

Smart-Home Automation Using IoT-Based Sensing and Monitoring Platform

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ABSTRACT

To comfort the living conditions within of a human his home, she can use home monitoring and automation are utilized. The standards of human's comfort in homes can be categorized into several types. Among these categories, the most significant ones are the thermal comfort, which is related to temperature and humidity, followed by the visual comfort, related to colors and light, and hygienic comfort, associated with air quality. We are proposing a system to monitoring the parameters range which will increase the comfortness of the human. Additionally, we incorporate the smart home technique which controls the home appliances by intelligent automatic execution of commands after analyzing the collected data. Automation can be accomplished by using the Internet of Things (IoT). This gives the inhabitant accesses to certain data in the house and the ability to control some parameters remotely. We propose the complete design of an IoT based sensing and monitoring system for smart home automation. That uses the EmonCMS platform for collecting and Visualizing monitored data and remote controlling of home appliances and devices. The selected platform is very flexible and user-friendly. The sensing of different variables inside the house is conducted using the NodeMCU-ESP8266 microcontroller board, which allows real-time data sensing, processing and uploading/downloading to/from the EmonCMS cloud server.

Keywords : IOT, CMS, Humidity, Air Quality, Temperature

I. INTRODUCTION

Smart Home is collaboration of technology and services through a network for better quality living. A smart home allows the entire home to be automated and therefore provide ease and convenience to everyday activities in the home. This technology is used to make all electronic devices to act 'smart'. In the near future almost all the electronic devices will take advantage of this technology through home networks and the internet. Many people think this technology as pure networking. Others think this technology will reduce their work

load, but smart home technology is combination of both and much more. Smart home technology is currently being implemented for entire house in particularly kitchen and living room. Basically, smart home facilitates users with security, comfortable living and energy management features as well as added benefits for disabled individuals.

This technology might sound new but it just uses the existing technologies. A smart device is a common appliance with a much more complex computer installed to give it more functionality. These functions are the ones which makes it so different.

Cable broadband, DSL, Bluetooth and wireless technologies provide a way to have a home networked for devices to communicate with each other as well as internet. These technologies either wired or wireless provide foundation on which smart home will operate.

II. LITERATURE SURVEY

A. Bluetooth based home automation system

Home automation systems using smartphone, Arduino board and Bluetooth technology are secured and low cost. A Bluetooth based home automation system proposed by R.Piyare and M.Tazil. The hardware architecture of this system consists of the Arduino BT board and a cell phone, the communication between Arduino BT board and cell phone is wirelessly using Bluetooth technology. The Arduino BT board has a range of 10 to 100 meters, 3 Mbps data rate and 2.4 GHz bandwidth.

B. Voice recognition based home automation

Voice recognition based home automation system proposed and implemented by a researcher. The hardware architecture of this system consists of Arduino UNO and smartphone. The wireless communication between the smartphone and the Arduino UNO is done through Bluetooth technology. Android OS has a built-in voice recognizing feature which is used to develop a smartphone application which has ability to control the home appliances from user voice command.

C. ZigBee Based Wireless Home Automation System

ZigBee based wireless home automation system has also been studied, it consists of three main modules, handheld microphone module, central controller module and appliance controller module. Handheld microphone module use ZigBee protocol and central controller module are based on PC. In this system, Microsoft speech API is used as a voice recognition application, wireless network is established using RF

ZigBee modules due to their low power and cost efficiency.

D. GSM Based Home Automation System

A smart home automation system implemented by using Global System for Mobile communication (GSM). The hardware architecture of the system consists of GSM modem, PIC16F887 microcontroller and smartphone. The system used a GSM modem to control electric appliances through SMS request. PIC16F887 microcontroller interfaced with a GSM modem and it is used to read and decode the received SMS to execute the specific command.

F. EnOcean based home automation system

The EnOcean is newly developing energy harvesting technology used in transportation, building and home automation systems. EnOcean's technology is productively in logistics as well as in the industry due to energy efficiency and easily installing device anywhere for users ease which significantly save the installation cost up to 40%. Moreover EnOcean's devices utilize 315 MHz band and it provides convenient ways for home automation system.

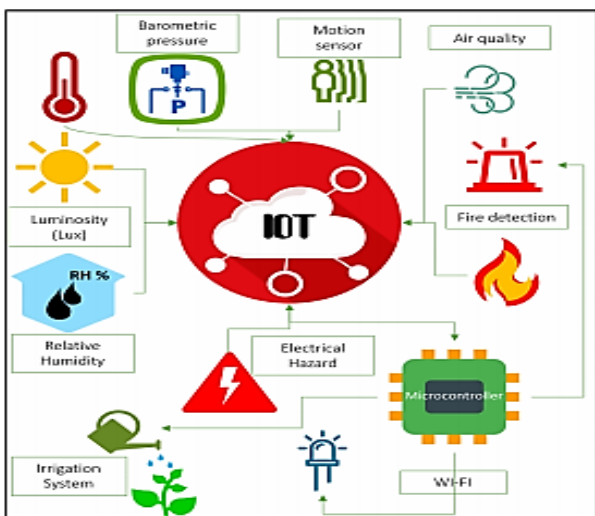
III. EXISTING PROCESS

Smart home technology has the potential of bringing benefits to modern households and their inhabitants. Yet, ever since its early development, it has been struggling to reach mass consumer adoption. Privacy and security, trust issues, reliability, and price are just some of the challenges smart home technology is facing. In addition, literature suggests that there is an evident gap between the functionalities offered by smart devices and users' needs. Investigating these potential adoption challenges in some more detail, we conducted an interview study with existing smart home technology users. Results show that privacy and security are still the most prominent hindering factors, and that the often insufficient interoperability of devices becomes an ever-growing

concern. Also, smart home devices are consistently perceived as complex and expensive, and lack perceived value and trustworthiness.

IV. PROPOSED METHODOLOGY

As mentioned earlier, the monitored parameters in homes are selected to ensure a smart, efficient and comfortable living conditions. Therefore, one hub is made to measure temperature, humidity, light intensity, proximity, and CO2 levels. This hub can be placed in each room of the house, and preferably at a high level above the ground and below the ceiling. Collected data can be processed and used to control smart devices such as smart LEDs and A/Cs. The schematics of the proposed design. It comprises mainly sensors, processor, user interface, and data communication and transmission links.



V. IMPLEMENTATION RESULTS

This section reviews the typical configuration of home automation system using an IoT platform. Illustrates such a platform which consists mainly of data sensing and acquisition, processing, transmission, and display.

A. Data Sensing and Acquisition

To ensure a good comfort level, the typically monitored parameters in houses are temperature,

humidity, luminosity, and air quality (i.e. CO2 and dust levels). Usually, the term “Big Data” is often associated with IoT and refers to the large number data collected from a large number of sensors and devices to be processed, which is the case here. In fact, depending on the number of sensors and the measurement-sampling rate, a large number of data might be generated and transmitted through the internet to the cloud server, which should be able to handle such large amount of data communication and archiving.

B. Data Transmission

Transmitting data between devices and controllers is done using one or more communication technologies. These include Bluetooth, ZigBee, Wi-fi, Ethernet or GSM. Bluetooth and ZigBee are commonly used for in-home data transmission and control and provide the link between the sensors and the central processing unit. These data communication technologies are popular because of their low power consumption, and simplicity to implement. Furthermore, IoT requires the use of either Wi-fi or Ethernet to connect to the internet. While Ethernet is by far faster than Wi-fi connection, the high data rate is not essential for home automation applications. Additionally, Wi-fi has the advantage of mobility, making it more widespread in most systems. Wi-fi technology consumes more energy than alternatives such as Bluetooth or ZigBee. The power consumption can be reduced by lowering the frequency of data uploading.

C. Data Processing (Microcontroller)

The data collected in a home automation system is usually processed and managed by a microcontroller such as Arduino, Raspberry Pi, and NodeMCU. Raspberry Pi is a small single microcontroller computer. With a higher RAM of 256MB or 512Mb, depending on the model, it can handle more complex tasks than other controllers and used mostly as a central processing unit for multiple devices. Most

new models of Raspberry Pi have USB and Ethernet ports, making it easy to upload data to the internet. On the other hand, Arduino is a single-board microcontroller that can be simply programmed to execute commands. Arduino comes in a variety of models with onboard flash memory ranging from 32kB to 512kB, and a typically a RAM of 2kB. Evidently, this controller is less powerful than the Raspberry Pi. However, most Arduino models are cheaper, easier to handle, and powerful enough to deal with home automation tasks. Another option is to use the Node MCU. It is an Arduino based microcontroller but with the addition of the ESP8266 Wi-Fi chipset. This microcontroller has a memory of 128kB and 4MB storage. It is mostly used for a single IoT application, or to eliminate the need for a central processing unit. Since each part of the system can upload data to the server individually, this also lowers the complexity of the coding and the connection chain. The biggest advantage of the Node MCU over the other alternatives is the significantly low price for a controller that can connect to the internet directly using Wi-fi, without the need for any additional peripherals or modules. An issue is that the Node MCU board has only one analog input, which limits its applications to as single data monitoring system. However, this drawback can be compensated for by using the ASD115, which is an analog to digital converter that has four analog input pins and has a higher conversion resolution of 16-bits.

D. Data Display & User Interface

The interaction between the user and the system can be done in several ways. One option is to use an application. There are many simple means to create a mobile or a web based app to display data, even with a limited knowledge of programming. Another control option is through mobile GSM where the user can send commands in codes by SMS to the microcontroller. This control method requires a special GSM module added to the circuit. This method can also be applied using emails.

VI. CONCLUSION

The proposed design of the smart solar home is very flexible and can be easily expanded and applied to larger buildings by increasing the number of sensors, measured parameters, and control devices. More functionality and smartness could be also added to the existing system for making the house automation system grow, adapt, and evolve by itself using advanced artificial intelligence.

VII. FUTURE ENHANCEMENT

There are a variety of enhancements that could be made to this system to achieve greater accuracy in sensing and detection.

- a) There are a lot of other sensors that can be used to increase the security and control of the home like pressure sensor that can be put outside the home to detect that someone will enter the home.
- b) Changing the way of the automated notifications by using the GSM module to make this system more professional.
- c) A smart garage that can measure the length of the car and choose which block to put the car into it and it will navigate the car through the garage to make the parking easy for the homeowner in his garage.

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Cite this article as :

R. Sugantha Lakshmi, P. Karthika, A. Rajalakshmi, M. Sathya, "Smart-Home Automation Using IoT-Based Sensing and Monitoring Platform", International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), ISSN : 2456-3307, Volume 5 Issue 1, pp. 409-413, January-February 2019. Available at doi : <https://doi.org/10.32628/CSEIT195190>
Journal URL : <http://ijsrcseit.com/CSEIT195190>