SMART POWER SOCKET

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January 2017

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Abstract

The emergence of Global Warming threatens the people to save and optimize the use of energy in a daily basis. In fact, controlling the energy consumption for some appliances is an effective method to save energy at home, since it prevents the users from utilizing too much energy. Even through there are some energy-effective products that are helpful in saving for particular devices, it's still hard to find a solid solution to effectively reduce appliances energy consumption in a house. Therefore, researchers proposed an IoT based intelligent energy saving device which can monitor, control and schedule power consumption of a certain device connected to a power source. The device will allow the user to switch a specific power socket remotely, monitor the power consumption of the appliances in use and schedule the use of certain appliance based on the needs of the user.

Objectives of the Study

The general objective of this project was to design a device for monitoring, controlling and scheduling of power consumption on a certain device connected to a power source to meet the requirements in accordance with codes of ethics, engineering standards and consideration of tradeoffs based on multiple constraints such as economic constraints, sustainability and functionality.

Specific Objectives

• To design an embedded system that can monitor, control and schedule power consumption.

• To develop an Android application that would control and display the device readings.

• To test and evaluate the prototype based on accuracy and reliability.

Scope and Limitation

The design focused on the construction of Smart Power Socket. The device is capable of monitoring, controlling and scheduling power consumption of an appliance in used, It Also shows the actual readings of the power consumption and the status of the socket in used for a specific appliance.

On the other hand, the design's limitations are as follows: The Socket only works with 220VAC devices; 2) Can only support a maximum of 3 loads per device.
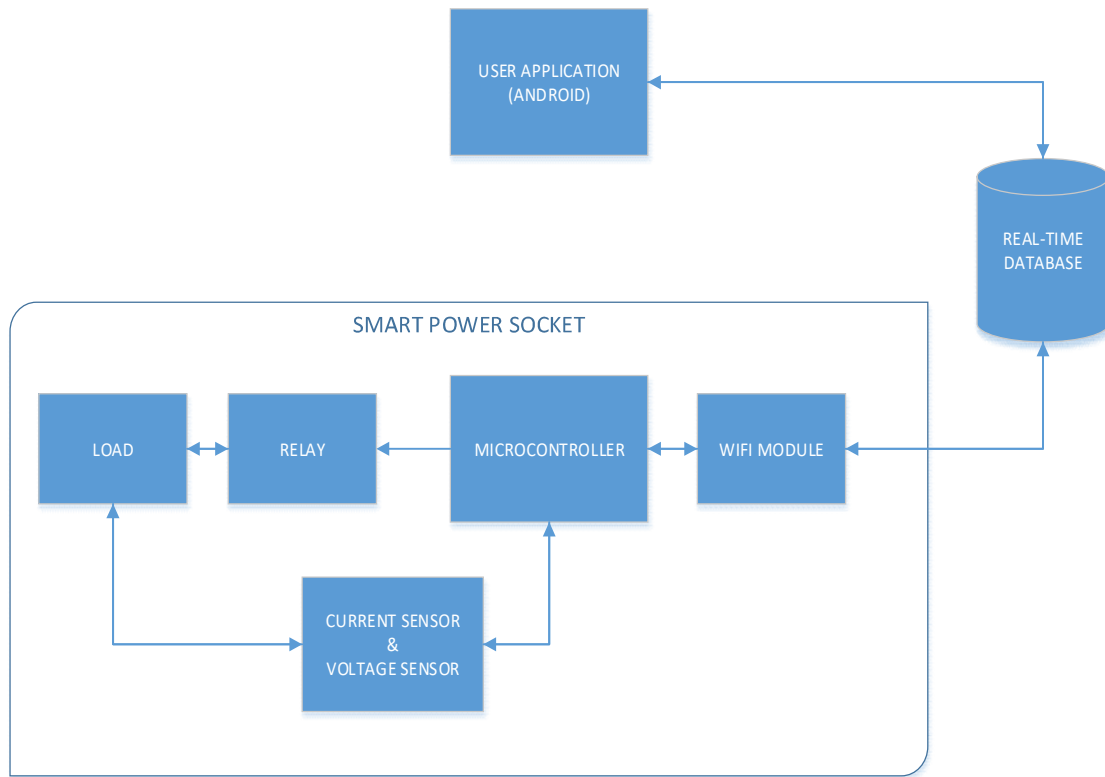
Block Diagram

Figure 1 Block Diagram

Figure 1 shows the Block Diagram of the project. Which consist of three major components: the device itself Smart Power Socket, Real-time Database and Android based user application. The device is composed of relays that can control the flow of alternating current to the load connected on the socket, current and voltage sensor which calculates the power consumption of the load connected to the socket, microcontroller that presides the operation of the system, and Wi-Fi module which allows users to communicate with the device.

Hardware Requirements

Upon designing of the project, the designers considered the factors that affects the process development of the design. These factors are the skills, knowledge and the materials that are required for the development of the design. These said factors are discussed below:

Knowledge:

The knowledge includes the application from the previous courses as listed below:

Embedded System

The device required the utilization of the current and voltage sensor needed in coding to the microcontroller chip. The system also required the communication between the microcontroller and the Android application which were all tackled on the Embedded Systems course.

Digital Signal Processing

The application of the knowledge learned in Digital Signal Processing would be the computations, conversions and different transformations of the gathered data from the current and voltage sensor.

Circuit Design

The designers applied the knowledge in circuit design for the specification of the design. This involves the computations of the components for the circuit such as resistance, voltage, and current that would determine the functionality of the device.

Electronic Components and Devices

The knowledge in the electronics had been applied and considered on the specification of the materials to be used in the specification and cost of materials.

Hardware Components:

Microcontroller

This would be the main component of the system that contains the instructions to be executed based on the given parameters to be inputted.

Power Supply

This component supplies electric power to the device. This term has been commonly applied to electric power converters that convert one form of electrical energy to another.

Android Device

This hardware component uses to control the mode and display the current state of the parameter applied to the device. The output is displayed in digital form.

Sensor

This component is set for its function to measure the current and voltage across the load. The sensors used is the Voltage and Current Sensor.

Relay

This component is an electronically operated switch driven by the microcontroller that controls the energy dissipated to the load.

Wi-Fi module

This hardware component connects the device to the database.

Software Requirements

The designers developed an Android Application that is used for controlling and displaying the parameters measured by the prototype. The skills and knowledge that the designers applied in developing the software were based on the knowledge that have been learned from Software Engineering and Android Programming as well as the software that has been used in the development such as Integrated Development Kit for android applications and Microcontrollers.

Knowledge:

The designers have applied the knowledge from previous course and programming languages taken as listed below:

Software Engineering

The knowledge that has been learned from the Software Engineering course has been applied in designing the Software Development Life Cycle (SDLC). The designers applied the systematic, disciplined approach to the development of the android application which are all based on the discussions taken in the Software Engineering course.

Open Source Programming

The android application was developed using an open source android development tool Android Studio. The use of this open source development tool greatly lessened the development costs of the device.

Microcontroller Programming

The program that has been integrated in the microcontroller has been developed through C programming.

Software Components:

The programming tools listed below are used for the development of the programs:

Integrated Development Environment for Android Application

The Integrated Development Environment (IDE) used in developing the android application is the Android Studio.

Project Flow and Gantt Chart

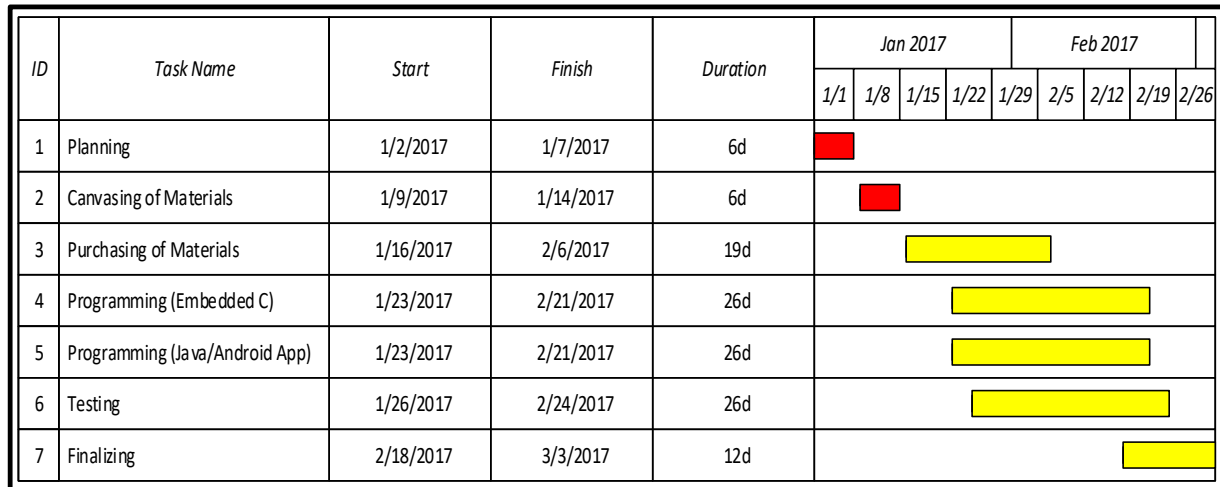| ID	Task Name	Start	Finish	Duration	Jan 2017					Feb 2017			
					1/1	1/8	1/15	1/22	1/29	2/5	2/12	2/19	2/26
1	Planning	1/2/2017	1/7/2017	6d	■								
2	Canvasing of Materials	1/9/2017	1/14/2017	6d		■							
3	Purchasing of Materials	1/16/2017	2/6/2017	19d			▬▬						
4	Programming (Embedded C)	1/23/2017	2/21/2017	26d				▬▬▬					
5	Programming (Java/Android App)	1/23/2017	2/21/2017	26d				▬▬▬					
6	Testing	1/26/2017	2/24/2017	26d					▬▬▬				
7	Finalizing	2/18/2017	3/3/2017	12d								▬▬	

Figure 2 Project Gantt Chart

Figure 2 shows the Project flow and Gantt chart of the project. the time allotment for the project is 9 weeks. The designers need to undergo 7 task in order to accomplish the design.