International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 04 | Apr 2020 www.irjet.net p-ISSN: 2395-0072

Advanced Internet & Bluetooth based Home Automation using Arduino Microcontroller

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Abstract:-This paper presents a low cost flexible and reliable home automation system with additional security using Arduino microcontroller, with IP connectivity through local Wi-Fi for accessing and controlling devices by authorized user remotely using Smart phone application. The proposed system is server independent and uses Internet of things to control human desired appliances starting from industrial machine to consumer goods. The user can also use different devices for controlling by the help of web-browser, smart phone or IR remote module. To demonstrate the effectiveness and feasibility of this system, in this paper we present a home automation system using Arduino UNO microcontroller and esp8266-01 as a connectivity module. It helps the user to control various appliances such as light, fan, TV and can take decision based on the feedback of sensors remotely. We have tested our system through conducted experiment on various environmental conditions.

Key Words and Phrases: Arduino Uno Controller; Internet of things (Iot);

Esp8266-01; Wi-Fi network; Home automation system.

Introduction

Internet has become an important part of human's social life and educational life without which they are just helpless. The Internet of things (Iot) devices not only controls but also monitors the electronic, electrical and various mechanical systems which are used in various types of infrastructures. These devices which are connected to the cloud server are controlled by a single user (also known as admin) which are again transmitted or notified to all the authorized user connected to that network[2-5]. Various electronics and electrical devices are connected and controlled remotel through different network infrastructures. Web browser present in laptop or smart phone or any other smart technique through which we can operate switches, simply removes the hassle of manually operating a switch. Now a day's although smart switches are available they proves to be very costly, also for their working we required additional devices such as hub or switch. As there is rapid change in wireless technology several connectivity devices are available in the market which solves the purpose of communicating medium with the device and the micro-controller. Starting from Bluetooth to Wi-Fi, from ZigBee to Z-wave and NFC all solve the purpose of communicating medium. RF and ZigBee are used to used in most wireless networks .In this project we have taken ESP8266-01 Wi-Fi module which is programmed through Arduino UNO to control various device At the end the paper concludes by looking at the future research and recommendations which are required to make the system more effective.

Literature Review

History of Home Automation:

If you think home automation is a new invention, you're only partly right. Science fiction that has fixated on smart home technology (remember Rosie from The Jet sons?) since, well, the beginning of science fiction – but it's not just that. For centuries, the world's greatest minds and most innovative inventors have been working toward technology that can almost think for itself. Here are a few highlights:1785:Less than a decade after the U.S. declared independence from England, Nikola Tesla invented the first remote control (to remotely control a boat).Early 1900s: Fast-forward a few centuries, and the Industrial Revolution has paved the way for the invention of the first home appliances. Granted, they weren't smart but they were absolute game-changers for early 20th century.1930s: By the 1930s, inventors had already turned their imagination to home automation. Although the technology was still many decades off, the World's Fair introduced the concept of automated home and smart appliances. Spectators were, unsurprisingly, fascinated with the idea.1950: Jack Kilby and Robert Noyce invent the computer chip – the building block for today's smart home technology.

1951: UNIVAC I, the world's first commercially available computer, is introduced to market. Consider UNIVAC I the great-great-great-great granddaddy of today's smart controls, which are all, essentially, mini computers.1964: The Uniscope 300, one of the first computer monitors, hits shelves. And what would computers, smart hubs, and smart device controls today be without digital

displays? 1966: Though never commercially sold, ECHO IV was the world's first homeautomation system. Invented by Jim Sutherland, the "Electronic Computing Home Operator" (hence, ECHO) could store recipes, relay messages, control a home's temperature, churn out a grocery list, and turn appliances on or off.

1969: DARPA introduces ARPAnet, the world's first network – the precursor to the modern Internet and with it, all our Internet of Things (IoT) smart technologies.1981:A precursor to today's wireless (802.11) technology is invented.

1980s: Home automation becomes commonplace, in the form of garage doors, home security systems, motion-sensing lights, fiber optics, thermostat controls, and other technology.

1991: Ad van Berlo pioneers the field of geron technology – technology to improve the lives of senior citizens and the infirm. (Remember the 90s-era commercials, "Help! I've fallen and I can't get up!"?) These early technologies form a firm base for the smart, life-enhancing features we love about today's smart systems.

1998-2000s: Smart homes became a thing. Throughout the late 1990s and early 2000s, smart technologies emerged, with gadgets and devices becoming more common and more affordable.

2.2) **Survey for Home Automation:**

Arduino UNO

The UNO proves to be Arduino's flagship board for beginner and also for advancedbusers. The system needs a micro-controller to process data and connects different modules for control. This purpose was solved by Arduino Uno which has ATMEGA328p processor. It has 6 analog input pins and 14 digital input/output pins[. It can operate with either 5V from USB plug or 12V from external power supply. In Arduino Uno pin 1 and 0 are used as default transmission and receiving pin

2.2.1 **Bluetooth based:**

Home automation system using cell phones: In Bluetooth based home automation system the home appliances are connected to the Arduino BT board at input output ports using relay. The program of Arduino BT board is based on high level interactive C language of microcontrollers; the connection is made via Bluetooth. The password protection is provided so only authorized user is allowed to access the appliances.

2.2.2. **Zig Bee**

Based home automation system using cell phones: To monitor and control the home appliances the system is designed and implemented using Zig bee. The device performance is record and store by network coordinators. For this the Wi-Fi network isused, which uses the four switch port standard wireless ADSL modern router. The network SSID and security Wi-Fi parameter are preconfigured. The message for security purpose first process by the virtual home algorithm and when it is declared safe it is re-encrypted and forward to the real network device of the home. Over Zig Bee network, Zig Bee controller sent messages to the end. The safety and security of all messages that are received by the virtual home algorithm. To reduce the expense of the system and the intrusiveness of respective installation of the system Zig Bee communication is helpful.

2.2.3) **Wi-Fi based**

Home automation system using cell phones: Wi-Fi based home automation system mainly consist three modules, the server, the hardware interface module, and the software package. The figure shows the system model layout. Wi-Fi technology is used by server, and hardware Interface module to communicate with each other. The same technology uses to login to the server web based application. The server is connected to the internet, so remote users can access server web based application through the internet using compatible web browser. Software of the latest home automation system is split to server application software, and Microcontroller (Arduino) firmware. The Arduino software, built using C language, using IDE comes with the microcontroller itself. Arduino software is culpable for

gathering events from connected sensors, then applies action to actuators and preprogramed in the server. Another job is to report the and record the history in the server DB. The server application software package for the proposed home automation system, is a web based application built using asp.net. The server application software can be accessed from internal network or from internet if the server has real IP on the internet using any internet navigator supports asp.net technology. Server application software is culpable of, maintain the whole home automation system, setup and configuration. Server use database to keep log of home automation system components, we choose to use XML files to save system log

8-Channel Relay

8-Channel relay is connected to the Arduino Uno and its output is connected to the home appliances in a sequence as (i) fan (ii) light (iii) room-heater and (iv) TV set. Relay takes low current and voltage and triggers the switch which is connected to a high voltage. 8 input pins of relay are connected to Arduino which takes5V supply from it and can trigger up to 10A, 250V supply

2.2.4) **GSM based**

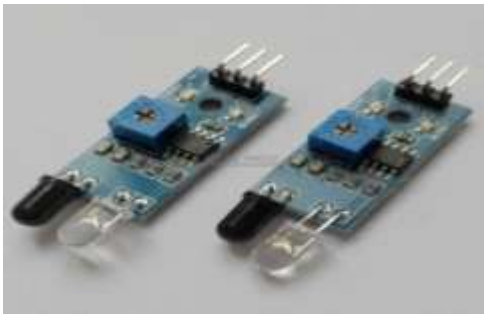
Home automation system using cell phones: Because of the mobile phone and GSM technology, the GSM based home automation is lure to research. The SMS based home automation, GPRS based home automation and dual tone multi frequency (DTMF) based home automation, these options we considered mainly for communication in GSM

Home automation using RF module:

The important goal of Home Automation System is to build a home automation system using a RF controlled remote. Now technology is accelerating so homes are also getting smarter. Modern homes are deliberately relocating from current l switches to centralized control system, containing RF controlled switches. Today traditional wall switches situated in various parts of the home makes it laborious t for the end user to go near them to control and operate. Even further it turns into more problematic for the old persons or physically handicapped people to do so. Home Automation using remote implements an easier solution with RF technology.

Infrared sensor

Infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED Light Emitting Diode and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED.



Gas sensors

Gas sensors use a small heater inside with an electro-chemical **sensor**. They are sensitive for a range of gasses and are used indoors at room temperature. The output is an analog signal and can be read with an analog input of the **Arduino**.

The output is an analog signal and can be read with an analog input of the **Arduino**. The MQ-2 **Gas Sensor** module is useful for **gas** leakage detecting in home and industry. It can detect LPG, i-butane, propane, methane, alcohol, hydrogen and smoke.

Home automation using Android ADK:

The devices of home are associate to the ADK and the Connection is established between the Android device and ADK. The devices of house are link to the input/output ports of the board (EMBEDDED SYSTEM) and their current situation will have passed to the ADK.

FUTURE WORK

The aim of this research was to design and perform a smart home automation system by remotely controlling and monitoring electronic devices in the house and monitoring of the temperature degree & Humidity percentage, gas leakage, fires, and rain; also Automation light by using motion and light sensors inside and outside the home by using internet of things. This work used an internet network due to its low cost and coverage of a large zone. It is applied to send information to the system to control devices and receive statuses of the appliances. The target has been carried out successfully. These devices are controlled by the web browser via the internet. As a result, the system can monitor and controlled from the web browser. Moreover, the gas, flame, light, temperature & Humidity and rain sensors work correctly with excellent results. This system also uses power saving using motion, light sensor to switch on and off lights in the room and outside. An A significant advantage of this system is that control every device via the web browser and Android application anywhere and anytime. Finally, the developed system offers a flexible, economical and remotely controllable smart home automation system. The Internet has changed drastically the way we live, moving interactions

between people at a virtual level in several contexts spanning from the professional life to social relationships. The IOT has the potential to add a new dimension to this process by enabling communications with smart objects, thus leading to the vision of ‘‘anytime, anywhere, any media, anything” communications. To this purpose, we observe that the Internet of Things should be considered as part of the overall Internet of the future, which is likely to be vividly different from the Internet we use today.

CONCLUSION:-

The home automation system has been experimentally proven to work satisfactorily by connecting sample appliances to it and the appliances were successfully controlled from a wireless mobile device. ... Thus a low-cost home automation system was successfully designed, implemented and tested.

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