

Enjoy!

Stable base legs

Please select a temperature

350°F

→

Please set a timer

7:00

→

Time left until toast

7:00

or touch for manual eject

Smart Toaster

Smart Toaster

Begin toasting
connect a toaster
Profiles

Establishing wireless Connection

Make sure your Bluetooth is on!

Profiles

New Profile
Delete Profile

Input New profile

Name: _____
Temp: _____
Time: _____

Delete which profile?

James
Alex
Ryan

Begin Toasting

Start Fresh

Load Profile

Load Profile

James

Alex

Ryan

Start fresh

Please select a temperature

350°F

Start Fresh

Please set a timer
7:00

Time left until

7:00

Or touch for manual eject

Enjoy!

touch to return to Main Menu

Estimated project budget and financing:

The estimated budget for the smart toaster is going to be approximately $500. We figure this is a good starting point for the project. We expect it to fluctuate a bit when ordering the parts and assembling everything.

Each member is going to pitch in ⅓ of the total cost for the project. So if the total does come out to $500, everyone will end up paying approximately $167.

We have no sponsors for the project and will be paying everything out of pocket. We do not want to work with a company. Since it's only $167, there will be no financing.

Initial project milestone for both semesters.

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Senior Design 1

Initial Project Standards - September 18
20 Page Project Standards - October 1
40 Page Project Standards - October 13
60 Page Project Standards - October 25
75 Page Project Standards - November 3
90 Page Project Standards - November 10
Final Project Standards - November 30

Senior Design 2

Order Parts - December 6
Design Circuit Board - January 20
Solder Circuit Board - February 1
App UI/UX Designed - February 8
Toaster Designed - February 25
Toaster Skeleton Built - March 2
App Developed - March 10
First Prototype Built - March 20
Final Prototype Built - April 8
Board & Presentation Created - April 18

Decision Matrix

The following is a list of other Projects/ Considerations:

1. **Padlock Mailbox**- the premise behind this design it to innovate another commonly used item. In the case of this mailbox it would be theft. The padlock mailbox would require a pin number to unlock a mailbox as well as have a smartphone application to be able to unlock the box. One major issue with this project is that the person deliver the mail may have issues putting in the mail. He or she would need some sort of special key to access the mailbox. Giving mail companies access to this would require a nationwide adaptation of the idea which can be difficult.

2. **Auto-targeting Nerf Gun**- the idea behind this project was to use a Nerf gun that would target and shoot certain targets it is programed to use. This project has been done by other groups in the past and shown to be a very interesting project. The challenge this proposes is more complex programmer for our group. Our group consists of only electrical engineers in which can pose a problem with projects that are very heavy on programming.

3. **Smart drinking cup**- UCF is known for its tailgates and football games. When it comes to drinking, there is a responsible and irresponsible way of doing it. Doing it responsibly maintains that healthy balance of excitement and safety. One idea that our group had was to develop a smart drinking cup that would automatically close itself when the user had too much to drink. This would work by having a sensor that analyzes the breathe of a user and would shut down if it met a certain limit. We decided to do not move forth with this idea because it would require a large adaptation into society as it would essentially have to ban other ways of consuming alcohol.

4. **Smart Microwave** - This project was most similar to the smart toaster. A phone app and smart capabilities would have been built into a microwave. We decided to go with a toaster instead of a microwave due to the costs associated with the microwave and the size of a microwave. It's too much of a hassle carrying it around. A toaster on the other hand is quite easy to carry. Also, microwaves are much more expensive than toasters. Since we are all college students on a limited budget, it was the best idea to work on the toaster.

5. **Laser harp** - Due to our love for music we did some research to combine that with our majors and decided on a Laser Harp for a possible project. This device would contain a laser shining at a mirror attached to a motor creating the illusion of multiple lasers. If one were to place their hand on top of one of the beams, a signal would be sent to a circuit board that's also connected to a computer with a synthesizer and plays a corresponding musical note. Once again this would take some coding and photonics knowledge, so it would be safer for us to work on something mainly electrical, such as the toaster.

Pros/ Cons on the Smart Toaster:

Pros :
1. Fun and interesting Senior Design project.
2. Involves multiple concepts in electrical engineering
3. No sponsorship required, each cost will be covered by group members.
4. Technology is fairly inexpensive and easy to obtain
5. Groups members are very familiar with the technology behind toasters
6. Can provide and innovative product available to the common consumer.
7. Challenges the group with design constraints.
8. Project can alleviate certain safety concerns

Cons:
1. Each member is an EE student, programming is on the group's weaker side.
2. Will require a bit mechanical design work

  With all things considering our group's final decision is to proceed with the smart toaster idea. The other two project suggestions would also be a fun/ interesting project to complete as well as challenge us in EE concepts, but each poses issues that hinder the possibilities. The smart toaster appears to be the best choice for the senior design project. Each project suggested requires a certain amount of programming knowledge; however, the smart toaster appears to us to be the most manageable.