International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 3 Issue 2, February - 2014

Design and Implementation of Cloud based Home Automation

[1.] Pratiksha D. Nitnaware, [2.] Jayashree G. Gadhave, [3.] Pornima U. Kakade, [4.] Prof. Amol G. Baviskar
[1,2,3.] Students , [4.]Proffessor, Pune University

***Abstract*— Today home Automation technology is consistently improving its flexibility by incorporating the modernized features to satisfy the increasing demand of the people. This paper represents design and implementation of a new home automation system that uses cloud computing as service. The proposed system consists of three main components; the first part is cloud server, which manages and controls the data and information of users and the status of appliances. The second part is hardware interface module which provides the appropriate interface to the sensors and actuators give the physical service. The third part is Home Server, which configures the hardware device and provides the user interface. This paper aims to implement the web services through cloud which is basically need for security and availability of the data. The proposed system is cost effective, comfortable and reliable also provides a safe home automation environment for entire family.**

Keywords*— Home Automation and security, Arduino Uno, Cloud Services, TCP-IP protocol

I. INTRODUCTION

Home automation provides you control of lighting, heating, ventilations, air conditioning appliances, roman blinds, curtains, security locks of doors and other systems by single touch on your smart phone. The primary objective of this project is to design and implement cost effective but yet flexible, adaptable and secure Home automation system. The main objective of Home Automation is to help Handicapped and Senior citizens to enable & control the home appliances and raise an alarm in critical emergency situations. This system support wide range of security, multimedia applications, and telecommunication device. Home automation systems are generally separated into two categories: Locally controlled systems and remotely controlled systems. Locally controlled systems comprises of an In-house controller to achieve home automation. It allows users the complete coverage of their automation system from within their home via a stationary or wireless interface. Remotely controlled systems use an Internet connection or Integration with an existing home security system to allow the user complete control of the system linked appliances from their Mobile device, Personal Computer etc.

A. Problem definition

Many people are always on the move from place to place due to business demands. Some people can spend a couple of days away from their home leaving all their household appliances without any kind of monitoring and control. Some devices are left plugged into power sockets whereas others are supposed to be plugged into and out of power sockets at different intervals depending on the time of the day. All this requires an individual to manually attend to each of the devices independently from time to time. All such monitoring and control can be done without necessarily being around or inside the home. Some devices if not controlled properly consume a lot of energy which leads to extra expenditure on electricity. Therefore we propose to design an internet based home automation system which will enable one to remotely manage his/her appliances from anywhere, anytime.

II. LITERATUTE SURVEY

As per the survey no system is at cheaper rates. There are various systems which are hard to install, difficult to use and maintain.

Anindya Maiti has introduced design and implementation of home automation as a service [1]. It conveys the home automation as a service based on cloud computing, which assist in shrinking residential computing workload.

H. EIKamchouchi explains a design and prototype implementation of SMS based Home automation. GSM model uses SMS technology to exchange data and signalling between users and home automation system [4].

Darshan Sonar developed an application for home automation using cloud computing and mobile devices [3]. The system allows the user to control appliances and lights in their home from a smart phones and pc from anywhere in the world though an internet connection.

Alexandru-Corneliu Olteanu designed a system for home automation using Zigbee protocol [2]. It can communicate with a home automation network through an internet gateway, but cannot directly communicate with the devices in the network, as the devices usually implement low power communication protocol, such as Zigbee. So they investigate several methods to equip an android device with dongle capable of Zigbee communication.

Mohd. Mohsin proposed a design for home automation and security system using android ADK. Home appliances are connected to the ADK and communication is established between ADK (Accessory Developement Kit) and Android mobile device or tablet.

III. ARDUINO UNO MICROCONTROLLER

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6

can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

- pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible with both the board that uses the AVR, which operates with 5V and with the Arduino Due that operates with 3.3V. The second one is a not connected pin that is reserved for future purposes.
- Stronger RESET circuit.
- Atmega 16U2 replace the 8U2

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward.

Fig 1: Arduino Uno Microcontroller

Microcontroller	ATmega328
Operating Voltage	5v
Input voltage	7-12V
Input Voltage(limit)	6-12V
Digital I/O pins	14 (of which 6 provides PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 Ma
DC Current for 3.3V Pin	50 mA
Flash Memory	32KB (ATmega328) of which 0.5 KB used by boot loader
SRAM	2 KB(ATmega328)
EEPROM	1 KB(ATmega328)
Clock Speed	16MHz

Table1: Specification of Arduino Uno Microcontroller

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

A. Communication via the serial port

In computing, a serial port is a serial communication physical interface through which information transfers in or out one bit at a time. But in most of the occasions only one of the equipment's can be controlled through this mechanism. This is a major weakness in serial port communication. Another limitation of this mechanism is the requirement to connect a hardware device to the other end in orderto synchronizes the communication. This is another drawback in serial port communication.

B. Communication via the parallel port

This is similar to the serial port but this mechanism does not require additional hardware for the synchronization of communication because data sent through these ports are already synchronized. But there is a limitation on the number of equipments that can be connected to this port. And also the parallel ports cannot tolerate uncontrolled inputs. This is another major weakness of this mechanism.

C. Communication via the network

In this mechanism communication is done via the network with the use of network cables and a switch. This medium is accurate since equipments can be distinguished with unique ip addresses assigned to them and also it does not impose any limitation on the number of equipments that can be connected. Though this mechanism requires wiring of equipments to the home computer this can be avoided with the use of Ethernet over power (EOP) mechanism. Power line Ethernet runs over residential power lines using a Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) protocol to arbitrate the
shared medium; a Physical layer designed for transmission over electrical wiring. Hence with the use of this mechanism it is possible to avoid wiring of equipments to the home system.

IV. SOFTWARE INTERFACE

The software interface for the system is RxTx library of Java.

RxTx

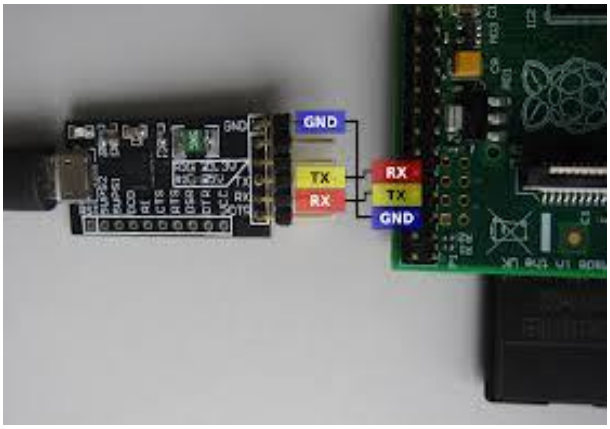

Fig 2. RxTx communication

RXTX is a native lib providing serial and parallel communication for the Java Development Toolkit (JDK). All deliverables are under the LGPL license. It was chopped out of a GPS application. The communication support was minimal and buggy. The hope was that the serial communication support would improve by sharing the code with other developers. Since then Sun produced the CommAPI and RXTX was moved towards supporting this standard. The shared code appears to have worked. The library provides most of the CommAPI functionality and works much better than the code originally shared.

V. CLOUD SERVICES

Cloud computing is a phrase used to describe a variety of computing concepts that involve a large number of computers connected through a real-time communication network such as the Internet. In science, cloud computing is a synonym for distributed computing over a network, and means the ability to run a program or application on many connected computers at the same time. The major models of cloud computing service are known as software as a service, platform as a service, and of infrastructure as a service.

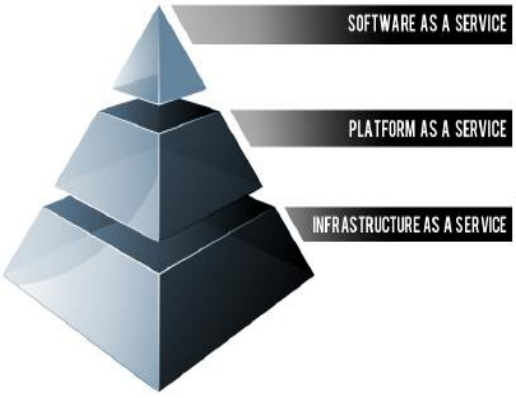

Fig 3: Cloud services stack

A. *Software as a Service*

Software as a Service (SaaS) is defined as the software that is deployed over the internet.With SaaS, a provider licenses an application to customers either as a service on demand, through a subscription, in a "pay-as-you-go" model, or (increasingly) at no charge when there is opportunity to generate revenue from streams other than the user, such as from advertisement or user list sales .SaaS is a rapidly growing market as indicated in recent reports that predict ongoing double digit growth. This rapid growth indicates that SaaS will soon become commonplace within every organization and hence it is important that buyers and users of technology understand what SaaS is and where it is suitable.

VI. ARCHITECTURE

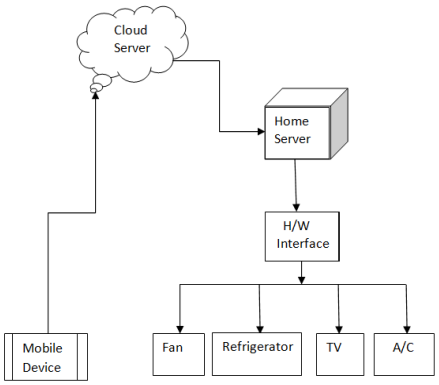

Fig 4: Architecture of HAS

A. *Proposed System Overview*

As mentioned the proposed home automation system consists of three main modules, the server, the hardware interface module, and the software package. Serial port is used by server and hardware interface module to communicate with each other. User may use the Internet to login to the server web based application, so that remote users can access server web based application through the internet using compatible web browser. The proposed system is implemented using JSP, HTML and CSS. The server application is implemented in JSP & Java whereas the embedded hardware interfaces application shall be implemented using C Programming Language.

B. *System Implementation Plan*

The system is comprised of different client modules for different platforms.

1. Cloud server

   It is a central server focused on providing services to the other sub modules. Central server acts as the brain and data respiratory system. It provides three interfaces to the three sub modules viz mobile, web configuration tool and home system. The server analyzes the data it receives from home, send updates to the mobile and vice versa. A database is

maintained by the server and it is updated according to the changes done at home end.
2. Embedded Program for Microcontroller, and Hardware Circuit.
3. Internet Client for any mobile phones or desktop.

VII. APPLICATIONS

Home automation makes your home safer: Its visible around us that crime is on the increase, families are beginning to aim at purchasing security alarm systems for their homes. Home Automation adds an extra sense of security to your home, using the automation system you can monitor your home security cameras using a remote device. You can receive notifications through email or message, when your alarm has been armed/disarmed or tripped.

1. Home automation saves you money and energy: Home automation systems are designed not to use a lot of electricity, added bonus to having a home automation system is that you can schedule your lighting in your home to go on and off at selected time of the day. Using a remote device, you'll have remote access to operate any lighting or electrical appliances.
2. Home Automation is great for the parents: If you have a new born or toddler in your home, having a home automation system is perfect for any parent. You can be anywhere in your home, and still be able to monitor your child in a different part of the house through the cameras installed in various rooms.
3. A home automation system is all in one user friendly system: For any technological fanatic this is the ultimate device. From the press of a button on a remote device, the user is able to control Lighting, Air Conditioning, Audio & Video systems and Security Video cameras.

VIII. CONCLUSION

We propose a scalable architecture, by using remote access, different communication channels, as well as various ways of offering the functionality to multiple user interfaces. We hide the complexity of the notions involved in the home automation system by including them into a simple, but comprehensive set of related concepts. Thus we have design an internet based home automation system which will enable one to remotely manage his/her appliances from anywhere, anytime.

IX. ACKNOWLEDGMENT

We acknowledge the effort and hard work by the experts who have contributed towards the development of different home automation system. We also acknowledge the reviewers of the journal for the suggestions and modifications to improve the quality of the paper.

REFERENCES

[1]. Anindya Maiti,"Home automation as a service", school of computing and engineering, 3 June 2012
[2]. Alexandru-Corneliy Olteanu*, George-Daniel Oprina*, Nicolae Tapus* and Sven Zeisberg"Enabling mobile Devices for home automation using ZigBee"
[3]. Prof. M. B. Salunke, Darshan Sonar, Nilesh Dengle, Sachin Kangude, Dattatraya Gawade "Home Automation Using Cloud Computing and Mobile Devices"
[4]. H. EIKamchouchi, Ahmed EIShafee"Design and Prototype Implementation of SMS Based Home Automation system"
[5]. Piyare, R., Tazil, M., "Bluetooth based home automation system using cell phone" *IEEE ISCE*, pp.192-195,2011.