

셀룰라 네트워크를 사용한 오피스환경에 적용한 M2M 통신응용연구

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M2M Communication Application of Office Appliances using Cellular Network

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Abstract

This paper presents a system design which allows monitoring and control of office electrical equipments and devices using sensor network through the use of 3G network. The system uses SMS and Email protocols by smart phones to pass information and can be utilized in many scenarios and variety of parameters in which monitoring is desired. The combination of sensors, algorithms and web service are used to generate useful information efficiently and at low cost for the user connected to internet. The information passed is independent of the location of the office users and therefore effective information transfer is achieved from which users can monitor and perform necessary actions to the situations back in the office.

1. Introduction

The Internet of Things (IOT) technology ties physical world objects to the internet thereby giving flexibility to monitor and manage these objects or things. The Objects or things in this context refer to devices which sense the environment around us. The applications of IOT are immense including smart home, intelligent transportation, government work, environment protection, public security, intelligent fire control, elderly care, personal health and industrial monitoring and so on. Hence this sensing body brings new perception to the way in which we interact with the environment around us on multiple levels including cultural, business, environmental, social, etc [1].

The sensor entity which is emerging into IOT is Wireless Sensor Network. There are approximately 1 billion internet users worldwide at present; therefore it makes sense to provide WSN service to this thriving community [2]. Wireless sensor network are spatially distributed autonomous sensors which monitor the physical or environmental conditions. The initial application of WSN was in the military service and from there on, WSN extended to other application areas such as structural monitoring, environmental observation, health monitoring, smart classroom, and

habitat monitoring, and tracking among others [3]. A Sensor Network can be composed of thousands of small smart devices comprising computational capability and memory, with one or more sensors and a limited power supply. The consistent progress in emerging sensor technologies such as wireless sensor networks has inspired IOT as this technology allows wide and cheap deployment of sensors on a large scale.

Today, internet of computers is becoming the internet of things, a global network which not only connects computers, but all kinds of processor-enabled machines/devices, such as domestic appliances, mobile phones and WSNs. The number of internet connected devices reached 9 billion in the year 2012 which included the traditional computer devices, mobile devices, and also the new industrial and consumer devices that are regarded as things [4]. The upcoming Internet of Things is comprised of proactive actors of everyday objects that surround us, generating and consuming information [5].

The WSN integration to the internet requires high performance computing and storage infrastructure for real-time processing and storage of data from WSN as well as the analysis of processed information to extract events of interest. For this matter, cloud computing is

growing to be a promising technology to provide flexible computing, software services and storage in a scalable and virtualized manner. Cloud computing presents various services like software, storage, computation and data access that does not require physical location and system configuration knowledge to users regarding the system which delivers the services [6]. Cloud Computing can be defined as the next stage in the internet's evolution, providing the means through which everything - from computing power to computing infrastructure, applications, business processes to personal collaboration - can be delivered to you as a service wherever and whenever you need [7].

II. Proposed System Architecture

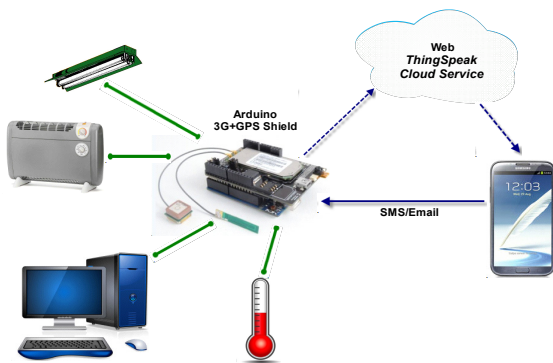


Figure1. System Layout

This paper proposes a system for monitoring and controlling of office electrical equipments through the use of Arduino 3G+GPS shield, 3G network and the cloud service called ThingSpeak. Figure 1 shows the system architecture. The new 3G shield for Arduino used in the system allows connectivity to high speed WCDMA and HSPA cellular networks. The cellular network enables connectivity to internet.

The Arduino is the main processor to which various types of equipments can be attached physically and will be powered through port connection to computer. For the desired parameters to be monitored in an office, suitable sensor will have to be integrated. There are various equipments in office which can be connected in this manner to provide awareness, security and comfort to office users.

System Operation

This system provides remote access and control to equipments in the office. These equipments include

lights, air-condition, heaters and other electrical equipments as well as computers. Arduino has various libraries and supporting programs which can allow equipments like computer to be controlled including locking and unlocking, opening programs and performing many other tasks in computers [8].

The data gathered from appropriate sensors are continuously updated to the ThingSpeak cloud service. The ThingSpeak web service is shown in Figure 2. On the cloud service, these data can be visualized in terms of graphs and gauges. Moreover, triggers can be set up on the service which can send Email and Twitter notifications to personnel during abnormal conditions for example when office temperature is low.

The online data is easily accessible through internet enabled smart phones. When an undesired data pattern is noticed, it can be normalized by sending an Email or SMS to the Arduino microcontroller through the smart phone. For instance, if the LDR value is low, it denotes that the office lights are still ON and can be instantly turned OFF by an Email or SMS. As the microcontroller receives the message, it then acts on designated relay switch to turn the light OFF.

This system not only can give information about office to the user when located away from the office but also changing the office environment upon departure and arrival of the personnel. The user on the way to office can easily turn ON the lights, activate the heater or air-condition depending on the season so that there is favorable room temperature upon the time of arrival and even drawing of curtains and opening of windows with actuators to bring the room to a comfortable state.



Figure 2. ThingSpeak Cloud Service

III. Conclusion

This paper has proposed a system for remote

monitoring and controlling of the office conditions through the use of Arduino 3G shield and Cloud web service. This system offers easy access to office equipments and devices. With the capability of this system, office users can have information about their office from anywhere providing more control resulting in users feeling secured and less worried about management of their office.

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