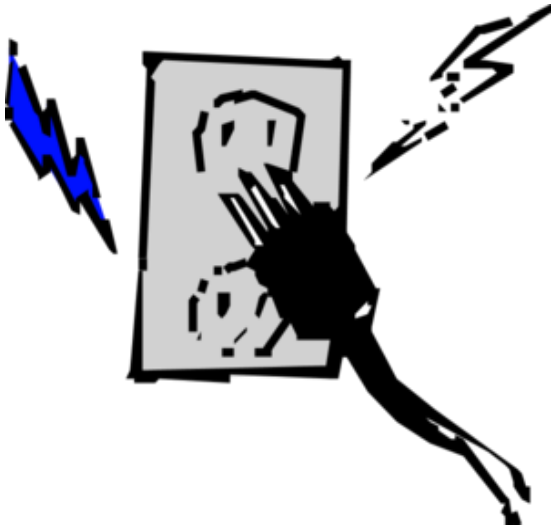
Initial Project and Group Identification Document

Smart Meter | Idea I



Senior Design 1

Group 1

Krystal Folkes	Computer Engineering
Jelani Foy	Electrical Engineering
Bailey Morgan	Electrical Engineering
Niabelle Thelemaque	Electrical Engineering

Project Narrative

The power grid is a large electrical network that has room for technological improvement and innovation. The idea of a "smart grid" is becoming more common as customer load growth keeps increasing. Having the ability to monitor a customer's load profile in real time will be useful to dispatchers in an energy control center, because they can get an accurate reading of the power draw in certain areas. Also, the ability to turn certain appliances on and off would help the system operators to level power peaks. By doing this, more expensive peak-load generators would not have to be used to keep up with peak power demands. This will help the power grid, as well as power companies, to become more efficient. The incentive for the customer to agree to this control by the system operators would be to save money on their next power bill. A credit will be applied to each power bill for being part of this program. The customer will also have the ability to allow or deny the supervisory control by the system operator.

Goals and Objectives

The goal of this project is to incorporate aspects of the smart grid into a home. The metering sensors should be able to communicate to a central smart device to update the smart device with real-time measurements. The operator's smart device shall be able to communicate with the switch in the appliance's power supply circuit. The customer's smart device shall be able to allow or deny the operator's control to the household appliances, and be able to display power consumption and amount of savings from being part of the peak load reduction program.

Project Description

This project idea will incorporate features of the smart grid. The idea is to have a microcontroller monitoring the power draw on common appliances in a home (air conditioner, washing machine, dryer, television, etc.…). These sensors will measure the voltage and current draw of each appliance, as well as the current and voltage phases to calculate the power factor. This information will be sent to a monitoring device (smart device, computer, etc.…). The monitoring device will mimic a monitoring device that a system operator would see, and the system operator would also be able to switch the appliances on and off from the computer program. A controlled switch in the appliance circuit will open and close to turn the appliance on or off. If the customer would not like to have their appliances turned off during the peak hours, then they will have the option from their application, or smart meter to turn off the system operator's supervisory control. The customer's app will also show their credits that they are receiving for allowing the system operators to turn their appliances on and off.

Project Specifications

- Smart Meter Casing
    - 1'x 1'
    - Weighs under 5lbs
    - Can be mounted to a wall
- Relays
    - Can successfully interrupt and reconnect appliance-source connection up to:
        - 3A AC
        - 130V AC
    - Attaches to outlet power source
    - Will be wired to smart meter
    - 0-6VDC input
- Voltage Transformation and Current Transformation
    - Will be able to transform household voltages (120VAC) to acceptable input voltages for microcontroller
    - Will be able to transform household AC currents (up to 3A) to acceptable input currents for microcontroller

- Wireless Communication
    - Can send and receive data up to 100ft.
    - Measurement and control information send and receive accurately to terminal
- Data Processing
    - Successfully calculate power values within accuracy of 5 Volt-Amperes
    - Successfully calculate power factor values within 0.05
- Measurements
    - Will be able to measure voltage within +/- 1V accuracy
    - Will be able to measure current values within +/- 10mA accuracy
- Terminal Program
    - Program will be able to display:
        - Appliance power consumption
        - Appliance power factor
        - Relay status (open or closed)
        - Supervisory control status (on or off)
        - Customer's incentive status

Marketing Trade-off Matrix

↑ - Positive correlation
↓ -Negative correlation
(+) -Positive polarity
(-) -Negative polarity

		Number of Devices	**Voltage Measurement**	**Current Measurement**	**Communication Range**	**Current Interruption**
		+	+	+	+	+
Size	-	↓	↓	↓	↓	↓
Cost	-	↓	↓	↓	↓	↓
Ease of Use	+	↑	↑	↑	↑	↑
Ease of installation	+	↓			↑	↓
Adaptability	+	↑	↑	↑	↑	↑
Accuracy	+	↓	↓	↓	↓	
Targets for Engineering Requirements		**3 Devices**	**0-130V AC**	**0-3A AC**	**100ft**	**0-130V AC 0-3A AC**

Budget

Name	Price	Quantity	Total
Microcontrollers	$5	3	$15
Relays	$2	3	$6
Operational Amplifiers	$1	20	$20
Transformers	$16	3	$48
Wireless Transmitter	$4	1	$4
Wireless Receiver	$5	1	$5
			Total: $98

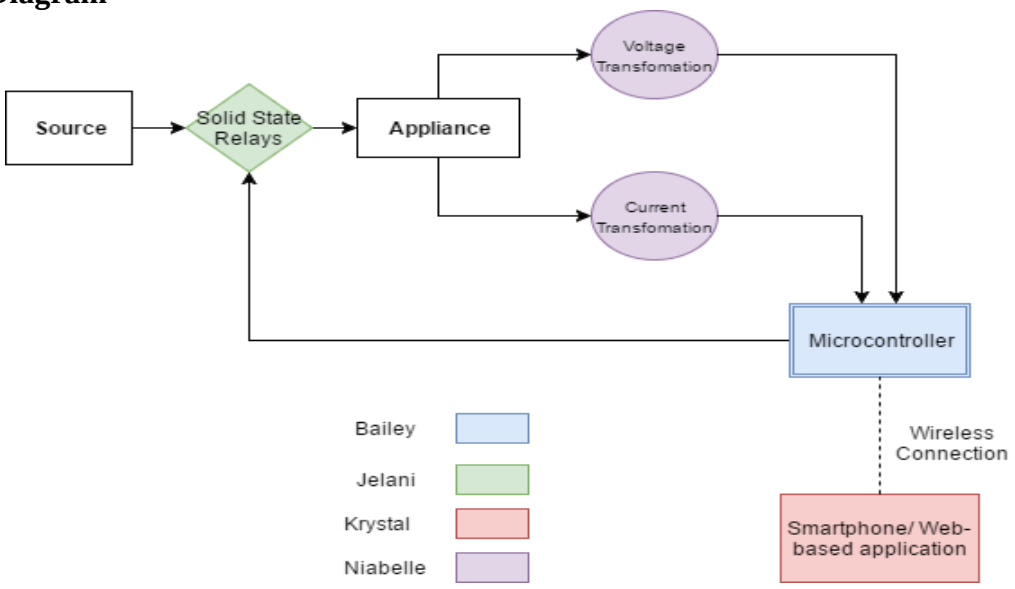
Note: These values are an estimate based on products already in the market.

Project Constraints

Any project or endeavor that a group of individuals, team, or company embarks on will have some challenges. One of our largest constraints is time. Due to the fact that we are taking Senior Design II in the summer, we have less time than if we take it in the Fall semester. As a result, we need to be conscious of time. We must practice time management and be strict on meeting deadlines in order to successfully complete our project.

Cost is another constraint that we face. To make this project feasible for production, we need to make sure that the cost remains as low as possible. While maintaining low costs, we also strive to make our project as efficient as possible. Further research in technology for our project will allow us to allocate money towards costly need-based components.

Block Diagram



Note: Items in block diagram are currently being investigated as of 2/2/17.

Smart Bioelectric Watch | Idea II

Group 1

Krystal Folkes	Computer Engineering
Jelani Foy	Electrical Engineering
Bailey Morgan	Electrical Engineering
Niabelle Thelemaque	Electrical Engineering

Project Narrative

The bioelectric smartwatch is a small electrical current device that has the capabilities of aiding and supporting those diagnosed with Parkinson Disease (PD). The bioelectric smartwatch will be able to collect data bioelectric impedance analysis on Parkinson Disease patients, and aid in the treatments process and tracking the "*amount of Parkinson's*" per day. The smartwatch will have the capability to send wireless data collected to our safe and secure web platform. The customer will also have the ability to allow or deny the supervisory to their medical professional or family. The smartwatch will also have the ability to display with helpful information and notify through watch vibrations when excessive tremors (shaking) occur. By doing this, we are providing aid with new age medical technologies, contributing to society, and helping in the physical therapy practices.

Goals and Objectives

The bioelectric smartwatch works toward essentially being a hub for health as well as monitoring conditions of the Parkinson Disease. The objective of this project is to create a Parkinson Disease smartwatch that can detect speed, bioelectric impedance, and frequency of tremors(shakes) to some degree of accuracy. Furthermore, this apparatus will utilize web application capabilities to store information that can be used for medical records and progress. Additionally, this information can be securely sent to family and medical professionals. Some of these operations include: displaying time, vibrating when tremors occur, detecting and calculating the speed of tremors, sending data wirelessly to web platform, as well as simple notifications to special alerts.

Project Description

The bioelectric smartwatch is to have a microcontroller PCB monitoring and detecting one type of motor unit activity such as the rhythmic spontaneous resting discharge. The concept is to monitor the speed of hand muscle contractions and the body impedance to send notification to user to notify them that they are experiencing a tremor. The accelerometer will measure the hand movement, as well as the electrode pads will collect body impedance and determine a threshold using a regression algorithm from previous published research to collect and send data wirelessly. This collection of data will determine if a tremor is occurring and signal a vibrator motor to notify the user with the smartwatch. This information will be sent to a monitoring device web platform (smart device, computer, etc.…) to help with, collecting data of progress and can be used to help medical professionals provide proper treatments for Parkinson conditions. The web platform will be secure and make sure the privacy of the user medical records is not compromised.

Project Specifications

- Watch Shell
    - 35mm x 42mm
    - Weighs under 1lbs
- Accessibility
    - Will be lightweight
    - Will be portable
- Wireless Communication
    - Can send and receive data up to 50ft.
    - Measurement and control information send and receive accurately to web-platform
- Measurements
    - Will be able to measure voltage within +/- 1V accuracy
    - Will be able to measure current values within +/- 10mA accuracy
- Final Program
    - Apparatus functions:
        - Detect shaking

- Alert user of shaking
- Detect speed of shaking
- Measures body impedance

Marketing Trade-off Matrix
↑- Positive correlation
↓-Negative correlation
(+)- Positive polarity
(-)- Negative polarity

		Dimensions	**Application Time**	**Display**	**Communication Range**
		+	+	+	+
Size	-	↓	↓	↓	↓
Cost	-	↓	↓	↓	↓
Ease of Use	+	↑	↑	↑	↑
Ease of installation	+	↓	↓	↓	↑
Adaptability	+	↑	↑	↑	↑
Accuracy	+	↓	↓	↓	↓
Targets for Engineering Requirements		**35-36mm**	**< 2 minutes**	**35-36mm**	**50ft**

Budget

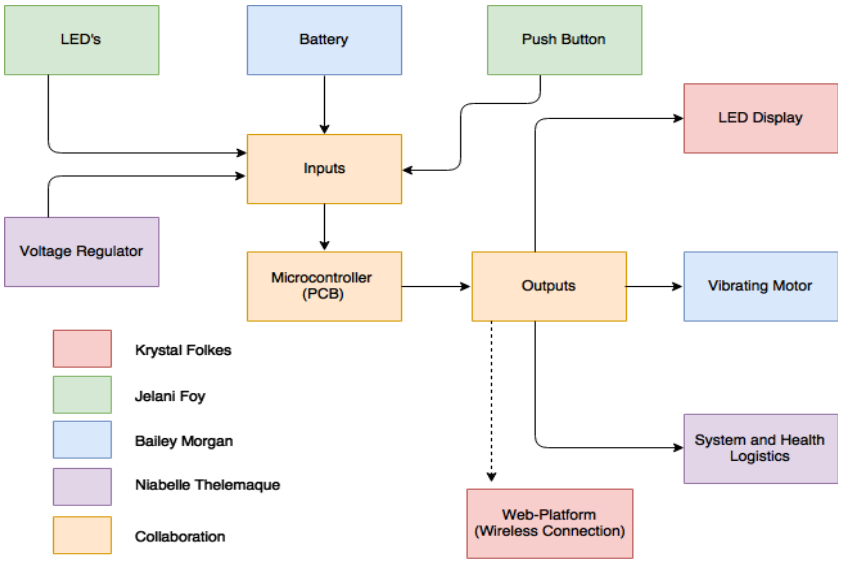
Name	Price	Quantity	Total
Microcontroller	$10	1	$10
LED Display	$10	1	$10
Capacitors	$0	TBD	$0
Resistors	$0	TBD	$0
Electrode Pads	$20	1 Pack	$20
Accelerometer	$4	3	$16
Vibrating Motor	$4	1 Pack	$4
Voltage Regulator	$4	3	$16
Push Buttons	$1	2	$2
Battery	$5	2	$10
			Total: $88

Note: These values are an estimate based on products already in the market.

Project Constraints

As previously mentioned in the Project 1 idea we will have a time constraint due to shorter summer semester. However, another challenge we could face is not getting enough participants to train and verify our bioelectric smartwatch to test the usability of the Parkinson smartwatch, and accuracy of tremor notification. We must work together to really push ourselves to create a real novice medical device and contribute to the research community.

Block Diagram



Note: Items in block diagram are currently being investigated as of 2/2/17.

Initial Project Milestones

Senior Design 1 Projected Schedule

Description	Duration	Dates
Project Idea	**1 week**	January 9- January 13
Divide and Conquer	**3 weeks**	January 13- February 3
Initial Project Document	**-**	February 3
Research and Writing	**2 weeks**	February 3- February 17
Update on Divide and Conquer	**-**	February 17
Individual Research and Writing	**5 weeks**	February 17- March 24
Table of Contents	**-**	March 24
Initial Draft	**-**	March 31
Final Document	**-**	April 27

Senior Design 2 Projected Schedule

Week	Description
1	Test Components
2-6	Build Prototype
7-8	Test Prototype
9-11	Finalize Prototype
12	Present Project