International Institution for Technological Research and Development
Volume 1, Issue 3, 2016

Sensor communication in Smart Home Using IoT

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Abstract

In the IoT, things are expected to become active participants where they are able to interact and communicate among themselves by exchanging data and information sensed about the environment. For that they react autonomously to the real world events and provide services with or without direct human intervention.

Home automation is nothing but automation of regular activities inside in the home .Now a day's due to huge advancement in wireless sensor network and other computation technologies, it is possible to provide flexible and low cost home automation system. However there is no any system in market which provides home automation as well as error detection in the device efficiently.

This project aims at Monitoring home appliances via Smartphone using Wi-Fi as communication protocol and arduino uno. The user here will move directly with the system through a web-based interface over the web whereas home appliances like lights, fan etc. are remotely controlled through easy website.

Key Words: *IoT, Smart Home, Sensors, and Controller*

1. Introduction

Today, technology has become an integrated part of people's lives. It has, and continuous to influence many aspects of daily life and has allowed better social interaction, ease of transportation, the ability to indulge in entertainment and media and has helped in the development in medicine. The creation of many devices such as mobile phones and computers have caused many people to rely on technology to communicate with their friends, store information such as pictures, movies, documents, and music.

Internet has changed human's life by providing anytime, anywhere connectivity with anyone. Internet helps us to bring in with immediate solution for many problems and also able to connect from any of the remote places which contributes to overall cost reduction and energy consumption.

Every day the modern people expect new device and new technology to simplify their day to day life. The innovators and researchers are always trying to fine new things. To satisfy the people but the process is still infinite. In 1990s, Internet connectivity began to proliferate in enterprise and consumer market, but was still limited in its use because of the low performance of the network interconnects. In the 2000s internet connectivity became the norm for many applications and today is expected as part of many enterprise, industrial and consumer products to provide access to information. However, these devices are still primarily things on the internet that require more human interaction and monitoring through apps and interfaces.

For many years Home automation is mainly used as features of science fiction writing, but it's become practical since the early of 20^{th} century that is because of the introduction of electricity and rapid improvement in information technology

1.1. Smart Home

Home automation or smart home is described as a technology which is used within the home environment to provide comfort, security, convenience, and energy efficiency to its user or occupants. By inclusion of the internet of things, the research and development of home automation are going to become more and more popular. Different wireless technologies that support remote data transfer, control and sensing such RFID, Wi-Fi, Bluetooth, and also cellular networks have been evolved to add intelligence at various levels in the home. [1]

Home of the 21^{st} century will become more and more self controlled and automated due to the comfort it provides, especially when employed in a private home. A home automation system is means that allow users to control electric appliances of varying kind.

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Many existing, well-established home automation systems are based on wired communication. This does not pose a problem until the system is planned well in advance and installed during the physical construction of the building. But for already existing buildings the implementation cost goes very high.

In contrast, wireless system can be of great help for automation system. With the advancement of wireless technologies such as Wi-Fi, cloud networks in the recent past, wireless systems are used every day and everywhere.[2]

1.2. Internet of Things

The Internet where the existing network of internet to the computer systems will connect to the real world objects or things. Things may include any objects, home appliances, devices, vehicles, etc. and when these things connect to the internet in specific

Figure 1 Objectives of Internet of things

infrastructure via standard protocols then the whole system is said to be internet of things. [3]

The term "Internet of Things" has come to describe a number of technologies and research disciplines that enable the Internet to reach out into the real world of physical objects. [IoT 2008] Figure shows the objectives of IoT.

1.3. Challenges

Many key challenges have discussed by Dhananjay Singh et aI., and Sarita Agrawal et aI., in [3] [4].

- Standards: Standardization is very essential for loT environment as it is expanding globally. Challenges are comes related which standard should be used, which will provide secure medium, how it will make system more reliable.
- Identification: Identification is required for each device so that each device can identify uniquely.
- The user's data should be confidential. Connection should be done with providing privacy.
- Authentication: Authentication is must to secure Smart Home system from an attacker. Server has to give access only authentic users.
- Security: The system should able to take appropriate actions on security threats. And system should be able to reconfigure by itself after attacks.
- Integration: The main challenge with loT is to integrate applications in loT environment.
- Coordination: Coordination is required between the globally connected objects, humans, programs, process, etc.
- Data Storage: As applications of loT are increasing, the amount of data getting collected is huge. The challenge is where to storage the huge data. Huge database can solve this problem. Artificial intelligence algorithms must be applied to extract meaning data from redundant data.
- Network Self-Organization: Network structure should be created in such a way that every device connected to it could self-organize them. Actually it is network which should be able to self-organize

1.4. Related Work

Home Automation is automation of the home, housework or household activity. Home automation may include centralized control of lighting, HVAC (heating, ventilation and air conditioning), appliances, security locks of gates and doors and other systems, to provide improved convenience, comfort, energy efficiency and security. Home automation for the elderly and disabled can provide increased quality of life for persons who might otherwise require caregivers or institutional care.

The popularity of home automation has been increasing greatly in recent years due to much higher affordability and simplicity through smart phone and tablet connectivity. The concept of the "Internet of Things" has tied in closely with the popularization of home automation. A home automation system integrates electrical devices in a house with each other. Through the integration of information technologies with the home environment, systems and appliances are able to communicate in an integrated manner which results in convenience, energy efficiency, and safety benefits. However, problems with complexity, competition between vendors, multiple incompatible standards and the resulting expense have limited the penetration of home automation to homes of the wealthy, or ambitious hobbyists.

There are a number of issues involved when designing a home automation system. It should provide a user- friendly interface on the host side, so that the devices can be easily setup, monitored, and

controlled. Furthermore the overall system should be swift enough to realize the true power of wireless technology. Lastly the system should be cost effective in order to justify its application in home automation. To minimize the shortcomings of each system and to overcome the design issues previously mentioned, this project integrates locally and remotely controlled systems with the use of Cloud data network. This allows the system to operate without the dependence of a mobile provider, allows the system to be used with various mobile phone platforms, and allows the system to operate locally when phone or computer access is not available. Cloud networking and data infrastructure allow individuals to monitor, manage, and control their personal data points through the Internet. One of the available services is Pachube [5].

Many of the home automation systems that are commercially available can be separated into two categories: locally controlled systems and remotely controlled systems. Locally controlled systems use an in-home controller to achieve home automation. This allows users complete use 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 their system from their mobile device, personal computer, or via telephone from their home security provider. [6]

In some study also have presented Bluetooth based home automation systems using Android Smart phones without the Internet controllability. The devices are physically connected to a Bluetooth sub-controller which is then accessed and controlled by the Smart phone using built-in Bluetooth connectivity. Researchers have also attempted to provide network interoperability and remote access to control devices and appliances at home using home gateways. [2]

1.5. Objectives

- We sense environmental conditions by various sensors and according to its values, we control various devices which are connected to microcontroller through drivers and relay board.
- One PC connected to microcontroller will monitor the sensors values continuously
- We can manage to change settings by just changing the threshold values in the Pc.
- If some device is not functioning after some time period sensors will detect the faulty device. For example, if light bulb is not working after 5 second light sensor will detect the problem. Then Home PC will inform it to cloud server then server apply data mining on its available data sets to find out which technician or service provider to call and it sends notification to that technician and user via SMS or E-mail.

2. Proposed work

Home automation is nothing but automation of regular activities inside in the home .Now a day's due to huge advancement in wireless sensor network and other computation technologies, it is possible to provide flexible and low cost home automation system. However there is no any system in market which provides home automation as well as error detection in the device efficiently.

Every user who is experienced in the existing system may think of a system that may add more flexibility and run with some common applications such as android. This work is designed in such a way to avoid the disadvantages of the existing system. The proposed system supports more elasticity, comfort capacity and safety.

The main objectives is to design and to execute an cost effective and open source home automation system that's capable of leading most of the home and sustain the house automation system. The predictable system contains a great elasticity by using wireless reliable technology to interconnecting various modules to the server of home automation system. This in turn reduces the deployment cost; will add to the flexibility of advancement, and system reconfiguration. The projected system can make use of wireless LAN(Local space Network) connections between various sensor, hardware modules and server, and various communication protocols between users and server[2].

2. 1. Functions

- The proposed "Smart home" system has the capabilities to control the following in users home and monitor the following alarms:
    - Temperature and humidity
    - Motion detection
    - Fire and smoke detection
- The proposed "Smart home" system can control the following appliances:
    - Fan On/Off
    - Fan Speed

2. 2. IoT Architecture

The IoT-based architecture provides high-level flexibility at the communication and information. It is an approach which is relevant in many different environments such as patient monitoring system, security, traffic signal control or controlling various

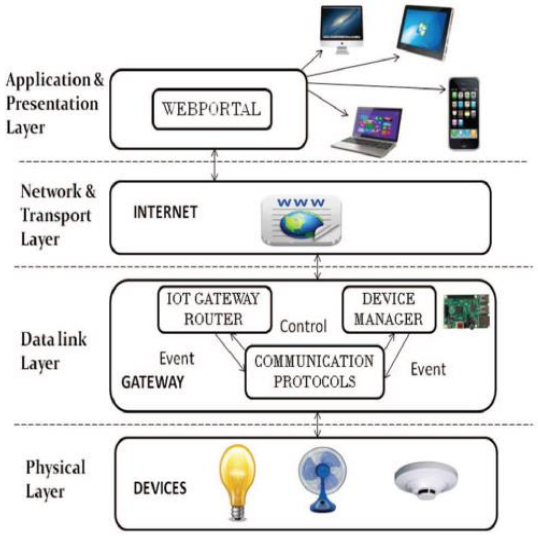


Figure 2 Layers of IoT

applications. The IoT project aims to bring out the various opportunities of using IPv6 and other related standards to overcome the disadvantages using of the Internet of Things [5]. The IoT projects proves a dominant and thorough study of all sensible functionalities, mechanisms and various protocols that can be used for building IoT architectures however interconnections may occur between all totally different IoT applications. As in the networking field, where several solutions emerged at his infancy to leave place to a common model, the TCP/IP protocol suite, the emergence of a common reference model for the IoT domain and the identification of reference architectures can lead to a faster, more focused development and an exponential increase of IoT-related solutions. These solutions can provide a strategic advantage to mature economies, as new business models can leverage those technological solutions providing room for economic development

2.3. Design

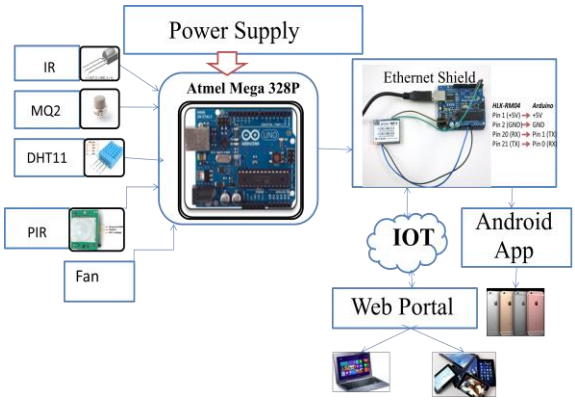


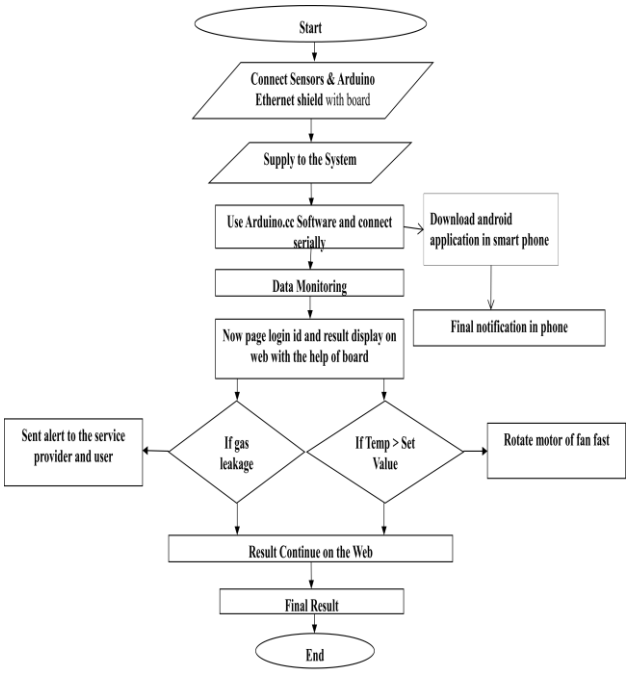
Figure 3 Block Diagram

In this Paper we will see how to provide fully smart Home condition monitoring by various sensors (Temperature, Humidity, Motion and Gas leakge) for providing necessary data to automatically detection and resolution of any problem in the devices.

2.4. Requirement

Hardware	***Software***
Arduino uno board	IDE for Arduino
Ethernet Shield (hlk-rm 04)	Acees of Cloud
Sensor : DHT 11, PIR, MQ-2, Fan Motor	Android Studio for mobile app

2.5. Flow Chart



2.6. Application

- Smart homes take advantage of automation technology and modern building techniques to give homeowners a new level of control. Smart homes may be built from scratch with automation as a key design goal, or constructed from existing homes during a major renovation. In both cases, smart homes offer several advantages over conventional homes.

- Smart homes include advanced security systems with cameras, motion sensors and a link to the local police station or a private security company. Smart homes may also use key cards or fingerprint identification in place of conventional locks, making it harder for someone to break in.
- For elderly or disabled residents, a smart home may feature accessibility technologies. Voice-command systems can do things like control lights, lock doors, operate a telephone or use a computer.
- Smart homes offer enhanced energy-efficiency. Lights can shut off automatically when no one is in a room, and the thermostat can be set to let the indoor temperature drop during the day before returning it to a more comfortable level just before residents arrive in the evening. All of these automated tasks, along with modern, energy-efficient appliances, combine to save on electricity, water and natural gas, thereby reducing the strain on natural resources.

3. Conclusions

A Smart Home system integrates electrical devices in a house with each other. The techniques which are going to use in home automation include those in building automation as well as the control of domestic activates, such as TV, fan, electric tubes, refrigerator and washing machine.After studying and understanding literature review and other exciting work, I will design a new technique that will give me better understanding about home requirement.This system is not only just monitoring but it acts according to requirement. This system also provide notification to the user about any error occurs in the devices and send SMS to the service provider about the problem.In this, I am planning to eliminate most of the human interaction by providing intelligent system

Acknowledgment

The successful completion of this required a lot of assistance, advise, support and I am grateful and deeply indebted to all those who have assisted and guided me in all ways. I am
also thankful to my guide **Mr. Utkarsh Patel** provide me definition and valuable information about this Project. I heartily thank you my husband for his constant support and guidance**.**

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Biography

Twinkle Rameshbhai Gondaliya has received her B.E. degree in Electronics & Communication from Sabar Institute of Technology for Girls, Gujarat. She is currently a Postgraduate student of Communication System Filed form the department of Electronics & Communication, in Silver Oak College of Engineering and Technology, Gujarat. Her research interests include Internet of Things and Sensor Communication.