A Non-invasive Appliance and Application for Remote Washing Machine Monitoring.

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1. INTRODUCTION

Energy Monitoring systems are vital technologies in all fields. The ability to know the efficiency and power usage of machines in this day and age is a highly sought after and essential tool. As energy prices increase and shortages affect more of the world, being the appliance or the system with the lowest power usage will become the goal for all. To determine this energy usage, extensive energy monitoring systems are being developed and used in all industries.

The motivation behind this project stems from a problem I noticed while living in residence halls. With washing machine on only the basement floor, one would have to walk down many flights of stairs with your laundry to the machines only to discover the machines to be taken. This process would be repeated multiple times until an open machine appeared. For myself and other busy students this problem is both an aggravation and huge waste of time.

The following section is a summary of previous work upon which this project is built. A brief summary of work completed to date is given, along with a schedule for remaining tasks

2. RELATED PRIOR WORK

In this section 5 papers about energy monitoring systems are reviewed and compared to provided a background for this projects. Based on metrics for energy monitoring systems, we divided the sources into the following categories:

2.1 Non-invasive hardware

Non-invasive hardware is a common approach to energy monitoring hardware where the system to be monitored need not be dissected and the structure of the monitored system does not need to be known, meaning the non-invasive hardware is universal. [2] investigates a load monitoring technique for energy monitoring. The non-intrusive appliance covered in this article would be used in homes to provide information on energy consumption on major electrical appliances, although the author does note that uses in the commercial and industrial sectors are possible. The articles goes into depth on how the use of this appliance in homes will aid in monitoring of the energy crisis. [1] describes and introduces the Energino, a standalone plug-load meter based on the Arduino platform. The researchers state that the driving factor behind the Energino's development was the lack of affordable and reliable energy consumption tools, which researchers need for development of simulators. The article goes in depth on the hardware, software, and networking involved in the Energino. One of main goals described by the article is to create a easily usable device. [5] investigates a possible use of the arduino platform for development of a smart plug, a non-invasive universal plug that can be used remotely to monitor energy consumption. This article also goes into detail on the devices connection to an android device for remote monitoring. However the articles does not give a prediction of when this device will be on the market and their website does not either. [3] goes in depth on a hardware design of an energy monitoring appliance using their presented SPOT architecture. SPOT stands for, scalable power observation tool. Their design features nodes which are used to monitor a range of devices over a period of time. This article details the hardware level design and dissects each part of the design to describe its use.

2.2 Software/Networking

Due to the wireless nature of non-invasive hardware for energy monitoring, software and networking for these systems are very important for getting the collected data to useful machines for the monitoring to occur. [4] goes into detail on the process of transmission of data from non-intrusive energy monitoring devices across wireless sensor networks. The article describes also their lab experiments and test as well as their results. In addition [1] goes into detail on the software and networking involved in Energino described in the above section. The article analyzes the C/C++ programmed arduino hardware and Wiring library used to create the Energino. In addition, the articles covers the wireless network setup used and how it connects to the client used for monitoring. Lastly [5] covers the software and networking involved in connecting the arduino platform smart plug to a server housing an android application.

3. PRELIMINARY RESULTS

To date, I have performed research in two aspects of the project. The first has been using a meter to measure the

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voltage being utilized by washing machines as they go through cycles. I measured how the voltage changed with different machines and different cycles and came to the conclusion that any voltage over 100 V indicates that a machine is in use.// I have also done research into the arduino platform, using a Uno board with multiple sensors and the C programming language. I have done work to gain understanding of the platform but have yet to produce any software to perform the needed task for this project.

4. PROPOSAL/DESIGN

To solve the problem described in the introduction, I plan to build a non-invasive piece of hardware, using the arduino platform, that will determine the voltage being supplied to a washing machine. Then wirelessly send a signal to an API that I will setup to edit a database of current washing machines, telling it either that the machine is being used or not being used. Lastly, I will develop an android application to pull information on the machines from the API and display that information to users of the app so that users can determine whether or not a specific machine is in use or not at the moment.

5. TIMELINE

The following task will be completed in the following order by their associates dates

1. 10/29.
    - Complete work with the Arduino software, Arduino board and sensors.
2. 11/5
    - Complete connection of Arduino board to WI-FI network.
3. 11/12
    - Complete set up server with database and API.
4. 11/16
    - Complete and submit first draft of research paper.
5. 11/26
    - Complete work on android application.
6. 12/4
    - Give final presentation on work.
7. 12/12
    - Complete and submit second draft of research paper.
8. 12/16
    - Complete and submit final of research paper.

6. REFERENCES

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