Automation of Household Electronic Resources using IoT

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Abstract
In today's world manual systems are being replaced by automatic systems. IoT (Internet of Things) the latest and emerging technology gave rise to many applications to be automated. Wireless Home Automation system (WHAS) uses IOT and enables user to control and monitor basic home appliances automatically through internet by using computer or mobile from anywhere across the globe to have a smart home. The object of this paper is to design and implement a system which could meet the needs of smart home. In the context a reasonable cost effective, reliable system for smarter homes was proposed which uses concept of IoT which paved a path for automation of smart homes. The proposed model uses an opensource platform Arduino microcontroller, local Wi-Fi network, capturing sensor data and converting into information by using Ubidots and a low voltage switching relay board to control the home appliances like fan, light, cooler, Air conditioner.

Keywords: WHAS (Wireless Home Automation), Arduino, IoT (Internet of things), ESP 8266 (Wi-Fi), Ubidots IoT cloud platform, Relay.

Introduction
In this 21st Era Homes are drawn to the self-controlling and automated electrical Appliances [3]. In this process it gave rise to the need of Home automation which gave a big platform for Internet of things. Internet of things is a technology of the future dwells that has already carried away by the smart homes [1] [7].

In the previous research, Home automations have been picturized with wireless communication. This does not rise a problem to the newly constructed buildings or well established with system installed based planning [16]. But for the already existing the implementations seems to be bit problematic in installing all the process and that leads to the high cost which every mediocre people can't afford. In contrast, the Raspberry Pi2 has made its place in the automation systems. To reduce the cost and paved the platform to have a smart homes in less of cost [5].

Pro's and Con's of Home Automation
Pros
Adding convince to your daily life: In this busy schedule of work life people wish to have everything in a smart way to make it easy. When you renovate your home into a smarter home, all your devices will be programmed according to your needs [2].

Customization: As they are many smart products on the market right now, it's up to the perception of the customer to what to bring to have a smart home. And home security system can definably touch the perception of customers [12].

Security: smart home security always proved to be the best to view from home no matter where you are [3].

Ease of use: Smart home itself gives the meaning to have the smart ways, to install the goods without any hassle installing [16].

Save money and the environment: By using this home automation can be low cost and helps to track the energy usage and expenses [3].

Cons
Cost: Most families may not able to purchase the smart home products as it has to invest large some at a type than the non-smart products [19].

Sight learning curve: though it has the advantage of having smart home systems to easy use, but at the +sometime it would difficult for most of the people in case of learning curve for people who are of remote areas [7].

Reliability: smart homes are obivisiously reliant on internet connect, if they have signal or connection problems then you will be left with smart products which doesn't work [14].

They are plenty of pros and cons to be considered to have second thought to opt or not to opt for smart homes. Smart home changes with the growing technology [19]. They can play a role in reducing the electricity bills and simply the daily tasks and to relax the nerves of the body. But for some smart homes where as it can be an economic burden. Its ultimately depends on the perceptions of the people to decide [12].

Literature Survey

Home Automation using Internet of Things was developed by Pooja Patel et.al [2], has been experimentally proven to work satisfactorily by connecting simple appliances to it and the appliances were successfully controlled remotely through internet.

PiCam: IoT based Wireless Alert System for Deaf and Hard of Hearing was proposed by Pushpanjali Kumari et.al [7], which is based on implementation of a low cost IoT based alert system for deaf and hearing impaired people for their safety purposes. The message is also received on user's phone through GSM and also the data is updated on the server.

Smart home automation system using AVR microcontroller was developed by Bulbul Bhaskar et.al [10], this system comprises of sensors Bluetooth and a microcontroller for automation of household activities like changes in temperature, lighting, detect fire and also it tracks safety of the home. A home automation system based on GSM technology was developed by SougataDas et.al [15] where home automations are controlled by mobile phone through GSM technology. In this control of appliances will be done through SMS (short Message Service) and in turn system also sends current status.

Raman deep Singh et.al [16], presents a home appliance controlling using ZIGBEE on ATMEGA128 hardware like fan, air conditioner and refrigerator etc, was done by sending commands through computer and ZIGBEE wireless communication protocol.

In this paper, Shiu Kumar [17] as developed about Ubiquitous Smart Home System Using Android Application an internet based smart home system that can be controlled remotely upon user authentication is proposed and implemented. The Android based smart home app communicates with the micro web-server via internet using the REST full based web service.

Sweatha K N et.al [18] presents a novel technology that contains the Field Programmable Gate Array (FPGA) as a controller and the devices are communicated to the FPGA from the mobile phone using speech recognition technique.

Smart home automation and communication system was proposed by Vijay P. Jadhao [19], which is based on ARM based automation

system .In automation phase household appliances are controlled by microcontroller ARMLPC-2148 and a cell phone.

Proposed Work

In today's busy lifestyle automation of things is essential. So a reasonable cost effective, reliable system for smarter homes was proposed in this paper which uses concept of IoT which paved a path for automation of smart homes [3]. In the context the proposed model consists of three devices, Arduino, ESP8266 and relay board as shown in fig: 3 the key component for this home automation is based on Arduino [2].

Arduino is open source platform in both software and hardware, so it is easy to configure and understand [1]. The Arduino microcontroller board is based on 54 digital input/output pins. The Esp8266 is interfaced to the Arduino via the Arduino SPI pins [4] [14]. Low voltage switching relays were used to integrate the devices with the Arduino for demonstrating the switching functionality [6] [13].

The ESP8266 can be controlled from your local Wi-Fi network or from the internet (after port forwarding) [4]. The ESP8266 has GPIO pins that can be programmed to turn an LED or a relay ON/OFF through the internet. The module can be programmed using an Arduino/USB to TTL converter through the serial pins (RX, TX) which connects Arduino, relay board to IoT platform i: e ubidots [11].

Ubidots offers a platform for a developer that enables them to easily capture sensor data and turn it into useful information [6]. Use the Ubidots platform to send data to the cloud from any Internet-enabled device. You can then configure actions and alerts based on your real-time data and unlock the value of your data through visual tools. Ubidots offers a REST API that allows you to read and write data to the resources available: data sources, variables, values, events and insights. The API supports both HTTP and HTTPS and an API Key is required [3].

A Relay is electrically operated switches, which allow low power (220v) circuits to switch a relatively high voltage or current on/off [8]. For a relay to operate a suitable pull in and holding current should be passed through its coil. Relay coils are designed to operate from a particular voltage often its 3.3V or 5V [9]. The function of relay driver circuit is to provide the necessary current energize the relay coil, when a LOGIC 1 is written on the PORT PIN thus turning on the relay [10]. The relay is turning off by writing LOGIC 0 on the port pin. In our system four relays are used for device control.

System Design and Implementation

The proposed Home Automation System has the effectiveness to access the home electrical appliances in smart homes viz;

Lights on/off
Fans on/off
Coolers on/off
LCD on/off

With less equipment to be installed this invades less space [2] [12].Fig 1 illustrates the connection creation and command execution after done with all the connection, here goes with a start of opening the IoT platform Ubi web interface where the user can login [8]. If the establishments turn out to be a positive sign than it leads to opening of the dashboard .The next step is to wait for the user command, where according to the command the system works with the help of the internet [10]. Incase if the establishment turn out to be negative than the user has to redo all the procedure [1] [7].

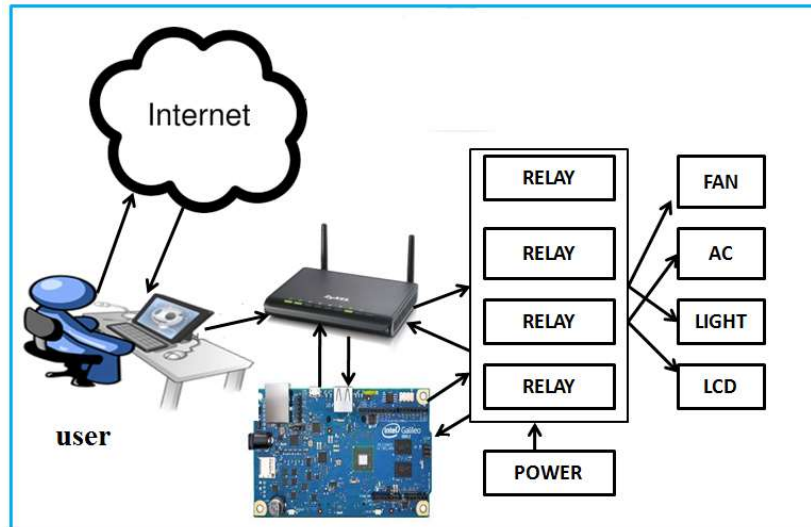**Figure: 1 Flow chart for connection creation and command execution**
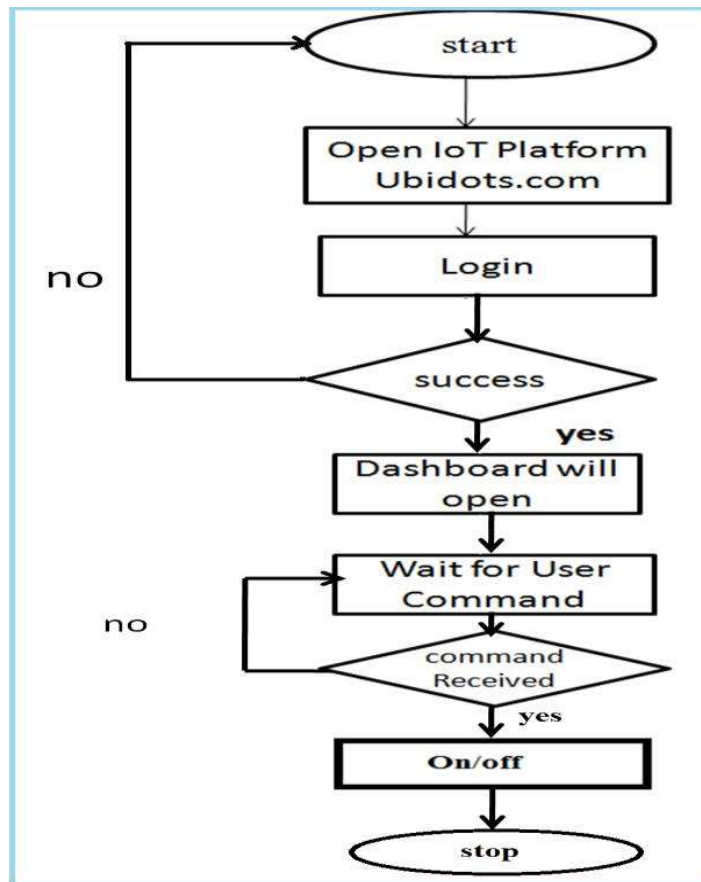
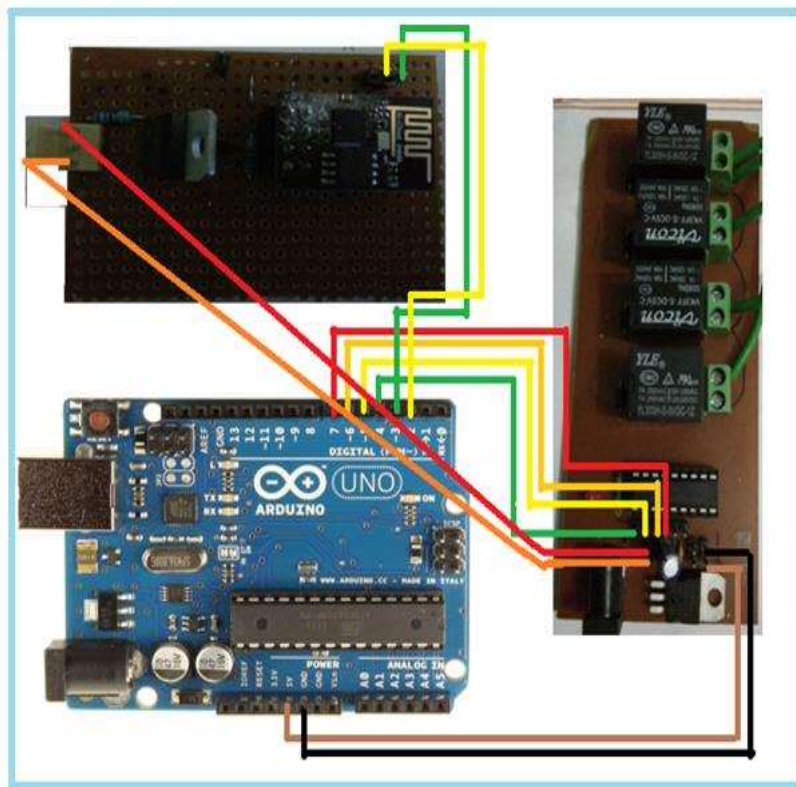**Figure2: Proposed model of home automation system**

Fig 3: Experimental setup of HAS

The fig: 2 and fig: 3 denote proposed system and experimental setup. This system consists of relay board, Wi-Fi module and ARDUINO (UNO). ARDUINO is connected to relay board and ESP8266 [12]. ESP8266 is used as Wi-Fi module. Relay board is connected to

devices to which automation has to be setup like lights, fans, coolers or any electronic devices of 220 volts [8][15].

Result Analysis

After connections are established, now connect to the PC and open the Arduino software, go to the file and select the Sketch book. Now dump the programme code into it, which is already programmed to the pins in which password of the Wi-Fi access is given and when we login to our ubidots account go to my devices and create graphical switches and it leads to the dashboard which we created will appear .When you switch ON a device, it will notify that the device respective device is ON by its colour [3]. The following fig: 4(a, b, c, d, e) will show the progressive for controlling devices.
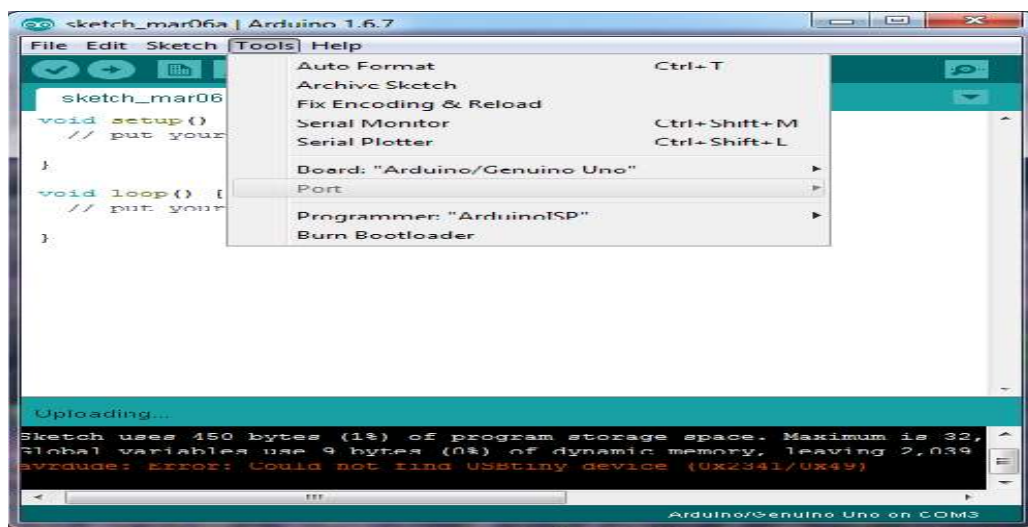

Figure 4: (a)

Figure 4: (b)
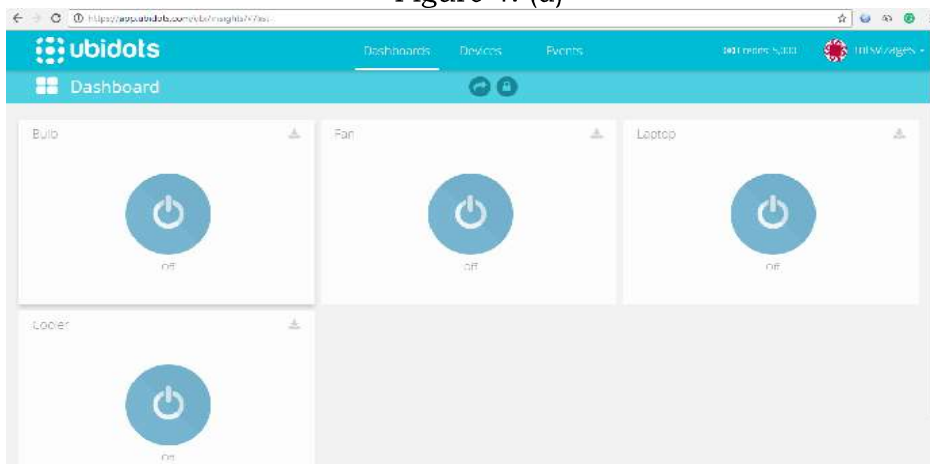
Figure 4:(c)

Figure 4: (d)
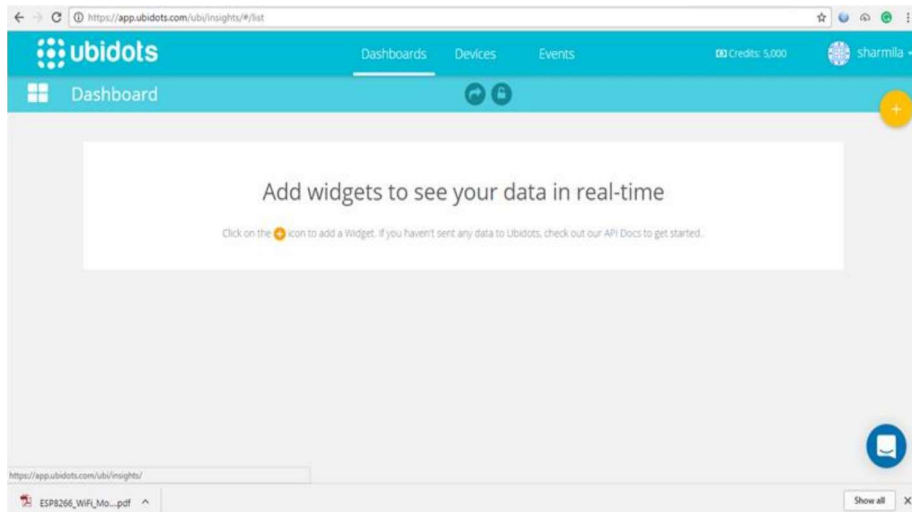

Figure 4: (e)
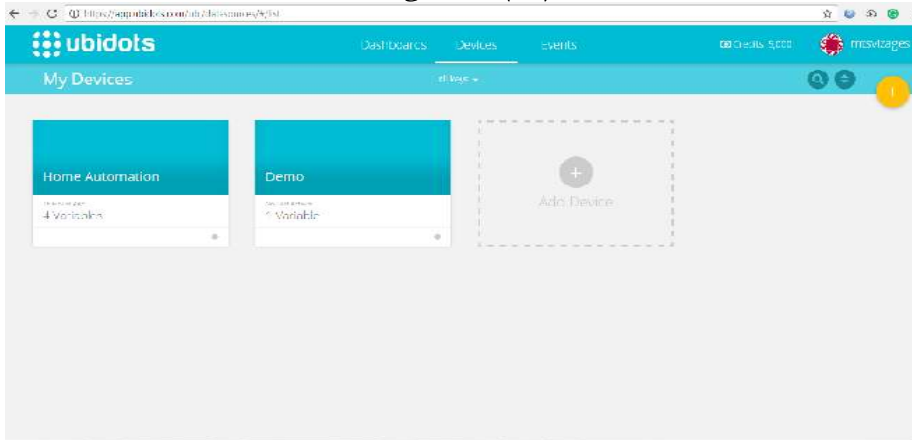
Figure: 4 Screen shots for online execution

Graphs

Figure: 5 sample graph showing the average value of the four devices

Figure: 6 sample graph showing the max value of the four devices.

Table 1. Comparisons of Arduino and Raspberry Pi2

	Arduino UNO	Raspberry Pi 2
Cost (base model)	20	39
Processor	16MHz AVR ATmega328P	900 MHz Broadcom ARM Cortex-A7
Storage	32 KB	n/a
RAM	2 KB	1 GB
I/O pins	20	17
OS	n/a	Raspbian, other varieties of Linux, Android

Languages	Arduino,	Python, C, C++, Java, Ruby
Best for	Hardware / prototyping	Software / server
Power supply	5V USB or DC jack	5V USB

Conclusion

This project has a vital scope in development of the smart homes and technologies. Home Automation is making its way in this fast generation cause human's are getting indulged in their work life which is making them to feel stressed to do their daily chores. This Home automation helps them to relax by using these appliances and useful in order to utilize the power effectively when they forget to switch off the appliances. This proposed system helps in reducing the wiring system and gives way to wireless system in electronic appliances.

Future Work

This system can be enhanced by increasing the relays which in turn adds more number of devices. This system can be used in medical and industrial automation.

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