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SMART ENERGY MANAGEMENT SYSTEM

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Abstract: A smart Energy Management System (EMS) can contribute towards cutting the costs while still meeting energy demand. The evolving technology of Internet of Things (IoT) can be utilized to better manage energy consumption in residential, commercial, and industrial sectors. This system includes, the home appliance which is interfaced with a data acquisition module that's an IoT object with a singular IP address leading to a wireless network of devices. With these techniques, household energy consumption can be monitored in real time, also being able to record information including operating time and power consumption information for each device. The Android interface provides the users with to watch and alter their electricity consumption habits in order to optimize the energy efficiency.

Index Terms - Internet of things; energy efficiency; home control; smart home

1. INTRODUCTION:

Energy is a vital aspect for any household, industries agriculture. Managing the energy efficiently and conserving it intelligently for appliances is extremely important in future. The emerging technologies of Internet of Things (IoT) can be utilized to manage energy consumption in residential, commercial, and industrial sectors. It collects data from the appliances and analyse the information thus, this analysed information in real-time can aid home owners, utilities and utility Eco-systems providers to realize significant insights on energy consumption of smart homes.

To solve this problem of energy management, this project is a system which will be very useful for the houseful and industrial applications. The system is proposed with a simple sensors and relays to monitor and control the energy consumption.

The rest of the paper is coordinated as follows, segment 2 contains the literature survey, segment 3 focuses on the hardware design, components and the methodology used in the proposed system. Segment 4 is focused on the results which the system obtains and the graphical representation of the proposed system. Conclusion is described in the segment 5. Segment 6 is focused on the future scope of the proposed system.

2. LITERATURE SURVEY:

For making this system to work, firstly the research was made about what was already present and build on it. After thoroughly searching and reading various research papers some useful information was found out.

Vignesh Mani, Abhilasha, Gunasekhar.[1] Proposed a detailed survey of controlling the home appliances and also monitoring the electrical parameters towards hazard has shown. Also work reporting on controlling the home appliance for reduction of energy consumption has mentioned.

ChaoHsien Lee¹, Member, IEEE, and Ying Hsun Lai² [2]. Proposed the detailed information on cloud computing which has been adopted widely to handle huge data and which motivates the propose of universal smart energy management system based on IoT platforms. This concludes us that to increase the interoperability the proposed system is integrated with open source IoT platform.

A. R. AlAli, Imran A. Zualkernan, Mohammed Rashid, Ragini Gupta, Mazin AliKarar [3]. A detailed literature survey of how data is utilized from IoT platforms has shown and multiple challenges such as data storage, data organization and data analysis are also mentioned in this paper.

After all the research and surveys for the proposed system, some of the key findings are that the research done up till now is a significant process for the proper home management system. There is a scope of work in the system Some of the scope of the work includes to make the system efficient and to make it more modern.

3. COMPONENTS:

3.1.1 Node MCU

NodeMCU is an open-source firmware which incorporates different open-source prototyping board designs. The prototyping equipment regularly may be utilized as a circuit board functioning, as a dual in-line package (DIP) which coordinates a USB controller with a conservative surface-mounted board containing the MCU and antenna.

3.1.2 Solid State Relay

A solid-state relay (SSR) is a gadget that switches on or off when an outside voltage is applied across its control terminals. It carries out a similar role as an electro-mechanical relay, however has no moving parts and due to which it has longer operational lifetime. SSRs contains a sensor which peruses the information (control signal), a solid-state electronic switching device which changes the power capacity, and a coupling mechanism to permits the control signal to enact the switch without mechanical parts. The relay may be intended to alter either AC or DC loads.

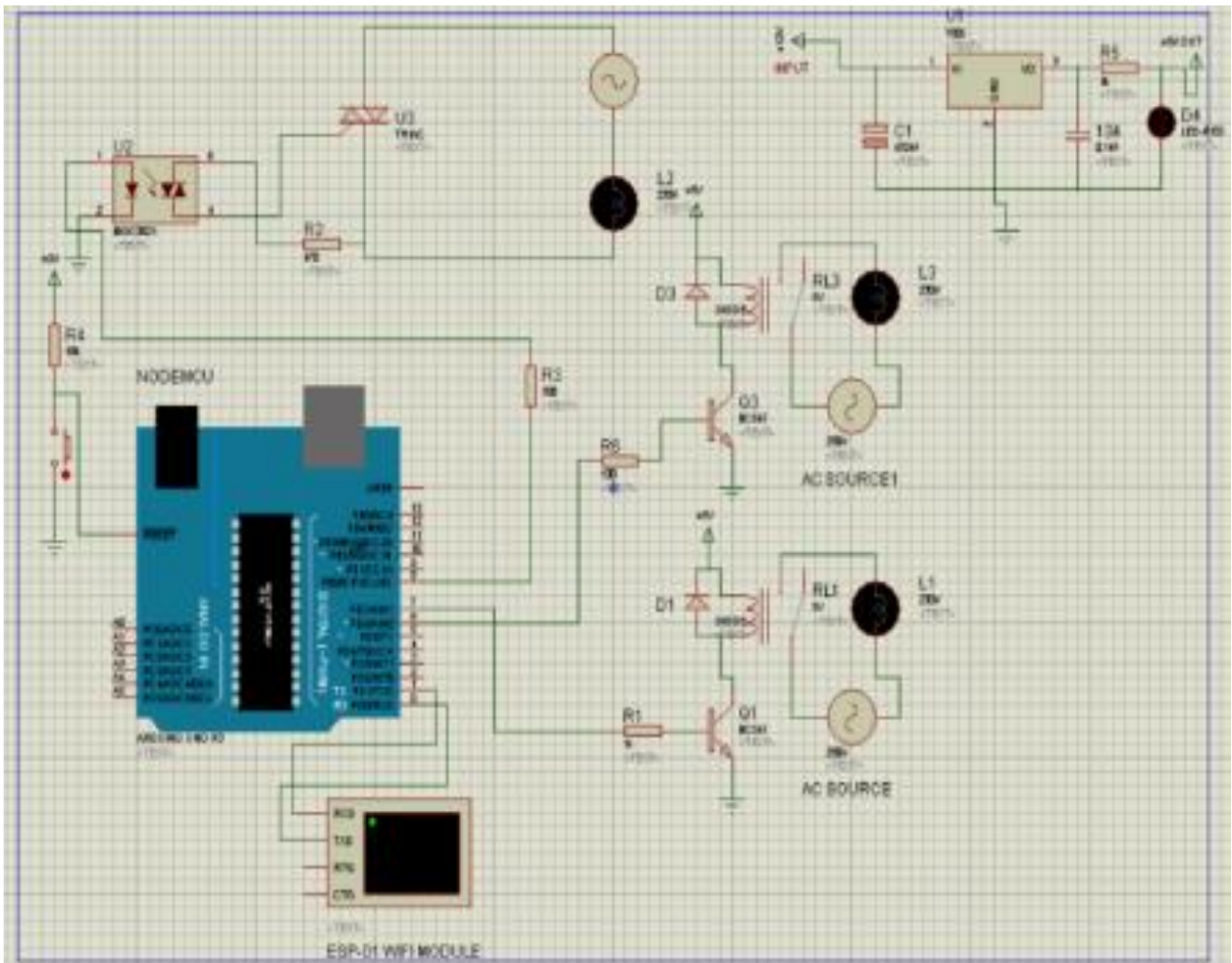
3.1.3-Channel Relay

It is the LOW Level 5V 2-channel relay interface hardware, for which each channel requires a 15-20mA driver ebb and flow. They are often used to control variety of machines and hardware with huge loads. It accompanies with high-current transfer that works under AC 250V 10A or DC 30V 10A. It has a typical interface which will be controlled directly by micro-controller.

3.1.4 Power Supply

A 7805 IC is utilized which is a three terminal linear voltage regulator IC and can convey a proper result voltage of 5V, and can be helpful in a wide range of applications. A 230V to 12V Step down transformer is utilized and its primary coils are connected to mains supply. It can convey 1.5 A current (with heat sink). VIN is the input voltage to the 7805 IC and could accordingly the source at any point be frequently from one or another battery of an unregulated DC. VOUT is that output of the 7805 IC, which might be controlled to 5V.

3.2 HARDWARE DESIGN:



3.2.1 WHAT IS An ARDUINO IDE?

Arduino is an open- source programming software, which basically used for the development of different electronic projects. Arduino board is able to act on the data form a sensor, and transform it into an affair- twiddling a motor, turning on a light source. we can specify the board what to do by transferring a group of instructions to the microcontroller mounted on the board. To do so we have to use the Arduino programming language (grounded on Wiring), and the Arduino Software (IDE), grounded on Processing.

At the same time, the Arduino has been the functional entity of thousands of systems, this incorporates ordinary objects to complex scientific instruments. A global community of makers- scholars, tinkerers, software engineers, and professionals has been around the improvement of the software (Arduino IDE), their contribution has amounted to a doubtful measure of accessible knowledge that can be of extraordinary assistance to newcomers and specialists.

Arduino was developed at the Ivrea Interaction Design Institute. It has been integrated for quick prototyping, focused at the personals with next to no knowledge in electronics and programming. As soon as it reached a global community, the Arduino board started changing according as indicated by new circumstances and difficulties, secerning its proposal from straightforward 8-bit boards to products for IoT operations, wearables, 3D printings and had relations with environmental factors.

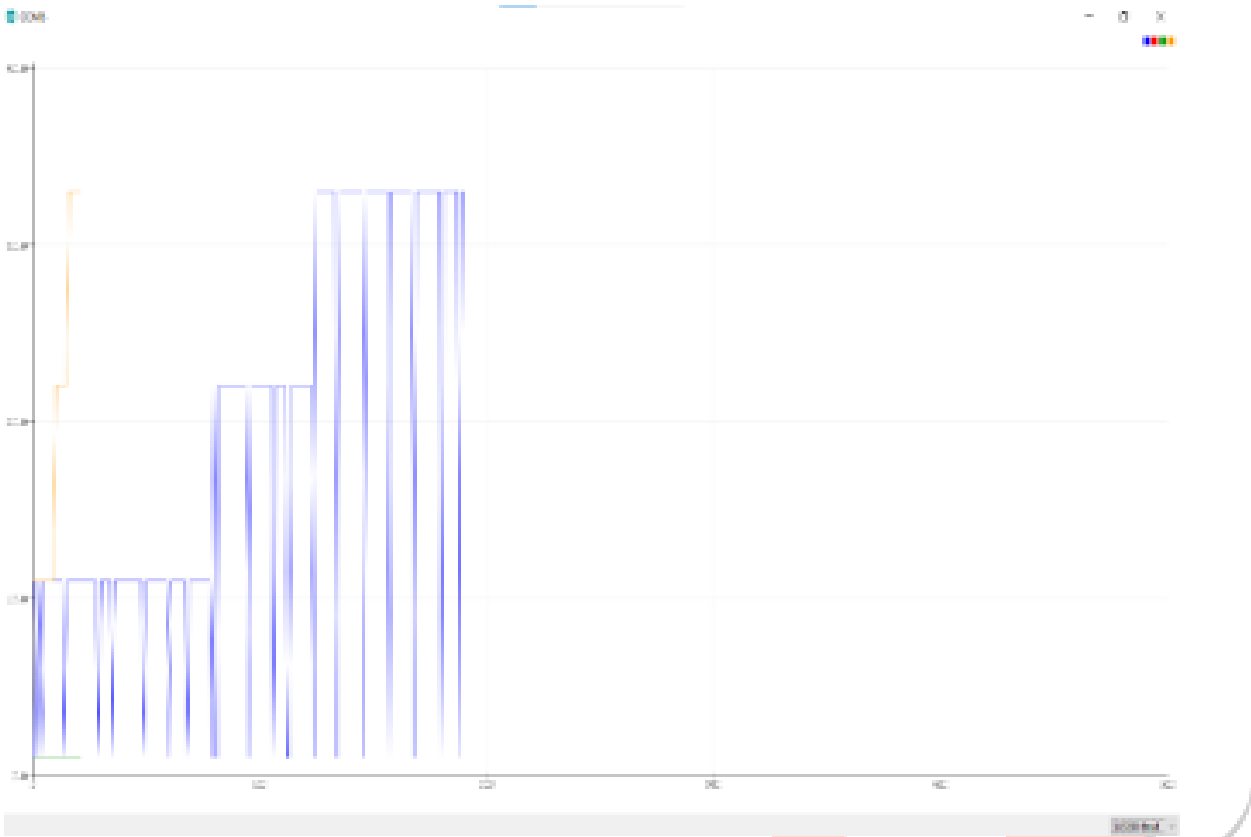
3.2.2 PROTEUS

The Proteus Design Suite is an individual programming device suite utilized principally for electronic plan robotization. The product is utilized considerably by electronic design brains and professionals to create schematics and electronic prints for assembling distributed circuit boards. The micro-controller re-enactment in Proteus works by appertain either a hex train or troubleshoot train to the microcontroller part on the schematic. It's likewise co-re-enacted alongside any simple and advanced gadgets associated with it.

4. RESULTS AND DISCUSSION:

After performing various experiments, the conclusion was made that each appliance has its own characteristics in a particular range.

We, have plotted the graph of each appliance on a in-built serial plotter in the Arduino IDE itself, where we can observe if the system or each appliances are operated as per given instructions which is shown in graph 1.



5. CONCLUSION:

In this project, we described the smart energy management system which is integrated with open-source IoT platform. Also, the outcome of project is to design a user-friendly system. In this system, each home device is connived with a data accession module that's an IoT object with a unique IP address performing wireless network of devices, this system is an innovation stage involved both hardware and software that allows the client to monitor and control energy usage through application.

6. FUTURE SCOPE:

Energy conservation is an important factor for any country. This system will help us to secure that factor. This system will not be only helpful for domestic purpose but it will also manage the industrial applications. Also, the concepts like machine learning and artificial intelligence would help to enhance the credibility of the system. Here we can also add the message or email notifications about the uses with the help of MATLAB applications.

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