International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 04 Issue: 07 | July -2017 www.irjet.net p-ISSN: 2395-0072

HOME AUTOMATION USING INTERNET OF THINGS

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Abstract - Internet of Things (IoT) is a concept that imagines all objects around us as part of internet. IoT covers a very wide range of objects and includes variety of objects like smart phones, tablets, digital cameras and sensors. When all these devices are connected to one another, they enable more and more smart services and processes that support our everyday needs, environment and health. Cloud based platforms help to connect to the things around us so that we can access anything at any time and any place in a user friendly manner using customized portals and built-in applications. Hence, cloud can be said to act as a front end to access IoT. Applications that interact with devices like sensors and digital cameras have special requirements for massive amounts of storage to store big data, huge computation power to enable the real time processing of the data into information. In this paper we present a Home Automation system (HAS) using Arduino Uno

Key Words: **Sensors, Cloud, IOT (Internet of Things), Home Automation system, Arduino Uno.**

1. INTRODUCTION

The Internet of Things (IoTs) can be viewed as connecting everyday objects like Internet enabled TVs, smart- phones, actuators and sensors to the Internet. The devices are smartly linked together allowing new forms of communication between people and things, and among things themselves. IoT technology has advanced significantly in the last few years since it has added a new dimension to the world of communication and information technologies. It's predicted that the number of devices connected to the Internet will increase from 100.4 million in 2011 to 2.1 billion by the year 2021, this growth is at a rate of 36% per year. In the year 2011, 80% of machine to machine (M2M) connections were made over mobile networks such as 2G and 3G and it is believed that by 2021, the ratio will increase to 93% since the cost related with machine to machine over fixed networks are generally more expensive than mobile networks. Now anyone, from anywhere and anytime can be connected for any reason and can expect that these connections will create and extend a completely dynamic and advances network of IoTs. The development of the Internet of Things will be revolutionary in a number of sectors, from transportation, automation, healthcare, energy, nanotechnology to financial services. IoTs technology can also be used to create a new wide development space and concept for smart homes to provide comfort, intelligence and to improve the quality of life.

Different appliances and devices in the home such as air condition, lightings, entertainment systems and home security can now be connected to the Internet in order to allow the user to control those remotely using Tablets or Smart phones. Not only can devices be controlled, but the home environment can also be continuously monitored for keeping track of energy consumption or maintaining certain desired temperature. This will contribute to overall energy saving and cost reduction which is one of the main concerns of many households. This implementation of IOT represents a flexible and low cost home control and monitoring system using an embedded micro-web server, with IP connectivity for accessing and controlling devices and appliances using a web server. The proposed system does not require a dedicated server PC with respect to similar systems and offers a unique communication protocol to control and monitor the home environment with more functionality than just switching.

2. PROPOSED SYSTEM

In order to address the mentioned issues of functionality and flexibility, we designed and implemented standalone, novel, flexible and low cost home monitoring and controlling system using Web services as an interoperable application layer. The system consists of a micro Web - server based on Arduino Ethernet and hardware interface modules. The architecture presented in this work can be customized in several ways in order to accommodate different application scenarios with minimum design and recoding i.e. each time a new device is added to the micro Web-server, a new thread dedicated to the device can be added to the web server. Hence, the aim of the proposed work is not to incorporate expensive components such as high end personal computers. This system allows authorized home owners to control and monitor connected devices at home. The web server provides a graphical user interface (GUI) for accessing and controlling the devices.

3. Implementation

A. Proposed System Functions

The given home automation system has the ability to control the following components in the user's home:

- Lights on/off
- LED on/off

- RGB LED on/off
- Fan on/off

B. Software Design: Front End Design:

HTML is a markup language that tells a computer how to display a web page. The documents themselves are simple text files with special "tags" or code that a web browser uses to understand and display information on your computer screen. HTML stands for Hyper Text Markup Language. An HTML files must have an .htm or .html file extension. An HTML file is a text file containing small markup tags. The markup tags contain instructions to the browser about how to display the web page.

C. Software Design: Arduino IDE

The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application. It includes a code editor with features such as text pasting and cutting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus.

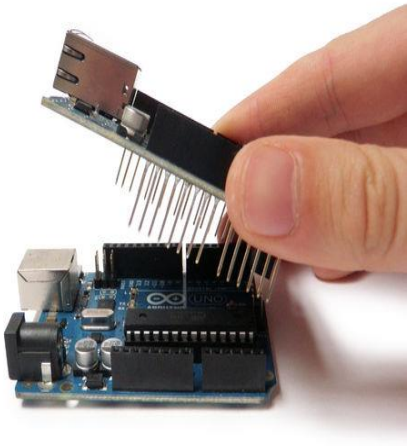
The programs written in the Arduino IDE are called sketches. The Arduino IDE supports a variety of languages such as C/C++. The IDE has a large collection of base class libraries to help the support the functionality of the Arduino. Methods such as digitalwrite() are used to write values to the pins of the Arduino.

A. Hardware Design: Arduino Microcontroller

The Arduino Uno microcontroller board is modelled on the ATmega328P microchip. It has 6 PWM output pins (14 input/output pins in total), 6 analog inputs, a power jack, a reset button , a USB connection, a 16MHz quartz crystal, an ICSP header. These components all play an important part in supporting the functionality of a microcontroller. It is powered either through a connection to a computer through a USB cable or through a direct connection to an AC source using an AC-to- DC adapter or through a battery

B. ETHERNET SHIELD

The Arduino Ethernet Shield acts as a medium to connect the Arduino to the internet. The Ethernet Shield must be inserted onto the Arduino Uno by placing the pins of the Ethernet Shield onto the corresponding ports of the Arduino Uno. This setup can then be connected to the internet using an RJ45 cable. The Arduino's code has to be verified and uploaded from the IDE to the microcontroller to issue instructions to the shield. The different parts of the platform such as documentation, software and hardware are open-source and available for free.

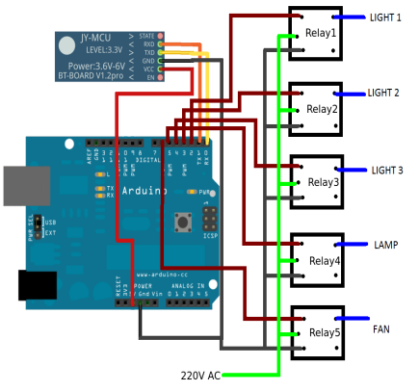


I. Architecture

The Proposed System consists of an Arduino Uno, an Ethernet shield coupled with the Arduino, a relay board to relay the current, a regulated power supply to convert ac power to dc, a breadboard to aid with the connections, devices to be automated and an A.C power supply. The connection setup is as shown in the figure below

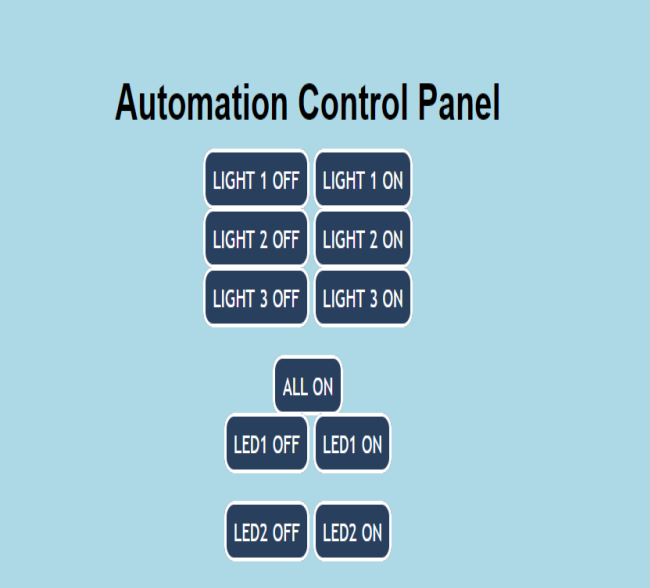
Design

Architecture Diagram



II. Result

Once the connections have been made, the code written in the Arduino IDE must be uploaded to the device. The IP address of the device is to be entered in a web browser in order to open the front end web page. The web page has several buttons which may be used to control the given devices as shown in the figure



3. LITERATURE REVIEW

Saito and others developed, in 2000 a home gateway system for interconnecting home network consisting of IEEE 1394 AV network and X10 power line home automation network with Internet. This provided remote access functions from Internet for digital AV appliances like Digital Video Camera, Digital VCR connected to IEEE 1394 network and home appliances like TV, desk lamp, electric fan connected to X10 controller.

Al-Ali and Al-Rousan developed, in 2004 a Java based home automation system via World Wide Web. The home appliances were controlled from ports of embedded system board connected to PC based server at home.

Alkar and Buhur implemented, in 2005 Internet based wireless flexible solution where home appliances are connected to slave node. The slave nodes communicate with master node through RF and master node has serial RS232 link with PC server. The nodes are based on PIC 16F877µc. PC server is formed of a user interface component, the database and the web server components. An Internet page has been setup running on a Web server. The user interface and the Internet front end are connected to a backend data base server. The control of devices is established and their condition is monitored through the Internet.

Tan and Soy developed, in 2002 a system for controlling home electrical appliances over the Internet by using Bluetooth wireless technology to provide a link from the appliance to the Internet and Wireless Application Protocol (WAP) to provide a data link between the Internet and a mobile phone. However, technical details relating to the controller are not revealed.

4. CONCLUSION AND FUTURE SCOPE

A. Conclusion

The home automation using Internet of Things has been experimentally proven to work by connecting simple appliances to it. These appliances were successfully controlled remotely through the internet. The designed system instigates a process according to the user's requirements, for example switching on a fan when it gets hot. Sensors can be implemented to store data which can later be used to analyze the system at hand.

B. Future Scope

The next phase for the Home automation market will occur based on a few key improvements in the technology available in Automation, such as improvement in Wireless Automation solutions as well as lowering of price points as the market begins to accept Home automation usage in larger volumes.
As with any industry, as Automation for residences become common place, the market will eventually be crowded with several players, multiple product offerings and competitive pricing. The market for just Home automation is estimated to be 3.2$ Billion by 2020. If IoT were to become common place, then we're looking at a multi-billion dollar opportunity in the Indian market.

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