International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 7
March 2018

Residence Energy Control System based on Wireless Smart Socket and IoT

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ABSTRACT

The main problem that is faced by all the human being of the earth is exhausting of energy resources. Energy should be saved in order to have good environmental conditions. So energy saving should be done in our daily lives. Somehow energy is being saved by different methods by controlling the appliances in home. This prevents the users by reducing unnecessary energy. Even though there are many different methods to prevent the energy from consuming, it is hard to find a efficient method to reduce the consumption of energy in home appliances .In order to find the solution for this problem we have introduced a smart energy control scheme, know as residence energy control scheme. This is developed based on internet of things and smart socket technology. This is used to reduce the energy consumption of home appliances without destroying sensors. This system provides four control modes, namely peak-time control, energy-limit control, automatic control, and user control. The first two are operated for all smart sockets in a house, while the next two are used by individual smart sockets. Therefore we can enhance the functionality of energy control. This system can save energy up to 43.4% for some appliances in one weekday.

INTRODUCTION

Introducing smart technologies have changed electricity infrastructure more efficiently. This smart technology is a next generation power Network and enables both electric power system Operators and consumers to reduce energy consumption and greenhouse gas emissions through the fusion of the information technology and power electronics technology. It has the capacity to sense grid conditions, measure power, and control devices by two-way communications, which leads to improvement in energy efficiency and grid reliability to the electricity generation, transmission, distribution, and consumption part of the electric power grid. A smart grid is a small-scale distributed power network. The main goals of the smart grid are a reduction in greenhouse gas emissions, enhancement of grid reliability, and energy self-sufficiency in distributed energy domains. In recent years, the technological progress of distributed renewable energy has enabled the household in the smart grid to independently generate and consume electricity. In particular, photovoltaic (PV) energy has been under the spot light as the distributed renewable energy source for residential energy consumers, due to cost reductions in production, governmental incentives, and convenience in setting up. Despite the great attention of household systems, it is still challenging for most utilities to introduce the quality of electric power, because of irregular generation.

Till now many energy control methods have been proposed. By utilizing IoT and developed a tablet-computer based Home Energy Management scheme to monitor the consumption of home energy. With this system,

users can set up management policies to control home energy consumption based on the time of a day. We can design a power meter which shows real-time information about home energy consumption to users. The main goal is raising consumers' energy consumption awareness, potentially inspiring them to be more energy efficient. Many of the electronic appliance control applications utilize a lot of sensors to sense user locations and activities. Some of them use Open Service Gateway initiative or Service-Oriented Architecture to predict users' behaviors in a house; with this we can manage the home appliances in a particular house. Some previous studies improved functions of sockets set up in a house and connected with wireless networks to control home appliances. Sensing users' location, motion, and habits with a large number of sensors may not be an energy efficient method since these sensors consume considerable resources. So it would be better for them to be low cost and high coverage. Also, according to the survey on developed countries by the International Energy Agency, the energy consumed by idle appliances, called standby energy, in a house is about 3% to 11% of total energy consumed by the house. Basically, house energy can be further reduced if standby energy is effectively lowered without significantly affecting users' everyday lives, implying that the conflict between house energy saving and user's living convenience need to be balanced.

RELATED WORK

The Internet of things is a new communication and network paradigm, and various studies of the IoT have been conducted. A multi layered agent-based architecture for the development of proactive, cooperating, and context-aware smart objects through a JADE-based middleware. The multilayered agent-based architecture consist of a wide range of smart objects from reactive to proactive, from small to very large, and from stand-alone to social. A new vision for Internet of Things based on cloud is introduced. This paper discussed key enabling technologies and applications of IoT in the near future. major opportunities are arising from the integration of social networking concepts into the Internet of Things. This paper also presented the various ongoing research activities around the world and discussed the most important technical challenges. We discussed about a scalable and self-configuring architecture for large-scale IoT. This architecture can provide autonomous services and resource discovery mechanisms with no human intervention to smart objects.

The developments of the IoT and wireless sensor networks come up with new solutions for residence management. In such a home management system, a fix IP address is required, and remote users need a high-speed connection to access the system. We established an e2Home association which enables remote users to manage smart home appliances, and uses emails as the communication medium. The advantage is that a user need not to establish a high speed Internet connection before he/she can effectively manage home appliances. However, the complex email services result in the fact that the system is a little hard to be constructed. here we published an adaptive versatile home architecture which creates a rational agent as a home servant to seek for a method that can maximize inhabitant comfort and minimize operation cost for users. We developed a context-aware middleware that provides users with an automatic home service inside a smart home following the users' preference. This middleware uses open service gateway as the framework of the home network, and employs sensed data to predict the users' preference for home appliances. This sensed

data includes pulse, body temperature, facial expression, room temperature, time and location.

INTERNET OF THINGS

The IoT is a new communication and network paradigm in which a variety of things or objects (e.g., not only networked devices, but also people, vehicles, and bridges) become an integral part of the Internet. In other words, the objects become smart objects which are equipped with microprocessors and transceivers, which make them able to communicate with each other and provide intelligent services to users autonomously.

A variety of applications and services of IoT have begun to emerge in various fields of vehicles, healthcare, home automation, and SG framework. In the field of communications infrastructure has been constructed in order to collect and analyze data in real-time by installation of smart meters. The smart meters communicate with each other over intelligent M2M communications. It is, however, partial IoT rather than fully IoT, because it is only focused on making metering devices. In this architecture, there are several limitations such as low scalability, low reusability, and low interoperability.

SYSTEM ARCHITECTURE

IOT based system architecture of RECOS

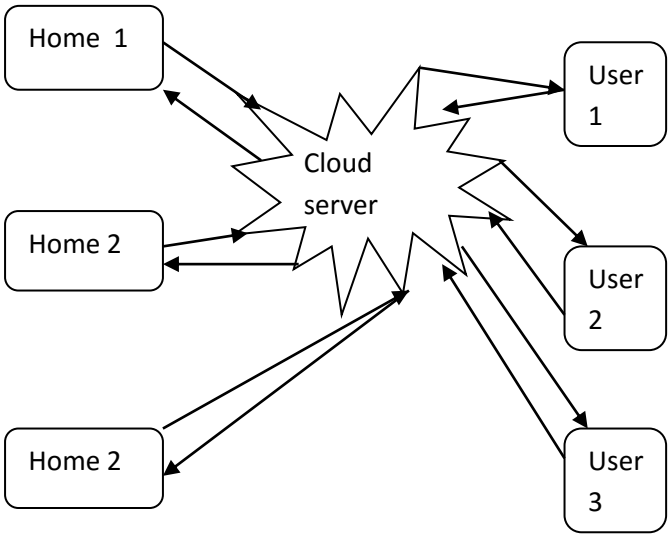


Figure shows the typical architecture of the conventional system. This is constructed by using various wired and wireless network technologies. The various network-based devices in the home, such as smart appliances, smart meters, smart distribution panels, renewable energy systems are connected. They have roles of aggregating data from the networked devices and transmitting the data to the central management server. These are fixed and are essential network components for reliable transmission in the HAN. Although this static network architecture enhances reliability of communication, it reduces scalability of networks, systems, and services. The fixed gateways, moreover, have another problem of a waste of energy. In the conventional system, the power needs to be always-on in order to collect data from appliances and sensors over the system, which results in constant power consumption.

In the RECoS, no sensor is deployed, and the information of appliances' energy consumption is collected by smart sockets through IoT. Those home appliances regularly or periodically staying in their standby states will be turned off by switching off the corresponding power supply embedded in their smart sockets with an electronic approach. After receiving user defined energy limit for a smart socket, the RECoS gives a one-day energy quota to the smart socket, and accordingly controls the energy consumed by those appliances connected to the socket.

Energy Saving Scheme with Interaction Based on IoT

Energy Saving Based on the Interaction between Devices

The proposed system provides an energy saving scheme through cooperation between home devices. A hierarchical relationships exists between home devices. For example, a PC, in general, is connected to a monitor, printer, and speakers, which are subordinated to the PC. When the PC is turned off, it is a waste of energy if monitor, printer, and speaker are turned on. Thus, a user can save energy by using this characteristic. The devices such as the PC are defined as the upper layered appliance and the devices such as monitor, printer, and speaker are defined as the lower layered appliance. When all upper layered appliances are turned off, the relevant lower layered appliances are turned off. For example, when the PC is turned off, the monitor, printer, and speaker are turned off. When the TV is turned off, all appliances, including the home theatre, set-top box, game machines, speakers, and DVD player, are turned off.

Energy Saving Based on the Interaction with User's Behavior Patterns

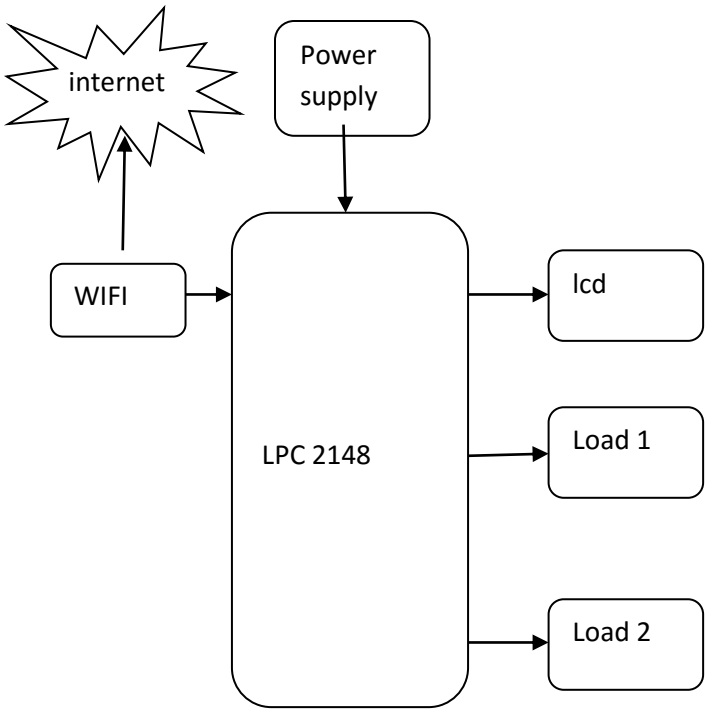
In order to reduce energy consumption, the proposed system controls appliances based on user's behavior patterns in the service domain. The existing home energy management service conducts appliance control only based on user movement and not user's behavior patterns. The proposed system generates user's behavior patterns based on the power feature data (gathered by ESD) and user movement data. The user's behavior patterns contain information on the purpose of user movement. The proposed system has two methods to control devices in order to save energy consumption. The first method is rule-based control. The proposed system generates various rules that connect a user's behavior pattern and location with device control. For example, if a user comes into a room, an ESD detects the user. Then, ESDs return all the appliances that were off in the room to standby mode. Depending on the operation of appliances and user movement, if a user completely leaves a room, energy saving is performed by cutting off standby power of appliances that are not operating. The second method is to utilize hierarchical relationship between the user's behaviors and home appliances. The user's behavior is defined as the highest layered appliance. The user's behavior is considered as ON when the user conducts a specific behavior and as OFF when the user finishes a specific behavior. For example, when the user leaves the bathroom, the lights and all electric devices such as electric bidet in a bathroom are turned off.

Energy Saving Based on the Interaction with User's Preference

The proposed system can provide a new form of energy management services by using users' preference. The new form of energy management services is not only efficient energy management service but also enjoyable energy

management service. It is possible to provide enjoyable energy management service through using user's preference. Therefore we developed a mobile application to vote on user's preference and conducted a simple experiment. The mobile application asked users to choose whether the users feel comfort or discomfort. Based on thousands of user votes, we are able to see which of the energy management services make people comfortable. The more data we collect and analyze the more comfortable energy management service we provide.

BLOCK DIAGRAM



HARDWARE DESCRIPTION

LP2148 ARM PROCESSOR

ARM is known as Advanced RISC Machine. Most of the embedded systems are designed by using ARM processor as a core. ARM has wide range of applications in every day Portable consumer devices. ARM1 prototype is introduced in the year 1985, in which one billion ARM processors are launched in worldwide by the end of 2001. ARM7 has high code density and low power consumption.

ARM creates a flexible embedded processor by adopting RISC Architecture. RISC Architecture provides or delivers simple but powerful instructions which executes within a single cycle along with high clock speed. By using ARM processor in embedded systems we can provide greater flexibility in software rather than hard ware. The designs rules we use in RISC Architecture are instructions, Pipelines, Registers, load store Architecture. ARM design philosophy includes extend battery operation, high code density, price sensitive, high volume application with low cost memory devices.

LCD

A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

POWER SUPPLY

Power supply is a reference to a source of electrical power. A device or system that

supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

This power supply section is required to convert AC signal to DC signal and also to reduce the amplitude of the signal. The available voltage signal from the mains is 230V/50Hz which is an AC voltage, but the required is DC voltage(no frequency) with the amplitude of +5V and +12V for various applications.

WSN

Wireless sensor network, sometimes called wireless sensor and actuator networks, in this system all the sensors are distributed to monitor ph value or environmental conditions, such as temperature, sound, pressure, etc. this data is passed through the network to the main location. The more modern networks are bi-directional, also enabling controlling of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on.

WIFI COMMUNICATION

Wi-Fi is a technology which uses radio waves to provide network connectivity. Wi-Fi connection is provided by using a wireless adapter to create hotspots. Areas which are in the region of a wireless router are connected to the network. Then it allows user to access internet services. Once it is connected, Wi-Fi provides connectivity to your devices by utilizing frequencies between 2.4GHZ to 5GHZ, based on data in the network.

Two types of data are communicated between robot and the control station. Control information has the higher priority because it is used to inform the robot how to act and react. This is used to say whether it is direct movement commands through teleportation or more general commands like informing the robot of a new destination for inspection and detection.

PROPOSED ALGORITHM

Algorithm for the proposed system is divided in two parts as

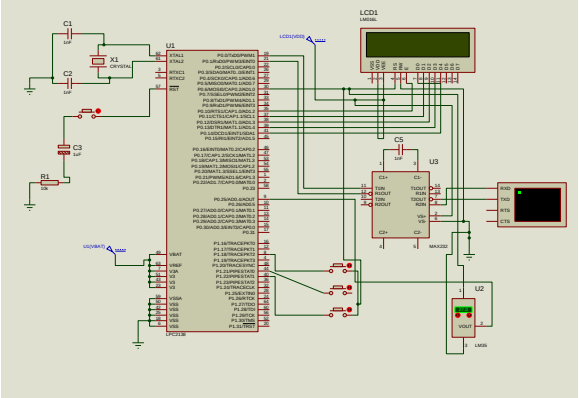
Algorithm for system consists sensors, ARM7:

1. Initialize SPI (Serial Peripheral Interface.
2. Initialize LCD.
3. Initialize WIFI, WSN.
4. Initialize all sensors.
5. Display sensors current status.
6. If any sensor status changes then message is displayed on LCD.
7. Operations in the kitchen will be send server using WIFI, alerting system on.

8. Then particular action will be taken by the owner depending on status of sensors .

RESULTS

SCHYMATIC DIAGRAM



CONCLUTION

This paper proposed an IoT-based RECoS with lightweight system. Considering a new communication and network paradigm, the IoT, we presented the requirements of an IoT-based RECOS and designed and developed the RECOS by reflecting these requirements. We proposed a method that is autonomously constructed and reconfigured. We presented the techniques for reducing the cost of the implementation of a RECOS with various perspectives on system, network, and middleware architecture. The proposed RECOS enables the construction of a RECOS to be more scalable, reusable, and interoperable. We implemented the proposed RECOS and performed an experiment to verify the performance and feasibility. We expect that this study will contribute to providing the guidance on the development of an IoT-based RECOS. As a future work, we will continue to research the technologies of context and situation awareness for energy management based on IoT. We will also carry out research on integration of social networking concepts into the IoT. In addition, we are developing the novel social IoT-based RECOS loads control that reduces energy consumption through integration of social networking concepts.here in this module

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