Arduino Uno based Wireless Home Appliance Status Intimation Control and System

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Abstract - *This paper presents a cloud based low cost home automation system implemented using NodeMCU and Arduino Uno. The remote monitoring aspect of this project demonstrates the ability of being able to know what is going on with different systems at home which can be used for control and safety. We can monitor the temperature for ambient control, the state of some sensors for intruder detection and the state of different devices like fans or lights at home. It is also demonstrated using some appliances, how one can control different systems at home using the cloud service via the Internet. So a virtual "switch" available in the cloud UI can be toggled to turn on/off fan and light. This project has a very large scope and can be integrated with many other systems like smart electronic appliances at home. This paper describes the project implementing the basic framework to achieve such a connected home. It gives a summary of hardware and software in the current implementation of the project, future improvements and scope.*

Key Words: IoT, Arduino Uno, Cloud networking, Wi-Fi network

1. INTRODUCTION

In the present day, security systems play an important role in the protection of lives and investment. This is achieved by the incorporation of various subsystems into the security system with a single control unit such as surveillance, intruder control, access control, fire detection, etc. A smart home is one that is equipped with lighting, heating, and electronic devices that can be controlled remotely by smartphone or via the internet. An internet based home automation system focuses on controlling home electronic devices whether you are inside or outside your home. Home automation gives an individual the ability to remotely or automatically control things around the home. A home appliance is a device or instrument designed to perform a specific function, especially an electrical device, such as a refrigerator, for household use. The words appliance and devices are used interchangeably.

1.1 Advantages of Home automation systems

In recent years, wireless systems like Wi-Fi have become more and more common in home networking. Also in home and building automation systems, the use of wireless technologies gives several advantages that could not be achieved using a wired network only.

1) Reduced installation costs: First and foremost, installation costs are significantly reduced since no cabling is necessary. Wired solutions require cabling, where material as well as the professional laying of cables (e.g. into walls) is expensive.

2) System scalability and easy extension: Deploying a wireless network is especially advantageous when, due to new or changed requirements, extension of the network is necessary. In contrast to wired installations, in which cabling extension is tedious. This makes wireless installations a seminal investment.

3) Aesthetical benefits: Apart from covering a larger area, this attribute helps to full aesthetical requirements as well. Examples include representative buildings with all-glass architecture and historical buildings where design or conservatory reasons do not allow laying of cables.

4) Integration of mobile devices: With wireless networks, associating mobile devices such as PDAs and Smart phones with the automation system becomes possible everywhere and at any time, as a device's exact physical location is no longer crucial for a connection (as long as the device is in reach of the network). For all these reasons, wireless technology is not only an attractive choice in renovation and refurbishment, but also for new installations.

2. RELATED WORK

Vinay sagar K N (2016) et al 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.

Pooja N.Pawar (2018) et al designed a people prefer more of automatic systems rather than manual systems. With the influence of Internet in people's life lots of new technologies are coming up. One of the latest, emerging and trending technologies is the 'Internet of Things'. This technology is expected to rule the world within a few years. Home Automation System uses the technology of Internet of Things for monitoring and controlling of the electrical and electronic appliances at home from any remote location by simply using a Smartphone. Implementation of a low cost, flexible home automation system is presented. It enhances the use of wireless communication which provides the user with remote control of various electronic and electrical appliances.

Shweta Singh (2017) et al proposed Home automation with the proliferation of IoT is becoming a reality now, and a variety of players like, Apple, Amazon, Google, Samsung, are all converging into this space to provide the platform and solutions for smart homes. In Light of this, present study addresses IoT concepts through systematic review of scholarly research papers, corporate white papers, professional discussions with experts and online databases. The main objective of this paper is to provide an overview of Internet of Things, architectures, and vital technologies and their usages in our daily life.

K.Saiteja (2017) et al develops a system that will provide remote control of home appliances and also provide security against the mishaps when the host is not at home. This paper is mainly concerned with the automatic control of light or any other home appliances using internet. It is meant to save the electric power and human energy. This application is made with the help of internet of things and raspberry pi. The various appliances connected to the raspberry pi is using wireless network.

Dhakad Kunal (2016) et al presented a Smart Building not only refers to reduce human efforts but also energy efficiency and time saving. In this ASP.NET is used in which appliances are connected to sensors and sensors give status of appliances to the web. Here electric appliances are operated by the website. The main objective of home automation and security is to help handicapped and aged people that will enable them to control home appliances and alert them in critical situations.

Dr. A. Amudha (2017) et al aim of this project is the home automation with full security and controlling the home appliances using wireless communication as Wi-Fi. We design this smart home system with the implementation of related software and hardware. To assure security the PIR and vibration sensors are used to detect the motion and vibration to prevent from theft. It alerts the people by buzzer and starts to record it through HD spy camera. The temperature and humidity of the each room is monitored and maintained at room temperature using temperature and humidity sensors which activates the exhaust fan to maintain the temperature. The water level sensor is used to fill the overhead water tank without wasting the water.

Priyanka Zambare (2018) et al designed an IoT has nowadays become an emerging and trending technology. It is a system of physical things embedded with sensors, software, electronics and connectivity to allow it to perform better by exchanging information with other connected devices, the operator or the manufacturer. Home automation based on IoT allows users to accessing and controlling of various home applications remotely using smart phones. It is mainly useful for physically disabled people and also to provide security to our house. It improves the standard and quality of people's living. And also make our home and life safer.

Abdul Aziz Md (2017) et al focuses specifically to design a voice controlled home automation system which makes operating electrical appliances in home through android application and set up the controlling actions in the mobile. The Bluetooth technology devices are used for home automation in a cost effective manner. The Internet of Things is emerging technology as the third wave in the development of the internet. Internet of Things (IoT) is expected to have massive impact on consumer products, business, wider culture, but these are still early days. It has potential for very wide applicability to almost all verticals and aspects of business, industries, manufacturing, consumer goods, supply chains, etc. IoT as a whole is very broad area.

Mamata Khatu (2015) et al suggested a people prefer more of automatic systems rather than manual systems. With the influence of Internet in people's life lots of new technologies are coming up. One of the latest, emerging and trending technologies is the 'Internet of Things'. This technology is expected to rule the world within a few years. Home Automation System uses the technology of Internet of Things for monitoring and controlling of the electrical and electronic appliances at home from any remote location by simply using a Smartphone. Implementation of a low cost, flexible home automation system is presented. It enhances the use of wireless communication which provides the user with remote control of various electronic and electrical appliances.

B.P Kulkarni (2017) et al proposes the design of Inter of Things (IoT) based home automation system using Raspberry pi. Currently in day today's life we can hardly find a house without a home automation system. This project is intended to construct a home automation system that uses any mobile device to control the home appliances. This home automation system is based on IoT. Home automation is very exciting field when it uses new technologies like Internet of Things (IoT). Raspberry pi is credit card size computer. Raspberry pi supports large number of peripherals. Raspberry pi is having different communication media like Ethernet port, HDMI port, USB port, Display Serial Interface, Camera Serial Interface, Bluetooth, Bluetooth low energy. It allows to control number of home appliances simultaneously. Here local server is created on Raspberry pi.
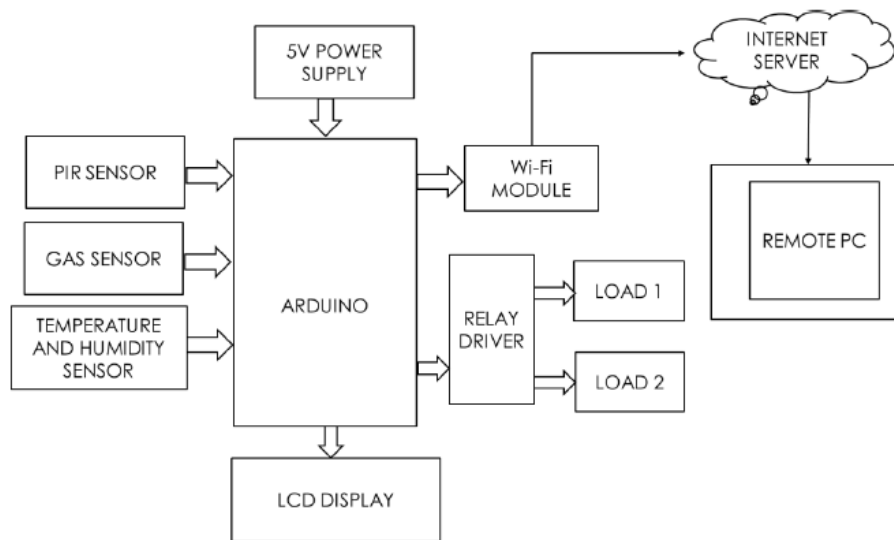
Fig -1: Home Automation Systems

3. SYSTEM ANALYSIS

The proposed system is a distributed home automation system, consists of server, sensors. Server controls and monitors the various sensors, and can be easily configured to handle more hardware interface module (sensors). The Intel Galileo development board, with built in Wi-Fi card port to which the card is inserted, acts as web server. Automation System can be accessed from the web browser of any local PC in the same LAN using server IP, or remotely from any PC or mobile handheld device connected to the internet with appropriate web browser through server real IP (internet IP). Wi-Fi technology is selected to be the network infrastructure that connects server and the sensors. Wi-Fi is chosen to improve system security (by using secure Wi-Fi connection), and to increase system mobility and scalability.

3.1 SYSTEM DESIGN

The system design is broken down into two main categories,

3.1.1 The hardware

It has the capability to connect to the router. It would also be able to turn on/off specified devices, such as lights and fans. It is called the 'Control Unit'. The UNO proves to be Arduino's flagship board for beginner and also for advanced users. 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. Arduino Uno, 2-Channel relay module is connected to the Arduino Uno and its output is connected to the home appliances in a sequence as (i) fan (ii) light. Relay takes low current and voltage and triggers the switch which is connected to a high voltage. 4 input pins of relay are connected to Arduino which takes 5V supply from it and can trigger up to 10A, 250V supply. The ESP8266-01 is a highly compact board, used as a peripheral for any board through serial (RX/TX) and also as a standalone board. The board requires 3.3 V and can be programmed with any FTDI operating at 3.3 V. The pins include power (+3.3 V and GROUND), RX / TX, CH_PD to enable the chip and 2 General Purpose Input Output (GPIO). Wi-Fi(wireless fidelity) is a wireless communication technology which is used here to provide a hotspot through which ESP8266-01 module can connect. The router will assign a unique IP address to the module for establishing a connection between web page and ESP8266-01. Gas sensor module detects various types of gas in an area. Here the change in value of resistance is used to calculate the gas concentration. Gases like Methane, Propane, I butane, Alcohol, Smoke, LPG and also hydrogen can be detected using this module. There are 2 output pins (digital one and analog one). Temperature Sensor It can measure temperature as well as humidity present in a room. Its range is less than 20 meters. It has a negative temperature coefficient (NTC) element and a humidity-sensitive element which is used to measure temperature between 0 - 50 degree Celsius.

3.1.2 The Software

Any web browsers can be used as a software tool to provide signals to the ESP8266 Wi-Fi module. Arduino IDE is used to develop coding for the modules. The Control Unit comprises of the microcontroller NodeMCU and the 2 Channel Relay board.

Relay board uses ULN 2803 IC to control the relays. The IoT web page communicates via NodeMCU to control the appliances , the values sensors get will be feedback to the web page via NodeMCU . The hardware also called the Control Unit comprises of the NodeMCU microcontroller and the Relay board. NodeMCU's digital output pins are connected to the Relay pins of the Relay board. Finally, each Relay is connected to an appliance. In the above the first relay is connected to a bulb, the second relay is connected to a fan.

3.1.3 Arduino code developed window

The following image shows the Arduino IDE with the coding we developed for this Smart home automation using IOT project.

Fig -2: Project code window

3.1.4 IOT web page

The following image shows the IoT web page we developed using Adafruit.io web page that was developed for project development purposes. We included 2 switches one for light and another one for fan , some 3 gauge meters for displaying the levels of temperature, humidity, and PPM of the home. using the feed comments in the coding we developed we received the corresponding values from the sensors we used like DHT11 ,Gas sensor. And an indicator is being included by us to indicate the invasion of intruders by using PIR sensor.
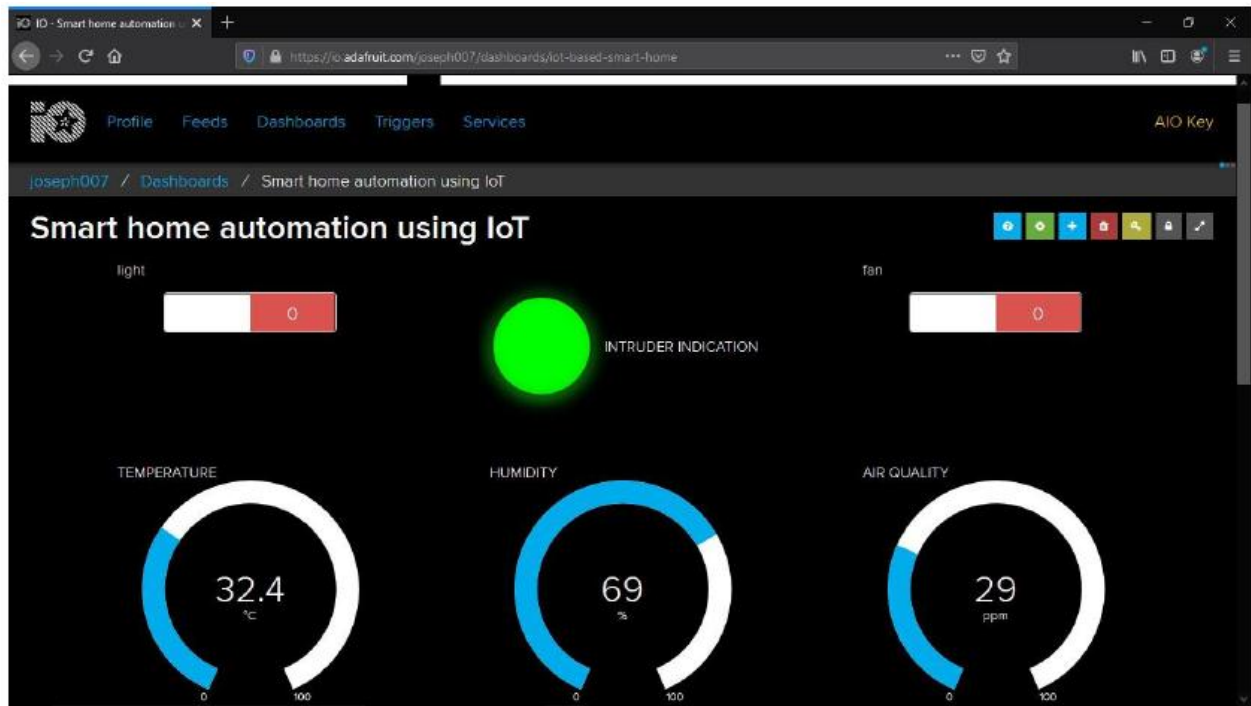
Fig -3: IOT web page

4. CONCLUSION

IOT based smart home system will bring more convenience and comfort to people lives. These home automation systems are mandatory because sometimes human can forgot to switch off the appliances when there is no need to use and in this situation, the home automation system is used to reduce the wastage of electricity. Home Automation is undeniably a resource which can make a home environment automated. People can control their electrical devices via these Home Automation devices and set up the controlling actions in the computer. We think this product have high potential for marketing in the future. At the moment the components are a bit too high to be able to produce these devices for an interesting price.

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