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NEARLY ZERO ENERGY BUILDING (NZEB) USING IOT AND SMART GRID

P. Deepak[1], Z. Anees Hussain[2]
Electronics and Communication, Engineering, Kumaraguru College of Technology, Chinnavedampatti, Coimbatore, Tamil Nadu 641049.
[1]allisdeepak@gmail.com, [2]aneeshussain14@gmail.com

***Abstract*—Current energy policy and climate mitigation goals require distinct reductions of the primary energy demand in the building sector. The existing building stock poses challenge since clear-cut technical and economical retrofit strategies for different types of existing buildings are still not established. The goal of the study is to identify such retrofit strategies to achieve optimal cost levels and to assess costs and benefits of nearly zero energy buildings (nZEB). Firstly building types are defined by covering single-family houses, multi-family houses, office buildings and school buildings. Secondly, a large set of generic energy efficiency measures are described, covering seven strategic fields, namely building envelope measures, heating and hot water supply technologies and fuel choice, ventilation and lighting systems, electricity and district heat mixes. This covers the usage of smart home appliances, eco-friendly building ventilation system. Thirdly, energy performance is calculated based on technical and physical characteristics and using building energy balance software. Fourthly, investment costs and life cycle costs are established based on unitary costs of building elements and building technologies. Cost-effectiveness is determined based on the net present value method which is compared to the annuity method for a couple of cases. The integration of smart grid and IoT(Internet of Things) is a new concept for conserving more energy.**

Keywords: **smart appliances, nZEB, smart grid**

I. INTRODUCTION

We consume a lot of energy in places of stay, work and worship. The number of power generating stations are very less when compared to the power consuming areas. Because of this we experience power shortage every time. In order to overcome this situation we provide ideas for reducing power consumption. Thereby, the extent of power shortage can be tackled. First of all, we identify the areas which consume more power and provide them with some name. The next thing would be providing a large number of energy efficient and mitigation measures such as providing smart usage of electronic appliances by automation of home appliances, by providing an inlet for natural ventilation and cool breeze by designing the architecture of the building. By following the above said aspects, the concept of designing an efficient building is achieved. Though the cost for building a zero energy building will be high, the future benefits of this are very cost-effective. Design objectives of this project will pave way for:

- Provide easier access to home appliances
- Provide an easier model to monitor the consumption of power
- Will pave way for reduction of power usage

Let's drill down into devices used to light, and heat and cool buildings, and the efficiencies that can be delivered when these devices are networked and can talk to each other. Only 1 percent of the world's buildings use systems to control and network lighting, and just 7 percent of lighting in commercial buildings is controlled by smart control systems. Beyond lighting, networked heating and cooling devices can cut loads of energy consumption, too. (1) Use of Smart appliances also helps us to reduce pollution.

II. LITERATURE SURVEY

Usage of energy reduction technique involves the usage of proper structural arrangement of buildings and also smart usage of electricity. The building must be constructed properly by providing it a natural ventilation area, so that the usage of power will be reduced in homes. Using dynamic glasses as windows improves the visual glare, reducing the cooling heating usage by 20% and reduce peak load by 30%. In the beginning, it was speed and performance. We love our electronic gadgets and PCs to be fast and furious, no matter if the energy consumption was over the top. The industry responded accordingly: the circuit design universe focused on speed and performance, so following Moore's Law, doubling transistor density every 24 months, the goal was always to make things faster and more frequent, and laptops becoming more robust and being able to run bigger programs. This leads to more power consumption. The introduction of smart Integration of Bluetooth and Wi-Fi technology in controlling home appliances can help and improve lifestyle of all user groups especially to the disabled and elderly people in term of safety and comfortable. The implementation of combined wired and wireless systems would be of most practical in designing a smart home system especially in cutting the system's installation cost for conventional home. The smart phone is the connected to the monitoring system by using the TCP/IP networking method via Wi-Fi. A graphical user interface (GUI) is developed as the monitoring system which exhibits the information gathered from the system. The GUI opens an option to the user to examine the fall as well as making the confirmation or

cancellation. A remote panic button has also been tested and implemented in the same android based smart-phone. In addition, the monitoring system can also answer the call automatically after the emergency alarm has started.

Appliance control subsystem enables the user to control home appliances remotely whereas the security alert subsystem provides the remote security monitoring. The system is capable enough to instruct user via SMS from a specific cell number to change the condition of the home appliance according to the user's needs and requirements. The second aspect is that of security alert which is achieved in a way that on the detection of intrusion the system allows automatic generation of SMS, thus alerting the user against security risk. In addition, the monitoring system can also answer the call automatically after the emergency alarm has started. Thus, this method of having smart appliances situated in buildings will not only help us to monitor the energy consumption of the entire building, but also to help us to efficiently reduce power consumption in the buildings also. The increasing use of IoT (Internet of Things) is shown in Fig 1. (2)

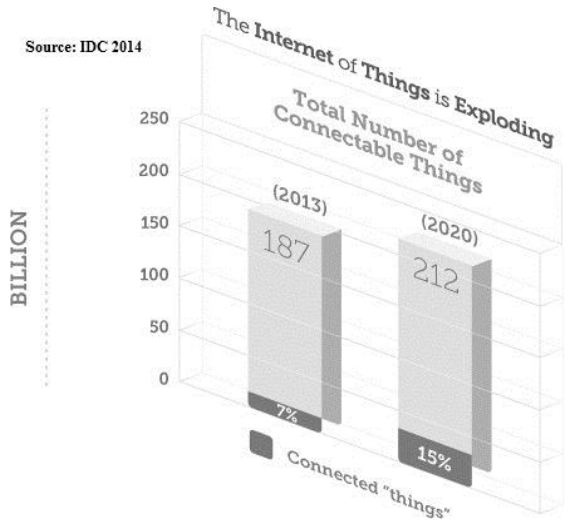

Fig1. The increasing use of IOT, Source: IDC (International Data Corporation), 2014.

III. HYPOTHESIS

We find that the energy is mostly consumed due to improper monitoring of the appliances and also due to the architecture of the buildings. Because of this, lot of energy is not utilised and over utilised than the prescribed level of the usage. Because of the negligence, the devices are consuming power much more than the prescribed use.

For example, a traditional house built with 30 light switches and 30 electrical outlets might stand for 50 years, with all those components still being original at the end of that period. But a modern house built with the same number of switches and outlets set up for Internet of Things might see each switch and outlet replaced at five-year intervals, in order to keep up-to-date with technological changes. This translates into a ten-fold increase in waste requiring disposal.

While Internet of Things devices can serve as energy-conservation equipment, it is important to keep in mind that everyday good habits can bring the same benefits. Practical, fundamental considerations such as these are often overlooked by marketers eager to induce consumers to purchase Internet of Things items that may never have been needed in the first place.(3)

IV. TECHNICAL BACKGROUND

Through internet, the various appliances are attached to a raspberry pi module. The module is connected to the power socket with the help of the Ethernet cable. Then, by using application software, the different appliances are controlled with the help of the smart phone as shown in Fig 2. Even the intensity levels of tube lights can also be controlled using this mechanism. By varying the intensity level of the bulbs, the distribution of brightness between the bulbs can be varied easily and the power consumption can be monitored.

When sensing and actuation systems are integrated by connecting through the Internet, energy consumption as a whole can be optimised. All devices will be integrated into all forms of energy consuming devices (switches, power outlets, bulbs, televisions, etc.) and be able to communicate with the utility supply company in order to effectively balance power generation and supply. This integrating system for devices would also offer the opportunity for users to remotely control their devices, or centrally manage them via a cloud based interface, and enable advanced functions like scheduling (e.g., remotely powering on or off heating systems, controlling ovens, changing lighting conditions etc.). Thus energy saving can be achieved through IoT.

Besides home based energy management, the device is especially relevant to the Smart Grid since it provides systems to gather and act on energy and power-related information in an automated fashion with the goal to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity. Using Advanced Metering Infrastructure (AMI) devices connected to the Internet backbone, electric utilities can not only collect data from end-user connections, but also manage other distribution automation devices like transformers and reclosers.

V. HARDWARE IMPLEMENTATION

The hardware used in building of smart appliances is a raspberry pi module, internet connection and a Zigbee module as shown in fig 3. The connectivity is established by programming the raspberry pi module with the zigbee

module. Thereby, a wireless communication link is established with the help of an internet connection.

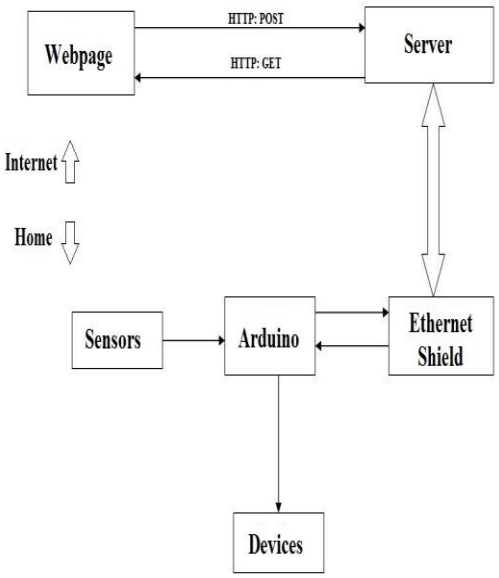

Fig 2. Block Diagram to show control of devices.

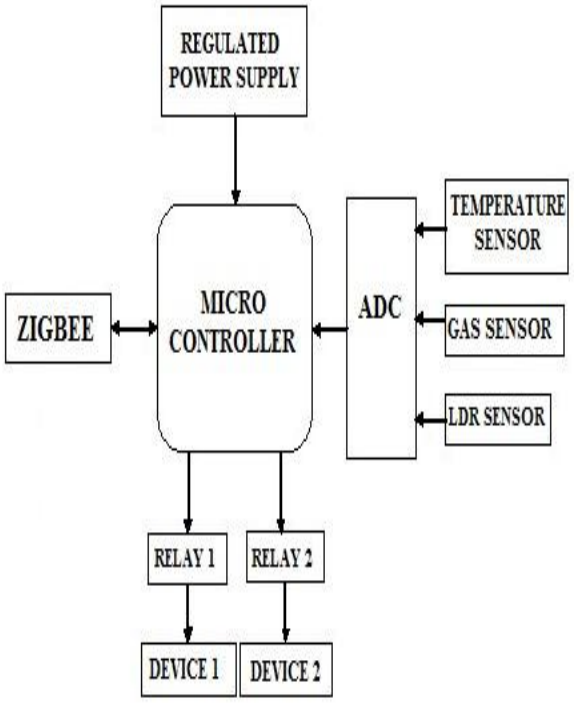

Fig 3.A reconfigurable smart sensor interface for wireless sensor network in internet of things

VI. CONCLUSION

Integrating Smart Grid and IoT gives a wider space for energy conservation. The interface of the appliances that we use in our home with the internet with the help of smart applications helps us to develop an energy conserving ecosystem as shown in Fig 4. IoT is an increasing demand from the users and has a great scope in nearby future. (2) All the pollution causing factors from appliances can be brought into control with the help of IoT by designing a Smart and Eco-Friendly Appliance. Also by having a proper architecture in the designing of buildings, it helps us to decrease the consumption of electricity and thereby energy is conserved. More research on the aspects of integrating Smart Grid and IoT will ensure an Eco-friendly environment.

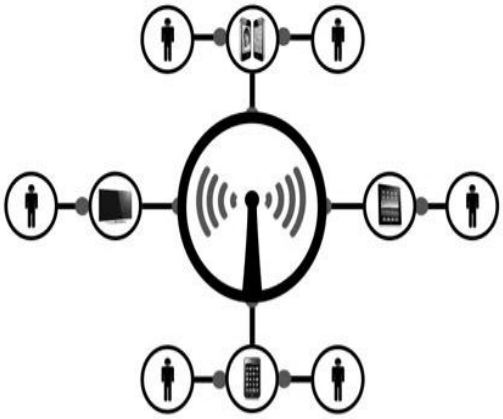

Fig 4. A interface of appliances that we use in home.

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