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AN IMPLEMENTATION OF THE CUSTOMER DOMAIN OF THE SMART GRID EMBEDDED IN AN INTERNET OF THINGS

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ABSTRACT

The Smart Grid is an evolution of the prevailing electricity grid. It contains of a two-way communication wherever electricity and knowledge are exchanged by the buyer and utility to maximise potency. Advancement in technologies has created an lot of convenient, economical and even more secure. Introducing the Raspberry Pi to the plant of home automation provides various customizations to show an everyday home into a Smart Grid. Raspberry Pi provides a low cost platform for inter connecting electrical/electronic devices and varied sensors during a home via the web network. The most objective of present work is to design a smart grid using various sensors which might be controlled and monitored by the Raspberry Pi via the Internet of Things (IoT). This can facilitate the house owners to provide straight forward, quick and reliable way to automate their environment. This paper proposes Smart grid systems comprises of digitally primarily based sensing, communications, and management technologies and field devices that operate to coordinate multiple electrical grid processes. An IoT of intelligent grid includes the applying information technology systems to handle new data and permits utilities to lot of effectively and dynamically manage grid operations. The data provided by smart grid systems conjointly permits customers to make informed choices about the approach they manage energy use.

Keywords: internet of things, smart grid, raspberry Pi, HTML.

INTRODUCTION

The smart grid is that the portion of the smart grid near to the home, and therefore the one with that customer interact. It permits a two-way information flow between customers and electrical utilities, reworking the historically passive end-users into active players within the energy market. Considering the seven domains of the abstract model of smart grids planed by the National Institute of Standards and Technology the last-meter smart grid corresponds to the “customer domain.” It allows residential, commercial, and industrial customers supported their completely different energy must optimize energy consumption and native generation, and to actively participate to demand-response policies, one of the most disrupting aspects of smart grids. Nontechnical customers would like a straightforward thank to control energy consumption and production, and to exchange power usage information at the right level of coarseness with energy suppliers or distributors. During this paper, present a design for the last-meter smart grid that is embedded in a platform for the internet of things (IoT). Our design has four main benefits and elements of novelty with regard to the state of the art, every appreciate the essential demand of being “customer-centric” and ascendible, so as to enhance market acceptance and easy preparation.

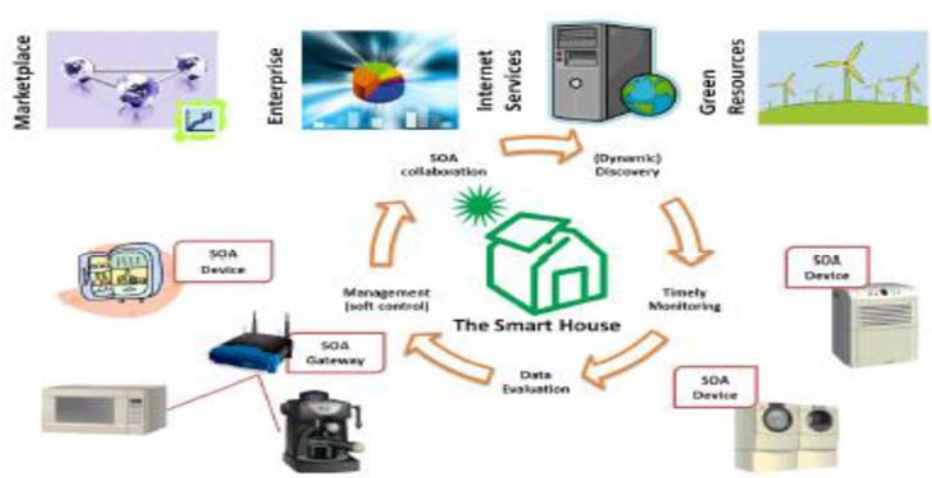

Figure-1. Collaboration within the smart house and with external entities.

The smart house of the long term are going to be able to collaborate with varied external entities, let or not its energy resources, marketplaces, enterprises, energy suppliers etc. The actual normal for high-level communication these days is via services, which allows for flexible functionality integration while not revealing details for the implementation.

Existing system

A set of papers focuses on the automation of the entire power distribution grid, of that the "last-meter" micro grid is only a subsystem. During this case, the entire grid includes power generation plants, transmission and distribution networks and "smart" customers with native generation capabilities, flexible usage and sometimes energy storage capacity. This huge infrastructure is typically managed by a central server/data storage or higher up management and information Data Acquisition (SCADA) system transmission from the client website to the last node of power distribution (last meter). Several transport choices are a unit generally projected, like the utilization of dedicated lines, to POTS/modem, PLC, wireless links. IoT platform consists of many hardware and software components, every described by its functions and by its interfaces with different components. During this approach, the design is well scalable and strong. Every element may be changed, redesigned, and extended with minimum impact on the on the remainder of the system. Due to the possibility of using the system to collect sensitive and confidential information, the platform ensures associate adequate security level each to end-to-end communications and to information access. For this reason, users got to be documented before they all access the platform and can only access specific sets of sensing element information through HTTPS.

Proposed system

In the proposed system, an energy management infrastructure specifically tailored for a smart office building, that depends measured information and on forecasting algorithms to predict the long run patterns of each local energy generation and power masses. The performance is compared to the optimum energy usage planning, which might be obtained assuming the exact knowledge of the future energy production and consumption trends and we describe the architecture of the Internet of Things platform and the specific intragrid implementation. It will gather information from heterogeneous sensing element communication protocols. The last-meter smart grid exploits existing infrastructure for in-industry connection to smart meters. Therefore, its design allows different wireless or wired protocols to be used for communications between meters, users, and other parts of the system. It provides secure and differentiated access to data. Single customers have complete fine-grained access to their own information, and might alter access by third parties. On the opposite hand, distributors and energy utilities will receive coarse-grained and mass applied match information. It permits to univocally map every sensing element and mechanism to a typical abstraction layer. To modify interaction with nontechnical users, sensors and actuators also are represented at a better abstraction level, independent of the physical details and of the communication protocols. Developers, utilities, and businesses will use this higher abstraction level to produce further services, as an example planning of energy usage by industry appliances in response to dynamic changes of energy rates, supported power demand and accessibility on the grid, or on monitoring and managing power consumption in real time.

Raspberry Pi

The Raspberry Pi could be a MasterCard sized single-board computer with an open-source platform. Higher-spec variant will increases the Raspberry pi GPIO pin count from 26 to 40 pins. There are a unit currently four USB 2.0 ports compared to two on the Model B. The SD card slot has been replaced with a more modern push-push type micro SD slot. Secure Digital (SD) cards area unit used to store the operating system and program memory in either the SDHC or Micro SDHC sizes. Most boards have between one and four USB slots, HDMI and composite video output, and a 3.5 mm telephone jack for audio.

Python

Python is a very useful and versatile high level programming language, with easy to read syntax that allows programmers to use fewer lines of code than would be possible in languages such as assembly, C, or Java. Python programs don't need to be compiled before running them, like C programs. Python also has a large collection of libraries, which speeds up the development process. There are libraries for everything like game programming, rendering graphics, GUI interfaces, web frameworks, and scientific computing.

HTML

HTML could be a straightforward, Universal mark-up language that enables net publishers to make advanced pages of text and pictures which will be viewed by anyone else on the net , no matter what reasonably computer or browser is getting used.

Block diagram

Many technologies and methods have been used in IOT based system to achieve the smart meter management and processing of the data, here we will collect all the data coming from the different sensors and sending to a computer. The key section of data processing includes data acquisition, data storage, data inquiry, and data analysis. In this project, a data processing framework is applied within the on-line observation system to touch upon large Varity of heterogeneous data collected from the underlying physical layer.

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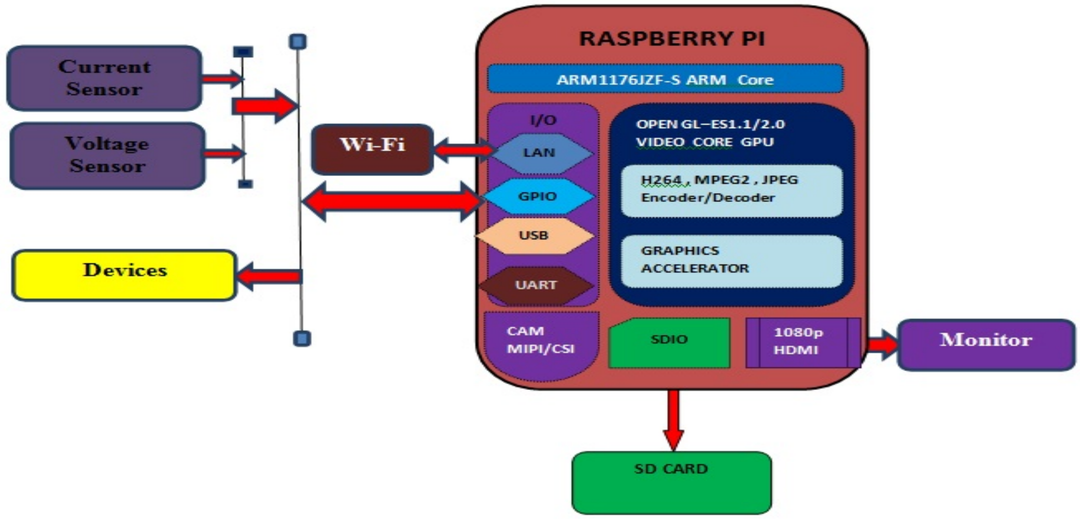

Figure-2. Block diagram representation of smart grid technology.

The framework is divided into a structure of six layers Device Layer consists of various kinds of sensors which are used to measure parameters (such as current transformer, power transformer, etc.) of the equipment. It is at the bottom logic structure of the system. The original data collection and system command are realized in this layer

Physical layer is created from information transmission devices mistreatment totally different forms of physical transmission strategies and protocols (such as Zigbee, wifi, etc.) as a result of different application environment and different needs. It's guilty of communication between the device layer and its higher layers it may regarded as a data transport layer

Physical communication protocol used by any type of device is transformed to a physical protocol by the intelligent gateway, which has the capacity of carrying Modbus/TCP protocol in agent layer. Thus, a complex heterogeneous network is changed into a relatively simple homogeneous network. The whole agent layer be regarded as a composition of protocol conversion. Data processing layer mainly deals with the massive data generated by online monitoring system. Its task includes congestion control of the network and filtration, validation, storage and analysis of the data. Device management layer is made up of two kinds of flows. The function of the data flow is to convert the heterogeneous data, which is obtained by different protocol technology in the physical layer, into a unified format data. The function of the process flow is to response to services requests from upper layer, and then converts it into the commands which can be performed by different underlying technologies. In this proposed project are controlling and monitoring the different sensors which are connected to the microcontroller and finally the collected data we will transmit to the admin system which is connected to Wi-Fi.

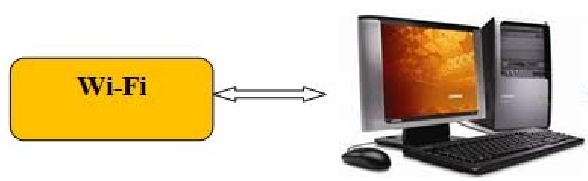

Figure-3. Monitoring and controlling section.

RESULTS AND DISCUSSIONS

Electronic devices can be controlled with the help of smart grid technology. Using webpage it is possible control the devices at anytime from anywhere as shown in the figures below. The advantage of this technology is it saves the power consumption.

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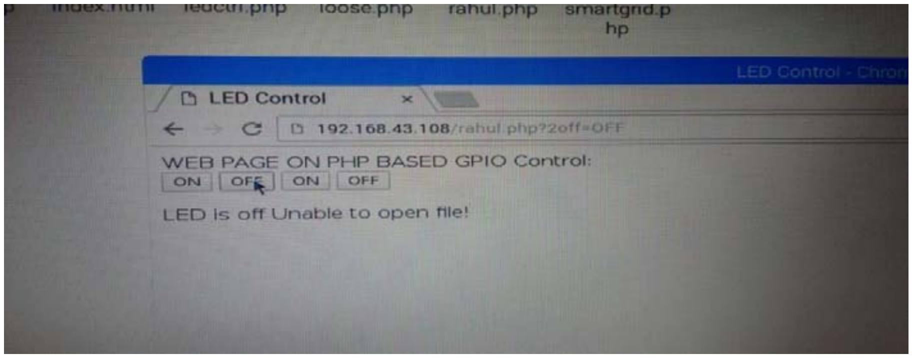

Figure-4. Control of devices using webpage.

Figure-5. Hardware unit.

Figure-6. Control of the device 1 using smart phone.

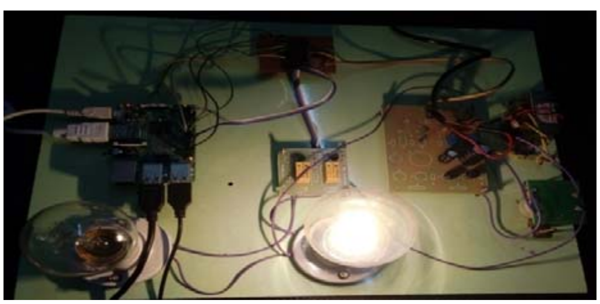

Figure-7. Control of the device 2 using smart phone.

Table-1. Table for controlling the devices using webpage.

Switch 1	Switch 2	Device 1	Device 2
OFF	OFF	OFF	OFF
OFF	ON	OFF	ON
ON	OFF	ON	OFF
ON	ON	ON	ON

CONCLUSIONS

Smart grid technology using the concept of IoT has involved in this project for controlling the devices at anytime from any place. This concept has been implemented successfully which helps to reduce the power consumption and saves the time of a person by not making them to be present near the device all the time. This monitoring provides more effective and efficient collection of data and reliable transmission. Cost effective analysis and less computational time are the advantages of remote monitoring.

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