Smart Home Automation System: Design and Implementation

Introduction

Smart home:

A smart home or building is a home or building, usually a new one that is equipped with special structured wiring to enable occupants to remotely control or program an array of automated home electronic devices by entering a single command. For example, a homeowner on vacation can use a Touchtone phone to arm a home security system, control temperature gauges, switch appliances on or off, control lighting, program a home theatre or entertainment system, and perform many other tasks.

Fig.1.1 smart home system

A home equipped with lighting, heating, and electronic devices which will be controlled remotely by smartphone or pc

Smart house is a term that refers to trendy homes that have appliances, lighting and/or electronic devices which will be controlled remotely by the owner, typically via a mobile app. good home-enabled devices also can operate in conjunction with different devices within the home and communicate data to different good devices.

Smart home-enabled devices will embody appliances like refrigerators, laundry machines, dryers, and toaster ovens, furthermore as heating and air-con units and lighting devices. Some samples of good home-enabled electronic devices square measure audio and video recreation systems, camera and security systems, and computers, laptops and different physical science mobile devices.

From the past few years, the house is provided with totally different equipment which will ready to give many facilities for the human life. The house automation plays a very important role in our day-after-day life. By mistreatment this home automation system, the house equipment’s like blower, bulb then several are often controlled by causation the signal. The technologies which will be utilized in the house automation are often simply accessible to several people. There’ll be numerous factors which will be concerned by mistreatment this home automation system. These factors are often given as follows

- The motion sensors that square measure used will ready to work with the protection systems and might be used for movement detection.
- The video police work instrumentation is often used for observance the specified sources that square measure required.
- The thermostat within the home automation can give to regulate the nice and cozy or cold that's needed.

Nowadays house is outfitted with totally different equipment and hardware’s, which provides

such a lot of facilities and opportunities to human life. Most used equipment's reception square measure electrical lightweight, blower, cooling and icebox. These square measure to be controlled by folks. But this could not be management led by all the time as a result of operator might not be a reception and if any necessity involves control this house hold appliances there ought to be alternate supply to regulate and monitor this instrumentation.

Fig.1.2 smart home controlled room

'Smart Home' is the term commonly used to define a residence that has appliances, lighting, heating, air conditioning, TVs, computers, entertainment audio & video systems, security, and camera systems that are capable of communicating with one another and can be controlled remotely by a time schedule, from any room in the home, as well as remotely from any location in the world by phone or internet.

Literature Review

- Author: Kumar mandula
- Title: "Mobile based home automation system using IoT'
- Published: 2015 International Conference on Control, instrumentation,
- Communication and Computational Technologies (lCCICCT)

Review:

Smart homes can be used for remotely monitoring and controlling electrical appliances fitted inside the home using smart & intelligent physical infrastructure. The present Government of India (GoI) has proposed to develop l00 smart cities across the country which will create a huge demand for smart home automation solutions in near future. In 'smart home' the word 'smart' means context aware which can be realized using Information and Communication Technology (ICT) and IoT.

Conclusion:

A prototype smart home automation using IoT is presented. This research work will be carried forward by integrating relays to Arduino board for controlling home appliances from a remote location in a real scenario. As an extension, authors propose a generic IoT framework and use cloud computing infrastructure for connecting and managing remote devices and also store sensor data. Authors plan to productize proposed home automation solution so that more number of people can use IoT in a smart environment.

- Author: Shiu Kumar
- Title: "Android based smart home system with control via Bluetooth and internet connectivity"

Review:

The Android based smart home app was designed using the Massachusetts Institute of Technology App Inventor that was originally provided by Google. The home screen and the main controls screen are shown in Fig. 2. Upon starting the smart home app, the user is given

the option to select Bluetooth or internet connectivity for connecting to the smart home micro web server. For internet connectivity, the user has to enter the IP address and a password whereas for Bluetooth connection selecting the device and entering a password is required. Access is only granted if the requested details are correct upon which the GUI statuses on the main controls page are updated to reflect the current statuses and the user can than perform the desired action using the GUI. However, if the entered details are incorrect or there is a connection problem appropriate messages are displayed on the user GUI of the app.

Conclusion:

The proposed smart home system and the smart home app has been successfully developed and tested. Devices such as light switches, temperature sensors, gas sensors, motion detection sensors and alarms have been integrated in the system to demonstrate its feasibility and effectiveness. Features such as low cost, user authentication, voice activation, security and surveillance, and automatic control make the proposed system unique.

- Author: Boris petelj
- Title: “Web based solution for smart home functionality extension and control'
- Published: 2015 IEEE 5th International Conference on Consumer Electronics Berlin (ICCE-Berlin)

Review:

Application corresponds to a software module used as additional logic to home automation system. Each application requires only necessary system resources based on its purpose and demands, hence division of system functionalities to separate modules was necessary. This encapsulation resulted in emergence of so called system packages - an interface through which applications interact with system resources like database, cloud connection or smart devices control. On the other hand, by demands regarding user management and customization of system, basic home automation features are partitioned into removable modules. These ideas, along with requirements of being lightweight, removable, accessible from any existing personal device and developed with standard technologies, make the concept of applications for home automation system. Application module consists of three major parts called back-end, front-end and manifest file, packed in one archive that can be installed or removed from the system. Applications are designed in client/server software architecture, where server part is within gateway device, and client part rests on controller device. Each application has connection to its dedicated back-end; however, the existence of single, transparent, supervisor software must be satisfied for the sake of applications security, resource management.

Conclusion:

With Admin application, we showed just some of solution capabilities, which already overcame constraints of existing home automation systems. Configuration and control of home automation system through developed extension is possible independent from OS platform of controller device, and was implemented with widely accepted technologies. Using only basic Web developing techniques it is possible to develop an extension for home automation system. Considering this, we give opportunity to developers of all experience levels to anticipate in its expansion. Users can enjoy these applications on all devices that supports Web browser, which

is also widely supported. These were the main limitations of systems that support some sort of user manageable extensions. Future work will cover designing of advanced applications, such as: location based device control, scenarios management and power consumption insight, as well as realization of template application for other developers, which will reduce necessary time for development and ensure quality of new applications.

Theoretical analysis

1. GSM Based Home Automation System

The system provides 3 means to control the home: the GSM network, the Internet and through speech. The real time monitoring has been an important feature that can be used in the home automation systems. As a change in the status of the devices occurs, the user can be informed in real time. The user commands are transferred to a server which is usually done by a PC.

Fig.3.1 sms based automation system

2. Bluetooth Based Home Automation:

The system makes use of a cell phone and bluetooth technology is secured and low cost. It makes use of an arduino bluetooth board. An interactive python program is used in the cell phone to provide the user interface. The i/o ports of the bluetooth board and relays are used for interfacing with the devices which are to be controlled. The bluetooth is password protected to ensure that the system is secure and not misused by any intruders. The bluetooth has a range of 10 to 100.

Fig.3.2 Bluetooth based system

3. Phone Based Home Automation:

Some systems are described as an enabling system that can be used to provide a common framework for home Automation. It provides a system for a smart home that includes facilities such as a system controller, house- wide wiring and a common interface. This will enable using the existing system for home automation. A hardware based remote controller for power point control has been described. The function of this remote controller is to control the power supplied to devices at a remote location. The system uses the telephone line for transmitting the commands. The controller is a logic system built entirely of hardware. It eliminates the cost incurred with microcontrollers. It uses a DTMF transceiver which is interfaced with a solid state relay to control the power supply. It could also be implemented experimentally with infra-red signals and AC power line carrier technology.

Fig.3.3. Phone based system

4. ZigBee Based Home Automation:

The ZigBee wireless communication technology can be applied for home automation. The system uses PIC microcontroller and voice recognition for this purpose. The voice commands are taken from a mike. They are compared with a voice store and processed. The PIC

microcontroller then transmits the commands through ZigBee to the receiver. The receiver unit has another PIC microcontroller that can process the command. It uses relays to control the respective appliances. This system has the drawback that ZigBee is a low range communication medium. So remote access is hindered from faraway locations. Also, the voice recognition module could become unwieldy. This system has the added feature of integrating a smoke detector to the system. When smoke is sensed, it sends a message to the user’s built-in mobile number.

5. Remote Control Based Home Automation :(Ir Radiation)

Fig.3.4 Remote controlled system

6. Wi-Fi Based Home Automation:

Fig.3.5

Wi-Fi-based automation system

Implementation of software:

1. NODE MCU:

Node MCU is an eLua based firmware for the ESP8266 Wi-Fi SOC from Espressif. The Node MCU firmware is a companion project to the popular Node MCU dev kits, ready-made open source development boards with ESP8266-12E chips.

Fig.4.1. Node MCU

Node MCU is an open source IoT platform. It incorporates firmware which keeps running on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which depends on the ESP-12 module. The expression 'Node MCU' as a matter of course alludes to the firmware as opposed to the dev packs. The firmware utilizes the Lua scripting dialect. It depends on the eLua extend, and based on the Espressif Non-OS SDK for ESP8266. It utilizes many open source tasks, for example, lua-cjson, and spiffs.

PIN DIAGRAM:

Fig.4.2. Node MCU pin diagram

2. LED:

A light-emanating diode (LED) is a semiconductor gadget that transmits obvious light when an electric current goes through it. The light is not especially splendid, but rather in many LEDs it is monochromatic, happening at a solitary wavelength. The yield from a LED can go from red (at a wavelength of around 700 nanometers) to blue-violet (around 400 nanometers). A few LEDs emanate infrared (IR) vitality (830 nanometers or more); such a gadget is known as an infrared-discharging diode (IRED).

A LED or IRED comprises of two components of prepared material called P-sort semiconductors and N-sort semiconductors. These two components are set in direct contact, framing an area called the P-N intersection. In this regard, the LED or IRED takes after most other diode sorts, however there are essential contrasts. The LED or IRED has a straightforward bundle, permitting unmistakable or IR vitality to go through. Additionally, the LED or IRED has an extensive PN-intersection zone whose shape is custom fitted to the application.

Advantages of LEDs and IREDs, contrasted and brilliant and fluorescent lighting up gadgets, include:

Fig.4.3. Led

Low power prerequisite: Most sorts can be worked with battery control supplies.

High productivity: Most of the power provided to a LED or IRED is changed over into radiation in the sought shape, with negligible warmth generation.

Long life: When appropriately introduced, a LED or IRED can work for quite a long time average applications include.

Marker lights: These can be two-state (i.e., on/off), visual chart, or alphabetic-numeric readouts.

LCD board backdrop illumination: Specialized white LEDs are utilized as a part of level board PC shows.

Fiber optic information transmission: Ease of balance permits wide interchanges transfer speed with insignificant commotion, bringing about rapid and precision.

Remote control: Most home-amusement 'remotes' utilize IREDs to transmit information to the fundamental unit.

3. Block diagram

Fig.4.4. Block diagram of the project

Conclusion

The main objective of our project is to control the home appliances with smartphone and web pages. In our project we have done it with Node MCU with aurdino software. smart home automation using IoT is presented. This work will be carried forward by integrating relays to Node MCU board for controlling home appliances from smart phone in a real scenario. The process of operating or controlling the various electronic home appliances using mobile device, which we are connected through the URL. This method of operating or controlling such applications is referred to a automation which has become an integral part of everyday life for human beings. The main working model we designed focus on home automation providing 100% efficiency. IOT platform allows the devices to synchronize with the IOT and it can be controlled by hand devices. The platform uses the IOT technology to create a network between the main server and the other electrical and electronic appliances making home smarter place

to live in. The whole network consists of a single admin which makes our model a secure one as the admin only have the authority to access all the nodes present under each user.

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