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Smart Device Based Home Automation using IoT via Internet Connectivity

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ABSTRACT

In today's world technology is getting more advanced, we have new technology for our personal living, even at home. Home automation is becoming more popular around the world and is becoming a common practice. The main concept of home automation is to automate everything in the house which can be done using technology to control and do the tasks that we would do manually. In this paper, we illustrate use of remote devices such as mobile phone, tablet or desktop and laptops to control, monitor the Home Appliances. In today's era, technology can enhance comfort zone of human life. Technology is evolving rapidly. By using the latest technology for home automation, we can build a fully automated home. By Using Raspberry Pi and Aurdino, a home automation system is built and is capable of operating home appliances automatically. In this paper we have implemented home automation for controlling electrical home appliances. We have provided the facility to control these devices through web as well as through mobile. Here we are using Raspberry Pi-3 as a server and Arduino to get the signals and send the same to the server. This paper proposes a very economical system for home automation.

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I. Introduction

The Internet of Things is the most trending technology today that stands alongside wearable and robotics. Home Automation is a concept in which devices of your home or from other places they are, have the capability to communicate with each other via the internet. Home automation is defined as home appliances automatically controlled by using various control system techniques. The electrical and electronic appliances in the home such as fan, lights, outdoor lights, fire alarm, kitchen timer, etc., can be controlled using various control techniques.

Usually sensors are used to push data to internet in recent technology. You can imagine a sensor installed in your garden which uploads data like temperature, humidity, soil purity and other data to internet which can be accessed around the world, which can be used to control appliances in your home like lights, door locks, air conditioning, etc. through a web interface or smartphone application. New technologies developed around the concept same as independent light-weight IoT networks, protocols for passing data, etc.

Wireless communication refers to the transfer of information between two or more points. Here a wireless technology uses radio waves. With these radio waves distances can be few meters for television or as far as thousands or even millions of kilometers for deep-space radio communications. In this paper we use Wireless communication between android device and Raspberry Pi using HTTP Protocol.

Serial communication is way of sending data one bit at a time, sequentially, over a communication channel or computer bus.

Whereas in parallel communication, several bits are sent as a whole several parallel channels. In this paper we use Serial Communication between Raspberry Pi and Arduino.

II. Literature Survey

MQTT based secured home automation system

In this paper [1] Author has discussed about a MQTT based Secured home automation system, which uses mentioned sensors and u Raspberry pi B+ model as the network gateway, they have implemented MQTT Protocol for transferring & receiving sensor data and getting access to those sensor data finally, also they have implemented ACL (access control list) to provide encryption method security for data and finally monitoring those data on webpage or any network devices. Raspberry-pi has been used as a gateway or the main server in the whole system, which has various sensor connected to it via wired or wireless communication.

Towards to responsive web services for smart home LED control with Raspberry Pi. A first approach

In this paper [2] Author has discussed about the evolution of the technology which has enabled people to retrieve information which were not possible before. The concept of Internet of Things (IoT) is a new growth for technology in processing information technology, which allows people to understand about their environment conditions and how they can control the variables that affect their lives. One of these variables is to handle events that occur within houses.

Cost effective digitization of home appliances for home automation with low-power Wi-Fi devices

In this paper [3] Author presents a conceptual idea about making a smart home automation using nodes instead of regular switch boards such that it should be an Smart Home with any Switch Boards. The system consists of Wireless nodes, Middleware, User Interface.

The Wireless nodes is capable of processing information using Actuator Node and Sensor Node the Actuator Node and Sensor Node publish and Subscribe data from node to Router in turn Middleware, Middleware consist of Home Automation Server which follows MQTT Broker and those data can be accessed by the User Interface i.e. the Android device and Web Application. The author then compares the cost of the proposed device with the traditional device and concludes the proposed method as Cost Effective.

A Smartbox as a low-cost home automation solution for prosumers with a battery storage system in a demand response program

In this paper [4] Author presents an electronic device named Smartbox as a low-cost and feasible home automation solution for prosumers, Smartbox acts like receive and Schedule the Load. The processing of the load is done in the cloud computing which calculates the optimal scheduling the solutions of a prosumers problem so that it can minimize the electricity bill and then returns the solution to the Smartbox via Internet. After receiving the Solution the Smart Box Hourly sends commands to those schedulable loads to implement the optimal loads scheduling. The Author describes a prototype of a Smartbox has been released and tested in the laboratory using an Arduino MEGA 2560 to provide a low-cost home automation solution.

III. Proposed Work

The architecture diagram depicted in Figure.1, explains the working procedure of the system. The system is installed in home where the Raspberry Pi act as a Server and N Rooms will be having individual Aurdino controlling the individual room .The Client i.e. Mobile Application or the Web Application request is given to Raspberry Pi and then request is forwarded to Particular Aurdino and then the Particular appliance will be turned on or off of that individual room and response will be send back indicating the status of the appliances

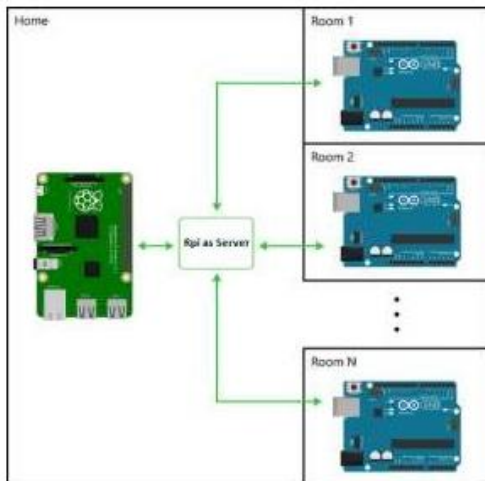


Fig 1. Architecture Diagram.

A. Architecture Design

Figure.1, Shows that one raspberry pi can be used to control many appliances.

B. High Level Design

The model depicted in Figure.2 clearly explains the working procedure of the system. An Arduino UNO will control devices. Periodically, the figure "Room Architecture" depicts how the Arduino UNO will connects with the devices. Each room has multiple controllable devices (i.e. Light(s), Fan, Wall Socket(s), etc.)

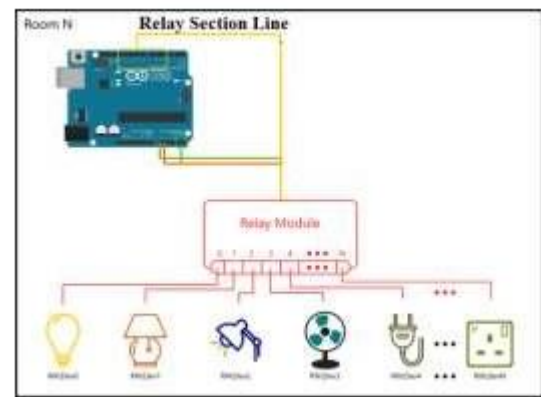


Fig 2. High Level Design.

C. Required Components

1. Raspberry PI



Fig 3. Raspberry PI.

Figure.3. Represents Raspberry Pi

The Raspberry Pi 3 is the 3rd generation Raspberry Pi developed which is replaced by Raspberry Pi two Model B in February 2016. Compared to the Raspberry Pi 2 it has

- A 1.2GHz 64-bit quad-core ARMv8 CPU
- 802.11n Wireless LAN
- Bluetooth 4.1
- Bluetooth Low Energy (BLE)

The Raspberry Pi 3 has an identical form factor to the previous Pi 2 (and Pi 1 Model B+) and has complete compatibility with Raspberry Pi 1 and 2. We recommend the Raspberry Pi 3 Model B for use in schools, or for any general use. If project requires embedding their Pi in a project they may prefer the Pi 0 or Model A+, which are more useful for embedded projects, and projects which require very low power.

2. Aurdino UNO



Fig 4. Aurdino Uno.

Figure 4. represents Aurdino Uno. Aurdino is an open-source project that created microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices. The project is based on microcontroller board designs, produced by several vendors, using various microcontrollers. These systems provide sets of digital and analog input/output (I/O) pins that can interface to various expansion boards (termed shields) and other

circuits. The boards feature serial communication interfaces, including Universal Serial Bus (USB) on some models, for loading programs from personal computers. For programming the microcontrollers, the Aurdino project provides an integrated.

D. Connecting Aurdino and RPI

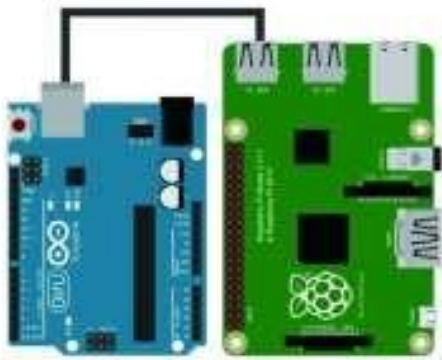


Fig 5. Connection of Aurdino And RPI.

Figure 5. Represents Connection between Arduino and Raspberry Pi

Connect USB 2.0 cable type A/B of Aurdino to the USB port of Raspberry.

E. Connecting Aurdino and Relay Module (Electronic Appliance)

Following are the steps for Aurdino and Relay Module. Figure 6. represents Connection of Aurdino And Relay Module.

- Connect the top one labeled VCC on the Relay Module to the 5V pin on the Aurdino
- Connect the second pin of Aurdino to RelayModule IN1.
- Connect the bottom one labeled GND to a ground pin of Aurdino.

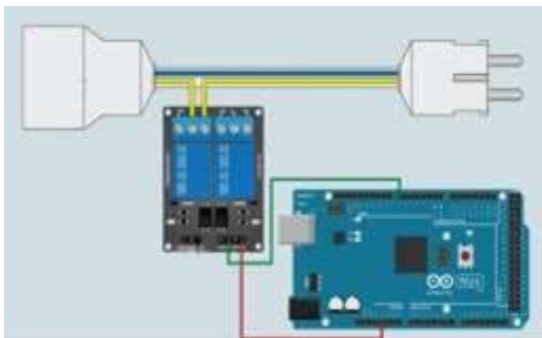


Fig 6. Connection of Aurdino and Relay Module.

IV. Implementation

The Figure 7. Represents connection between Raspberry pi, Arduino Board and relay module with home appliance CFL bulb as a protocol model. When the deployed system has power supply and android device send request to raspberry pi to switch on the bulb, raspberry pi will accept the request and forwards the request to Arduino, then Arduino will trigger relay and turns on the bulb.

Following are the Steps for Implementation

Initial Connect the Aurdino and RPI as per Figure. 5 and follow the instructions for connecting those components.

After the first Step Connect Aurdino and Relay Module as per Figure .6 and follow the instructions for connecting those component.

Finally connect the power source, Figure.7 shows the Model of our system which consist of all components.

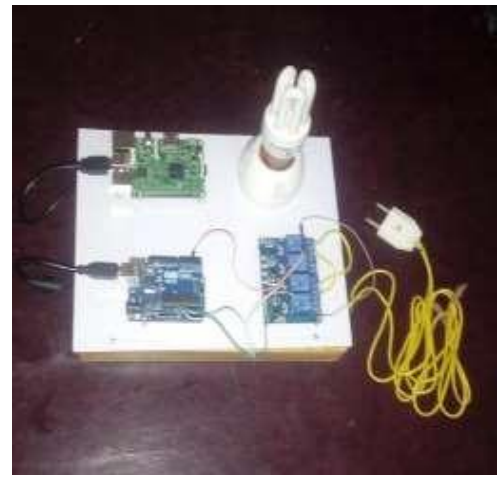


Fig 7. Implementation of the Home AutomationSystem.

V. Results

Whenever the android device requests server to turn on/off appliance from remote place, on receiving this request server will turn on/off appliance by triggering the relay based on the request type.



Figure 8. Represents graphical User interface for sending request to server.

VI. Conclusion and Future Scope

In conclusion, the Internet of Things is closer to being implemented than the average person would think. Most of the necessary technological advances needed for it have already been made, and some manufacturers and agencies have already begun implementing a small-scale version of it. The main reasons why it has not truly been implemented is the impact it will have on the legal, ethical, security and social fields. Workers could potentially abuse it, hackers could potentially access it, corporations may not want to share their data, and individual people may not like the complete absence of privacy. For these reasons, the Internet of Things may very well be pushed back longer than it truly needs to be.

In this paper we concluded that we can connect Raspberry Pi and Aurdino Serially and can be implemented to 4 Rooms as there are 4 USB Ports for the Raspberry Pi and we have carried out with the serial communication it is limited to 4 rooms and we can extended this project by making use of MQTT Protocol as it wireless and can connect N rooms.

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