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IoT Based Green Building

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Abstract— *Imagine, coming to the office or home and it wakes up. This is not a futuristic dream. It's already a reality and it's called the Internet of Things. The moment you reach your desk, an occupancy sensor switches on the fan and lights only above you or close by, similarly for all other occupants, so if a seating arrangement of a IT complex has 100 occupants and 80 have reported that day the optimum amount of lights/fan/ HVAC ducts will be working that day, other areas like meeting rooms, pantry, toilets are also electrically responsive only by your presence. The moment you turn off your system or any other equipment for more than 10 minutes, standing time (coffee maker, photocopier, fax, and printer) should also automatically switch off to save standby power, considering it is always manually possible to switch them ON/OFF at any instant and a similar scenario is for residences, hotels, institutes etc. where the building responds to occupants, requirement, and a pre-fed schedule simultaneously. Whenever there is any system in action constant or periodic monitoring is required. According to the parameters monitored proper action must be taken. If such system is at remote location or congested places, it become hard to monitor and take corrective action. Now-a-days there is an open-source revolution going on, where every software and its source code is available for free and the user can modify it according to need for personal use and achieve desired comfort level.*

Keywords— *Green Building, IoT (Internet of Things), Microcontroller, Raspberry Pi, Sensors, Stepper Motor*

I. INTRODUCTION

The advancement in growing field of technology has opened new gates for innovation using internet. In other words, almost every “object” can be a part of this internetwork. With smart connectivity, physical objects are networked and will gain the ability to communicate with each other. The main aim of “The Internet of Things (IoT)” is to enhance the capabilities of objects and forms a smart environment so that people can benefit from it to make life much simpler. The IoT applications cover the building of smart cities, the set up of smart environment, the provision of smart public services, the plan of e-Health, and the building of smart home/office, etc .As the population is growing at very faster rate, the demand for resources is also increasing as result the resources on earth are depleted quickly. To solve this problem governments around the globe are taking necessary initiatives to save this depleting resources. The proposition has been promoted on campuses of educational institutions as well as cities around the world. Smart campuses or smart cities are trendy applications in the paradigm of the IoT. The concept of “Green Building” implies the proposition of systems which are environment friendly or simply installing low power consumption systems. The concept of Green Building involves use of renewable sources as energy source for household activities by installing systems like rain water harvesting, solar water heater, etc. The construction of smart building will adopt advanced Information Communication Technologies to automatically monitor and control every facility on campus. The benefits gained from building a smart building includes systems becoming more efficient and the energy consumed is minimized. Such efforts are also recognized as constructing a “Green Building”. Hence we can say green building is analogous to smart building. In this paper we have demonstrated one of the smart application leading to green building. The objective is realized by constructing the Internet of Things using sensors. This will reduce energy wastage in a building. It’s a promising future vision which is technically rigorous, creative and an innovative pursuit for making systems more efficient. Along with energy solutions it offers an opportunity to work with program, site and climate. Using small embedded systems connected to internet we can monitor and control the whole building hence leading to smart building which may also be referred as green building where there is not actually zero energy consumption but highly reduced consumption of energy.

II. IMPLEMENTATION

A. Block Diagram

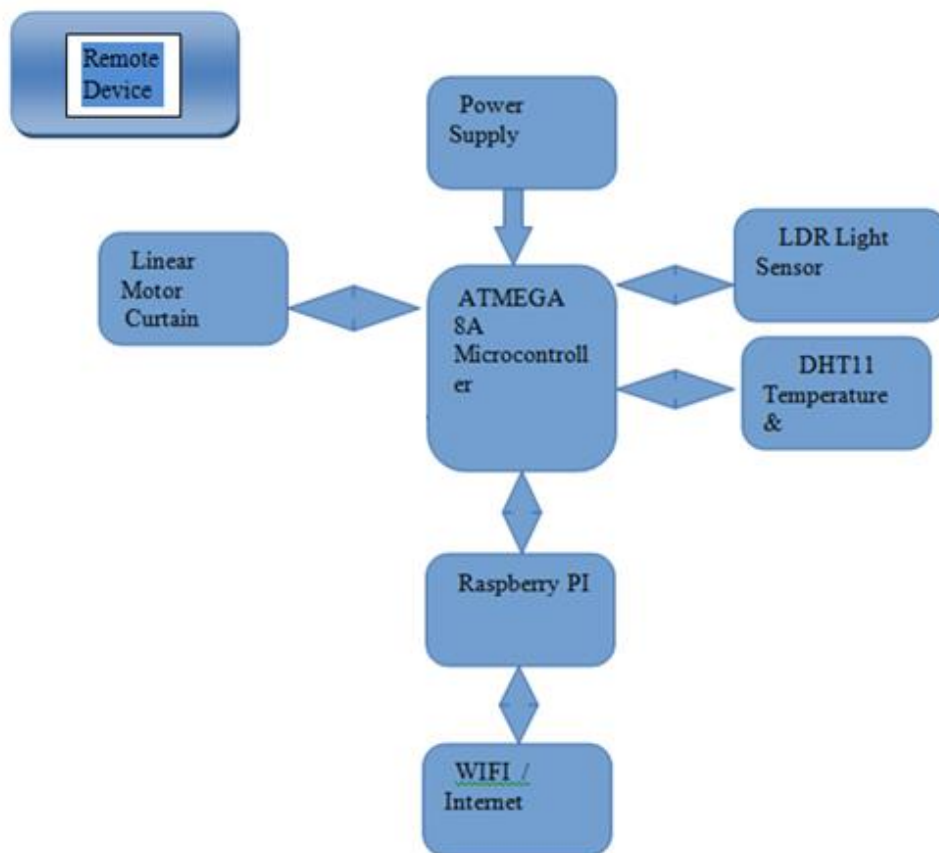


Fig. 1. Block Diagram For Iot Based Green Building

The basic block diagram of the IoT based green building is shown in the above figure. Mainly this block diagram consist of the following essential blocks.

1. Power Supply
2. Sensor circuit
3. Microcontroller ATMEGA8A
4. Shades Actuators (Stepper Motor)
5. Remote Device
6. WIFI Router
7. Raspberry PI

III. PROPOSED WORK

A. *Components*

- 1) *Power Supply*: There are varieties of voltage regulators available in market for different values of output that is required. Example: LD1117, LM2575, LM78XX, LM79XX series. In our project we will be requiring voltage regulators providing voltages of 5V and 12V for the operation.
- 2) *Sensor circuit*: This is one of the main part of project. The main intention of this block is to sense the reading and store them. For sensing the temperature and humidity we can use available temperature sensors like LM35, DHT11, etc and for light we are using LDR sensors. The readings from the sensor are fed to microcontroller and hence compared with original values and hence motor operation is controlled.
- 3) *Microcontroller*: The microcontroller is used for controlling action of the motor. Examples of microcontroller are AT89 or AT90 series, ATmega Series, AVR32 series, PIC Microcontroller series, ARM series, etc. According to the desired operation the control signal is sent to the motor. The selection of microcontroller should be based on ports required, processing speed, power consumption, cost, etc. For this project we have considered parameters like power consumption, microcontroller with ADC, USART and less number of ports, and lastly the main parameter considered is low cost.
- 4) *Shades Actuators (Motor)*: This block consists of motor that will be used to control the action of the curtains used in green building. By sensing the temperature, humidity and light intensity of the room the curtains will move back and fro. We can use different types of motors like DC Motors, BLDC, Stepper Motor, etc.
- 5) *Remote Device*: A remote device specifies which object is to be controlled or it is the device which can be controlled by connecting it to particular network or internet.
- 6) *WIFI Router*: Wi-Fi is a technology for wireless local area networking with devicebased on the IEEE 802.11 standards. A wi-fi router is a device that performs the functions of wireless access points. It is used to provide access to the internet or a private computer network. It can function in a wired LAN(Local Area Network) , in a wireless only LAN (WLAN), or in a mixed wired/wireless depending on the manufacturer and model. Example of Wi-fi router manufacturers are Apple Inc., D-Link, TP-Link, Netgear, Belkin, Motorola, etc.
- 7) *Raspberry Pi (Server Board)*: The Server board acts as mini computer. There are different server boards like Arduino, Raspberry Pi, Intel server boards, Orange Pi, etc. Here in this project we have used Raspberry Pi. It is a series of credit card-sized single-board computers developed in the United Kingdom by the Raspberry Pi. We can mount the Micro SD card and store the values obtained during monitoring of the system.



Fig. 2. Raspberry PI (Server Board)

IV. OUTPUT

Green Building IOT

The Date and time of the data on the server is : 12:44:36

The Temperature on the room is NTC sensor 30

The Temperature on the room is DHT11 sensor 27

The humidity of the Room is 17

The Intensity of the light in the room is 20 LUX

The Status of curtain 1

[Curtain Open](#)

[Curtain Close](#)

Fig. 2. Webpage for the IoT based green building

V. CONCLUSION

The construction of green building to function as a smart building has been a challenging and exciting task. It has become the need of every country around the globe so as to save energy resources. Considering this point we have implemented an automatic curtain system which will work on the values of temperature, humidity and light intensity and accordingly open or shut. This movement of curtains can be controlled manually also.

We have used the concept of Internet of Things to implement the same. We have continuously monitor the readings taken by sensors fed to microcontroller and observe the same readings on website which is created. Due to appropriate movement of curtains obtained by calculating temperature the rooms will remain cool i.e. use of air conditioners are reduced and also provide ample light monitoring the light intensity. This will reduce the energy consumption leading to concept of green building using IoT. Green Buildings or Smart Buildings covers vast topic of systems, but in this project we have implemented one of the application using embedded system which leads to green building or smart building. This system is low cost and also efficient. Hence implementation of this system will surely help in reducing the energy consumptions in homes, offices, educational institutes, etc.

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