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SCADA BASED DATA ACQUISITION SYSTEM

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ABSTRACT

The aim of this work is to propose a low-cost device for monitoring energy consumption of household equipments or smaller industries, based on the Arduino platform as a Data Acquisition (DAQ) module. An open source software Supervisory Control And Data Acquisition (SCADA) is used for simulation of data onto computer. The proposed system allows them to be identified the highest demands of energy consumption of a home or small industries with a consumption reduction goal. This work is an attempt to develop a DAQ system using the Arduino platform. The existing method is used only monitor the electrical load, but the proposed method is designed to monitor and control the electrical load at a time or one by one as per the demands. Based on the scheduled algorithm, the SCADA tool will work also as per the demands of electrical load. The main objective of this work is to save the power consumption of electrical devices. With the help of Global System for Mobile (GSM) it is easy to continuously monitor and control the data acquired by an Android Application.

KEYWORDS: SCADA, DAQ, Arduino, GSM.

I. INTRODUCTION

An electrical energy crisis required a significant reduction of consumption of all areas. Power consumption of the regions closer to the origin has increased as that more household appliances are being installed and energy storage or renewable energy [1]. This work aims to provide a prototype based on open source software that allows households and even small businesses to know the individual consumption of their equipment in a simple way and cheap.

A supervisory system developed in "Open Source" model that has a free license, the software ScadaBR [2]. The software ScadaBR is used for simulation of DAQ system and the Arduino is used to control the hardware components [3]. Improving energy efficiency is the first step, and more important for the achievement of three energy policies;

1. Security of supply,
2. Protection of the environment
3. Economic growth.

The policy on the subject had been mainly focused on improving efficiency technical potential and the potential for this, while contributions that examine the role of energy management have been scarce [4]. The consumption of energy and how the generation should be searched simultaneously for to reduce the cost of energy in homes only a small part of total cost production, when energy prices were low and relatively stable [5].

To implement home powered management, networked electric home appliances with control/monitoring capabilities and home networks without new wiring are indispensable [6]. A remote-controllable powered outlet system with a wireless mechanism for home power management has been developed in this work [7].

Block schematic of the proposed DAQ system is shown in the following figure. 1. Controlling and monitoring of various household devices is also shown in the diagram.

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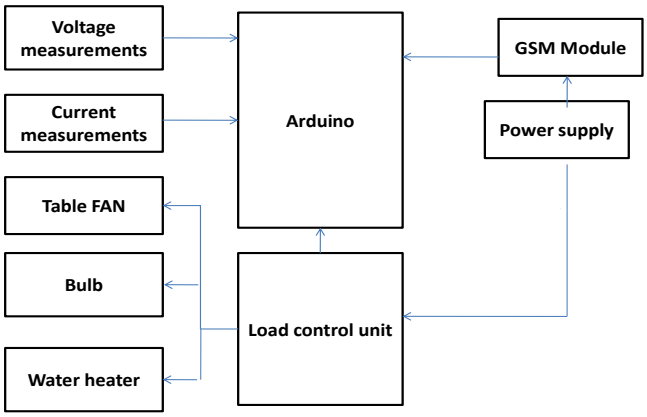

Figure 1: Proposed diagram of a DAQ system.

II. SYSTEM MODEL

This system has been designed to implement a DAQ system which is used for monitoring and controlling the electrical loads in household appliances and small businesses [8]. A smart meter may use control itself with all energy-sector processes [9]. The relay is working as a switch to ON/OFF of all the electrical loads. The ARDUINO is controlling the overall process. The author proposes to sense the voltage and current measurements through the mobile application. For remote monitoring and controlling user can use GSM module [10].

The device consists of the following components:

i. Arduino UNO
ii. Relay
iii. Rectifier
iv. Transformer
v. GSM Module: SIM 900A
vi. Junction Box

Arduino UNO

The Arduino UNO is an 8 bit microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. The ARDUINO is the heart of the hardware, which controls directly and indirectly all the function of the devices.

Figure 2: Physical appearance of Arduino board

Relay

High-voltage or high-current devices can be controlled with small, low voltage wiring and pilot switches. Operators can be isolated from the high voltage circuit. Low power devices such as microprocessors can drive

relays to control electrical loads beyond their direct drive capability. In an automobile industry, a starter relays to allow the high current of the cranking motor to be controlled with small wiring and contacts in the ignition key. In this work the relay is working as a switch. Based on the scheduled algorithm or based on the instruction the relay will be either ON/OFF.

Figure 3: Relay

Rectifier

A rectifier is a device which converts the AC current into pulsated DC. Here a full wave rectifier used. This DC voltage is sufficient to the Arduino which is controlling the hardware.

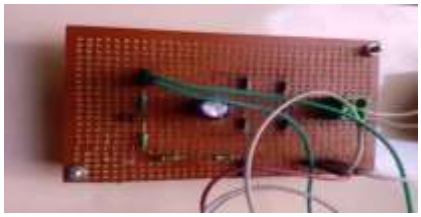

Figure 4: Rectifier

Transformer

A step down transformer with 12V AC output voltage is used for this work. Rectified 12V DC output is given to the processor.

Figure 5: Transformer

GSM Module: SIM 900A

The physical appearance of a GSM Module: SIM 900A is given in the following figure. 6.

Figure 6: GSM Module SIM 900A

Junction Box

The junction box is used to the input for all the electrical load. In this project total three electrical loads are used. The tree electrical load is connected to a common switch. The electrical load internally connected to the common switch and the relay such a way that only when you run the mobile app in ON. If the mobile app is OFF mode all the electrical load will be OFF even though you switch ON the main junction box. We can run the electrical load at a time or one by one base on our requirements using the mob app. Which one, the electrical load we want to run just run the mobile application and put the particular electrical load is ON.

III. SIMULATION RESULTS

SCADA software is used to monitor and control the DAQ. In this work SCADA tool is used to simulate the DAQ module. There are three electrical loads are used. Based on the scheduled algorithm timing the SCADA tool will work. In this simulation, a user can monitor and control the electrical load and also can observe the amount of power consumption.

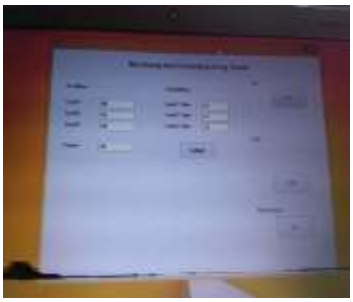

Figure 7: Simulation result of SCADA software

IV. RESULTS AND DISCUSSION

ARDUINO board is connected with relays and GSM module. The GSM module is connected in order to collect the information and display in mobile. The simulation was done by SCADA tool.

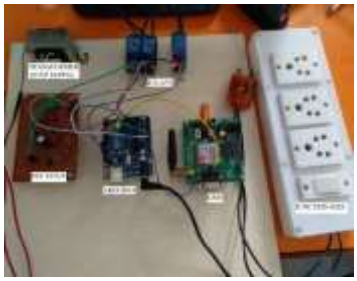

Figure 8: Hardware connection of the data acquisition system.

Figure9: Snapshot of power consumption in android application.

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V. COMPARATIVE ANALYSIS

The performance of the DAQ system using ARDUINO is better compared to other methods like ARM processors. Using a GSM module, the overall process is automated without human interaction. There are very less of chances regarding data updating errors because the overall process is automatic.

VI. CONCLUSION AND SUGGESTION FOR FUTURE WORK

Here attempt to connect ARDUINO to a DAQ system. It will continuously monitor and control the electrical load. In this work storage capacity is purely based on the mobile phone's internal memory and capacity of the SD card inserted in the mobile. It can also be stored onto the server. So data can be accessed from any device when connected to the Internet. It will be possible to add more electrical loads in the future, so a complete household device or a small business industry equipments are easily connected with this system.

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