Voice Recognition cum Real Time Sensor Application based Home Automation using Raspberry Pi device

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ABSTRACT

In this technique, we are trying to connect the household electrical appliances using Raspberry Pi 2 and an Android Smartphone. This is basically an application of Internet of things (IoT). Home Automation is the demand of the current generation and this is the future too. We will use an Android Application which will control the devices in the house. The Raspberry pi 2 will be connected to the devices and take the order from the users and manipulate or make changes accordingly. The product the reasonable and too easy to operate and will really prove to be a great product in market.

Keyword : - *Home Automation, Android system, Web server, Raspberry pi card, Electronic components, Smart Home.*

1. INTRODUCTION

Home Automation has revolutionized the present generation and had made life of mankind too simpler and automated. SoC mainly includes of the embedded systems like micro controllers which are small but provide a complete working environment like a computer. Home automation connects the system with the electrical switches which help us to monitor the usage of electricity in better, advanced and economical way. Home automation has the ability to play a significant role in the advancement and development of Internet of Things.

A home automation system is a technical solution that helps automating the group of electronic, electrical and technology-based targets within a house. It uses a combination of hardware and software technologies that enable control and management over appliances and devices within a home. A home with an automation system is also known as a smart home [1]. According to Bromley's definition, Home automation can be defined as the "introduction of technology within the home to enhance and standardize the quality of life of its occupants, through the provision of different services such as telecommunication, multimedia entertainment and energy conservation".

We have an existing technique to handle a raspberry pi embedded system using the python environment. But since we are working with the android smart phone, python will not be used, and its alternative 'java' language is used for android that will manipulate the raspberry. We have other Embedded systems like Arduino which can act as an alternative to the Raspberry. Now since Arduino is not as powerful as Raspberry, it will slow down the process

and surely will not be used for real time tasks. So basically this technique will provide an web interface to take input from the user to switch on or off the household appliances connected to raspberry pi.

2. SUMMARY

All the users who are experiencing in the current and existing system may think of a system that may add more flexibility and run with the common applications running on android. The proposed system is designed in such a way to avoid the limitations of the existing system. The proposed system supports more flexibility, comfort ability and security [4].This model targets at the home automation using raspberry through a webpage interface and the pre-defined algorithm given by the default programming environment python provided by the raspberry developers. Home appliance network (home automation) is required to be without new wiring and to be very easy installation. Field of home appliance network is still young, many initiatives and standardization efforts have already been made.The new kind of system brought android and raspberry-pi into home automation implementation [4].

With the explosion of internet based related technologies and the entire supporting internet framework, the home system looks feasible to enter this arena. Efforts in such direction will help to realize a genuine wireless, fully auto-running home automation system for the benefit of elderly and disable people or day care centre [3].

Although smart tools have been accessible in the past, their use has been very limited because they require intercommunication.

One preferred and suggested solution is to connect all smart phones using hard electrical wiring [5]; however, the resulting portability problem then produces an order for a wireless network able of accepting the devices. Organizations have therefore developed management, supplementary services, and gateways for smart devices [5]. Smart home network technology has been installed in various systems, such as power line and radio frequency systems [5]

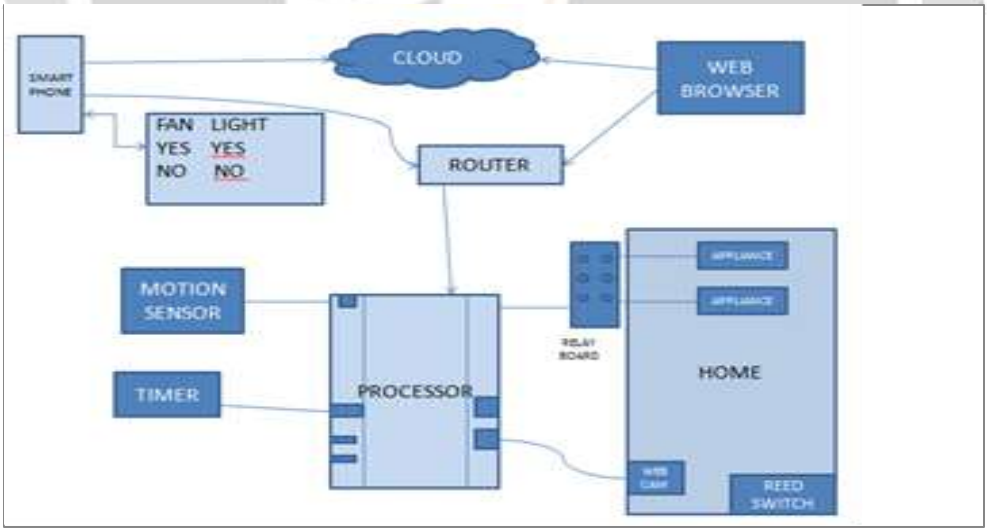


Fig -1: System architecture

3. SYSTEM OVERVIEW

The home automation system consists mainly of five things as follows:-

3.1 User Interface

In this project, the user interface will be the web page consisting of the buttons corresponding to the devices or the appliances present in the house. User will be able to handle the appliances by clicking the required option. Android will also be providing other UI modules for special interfaces such as dialogs, notifications, and menus. The interface should allow user to view device status and to control device.

Sr.no	Features of Raspberry Pi	Values
1	RCA Video Port	Yes
2	HDMI Port	Yes
3	Ethernet Port	Yes
4	USB Port	2x2.0 Port
5	3.5mm Audio Jack	Yes
6	SD Card Slot	Yes
7	Micro USB Power Port	Yes
8	Memory	1 GB
9	CPU	Broadcom 900Mhz

Tab -1: Hardware Specifications of Raspberry-Pi 2

3.2 Wifi Router Configuration

The Wi-Fi unit provides the medium for communication it can be also configured to make security services. The Wi-Fi should be configured with a certain address and user commands will be directing through Wi-Fi unit. You may use sudo nano /etc/network/interfaces for configuring Wi-Fi with raspberry-pi[4].

3.3 Raspberry-Pi 2

Raspberry pi is an embedded system which is debian optimized having ARM processor. It is single “on chip” computing hardware.

3.4 Relay Board

A relay is an electrically operated switch. [4] Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), where several circuits must be controlled by one signal in our system the output from raspberry is directly given to relay circuit. According to the out of raspberry, corresponding relay will turn on and makes its device working.

3.5 Appliances

Appliances are the basic electronic devices of the house which is to be handled or manipulated using Raspberry. It can be a light bulb, fan, AC, etc.

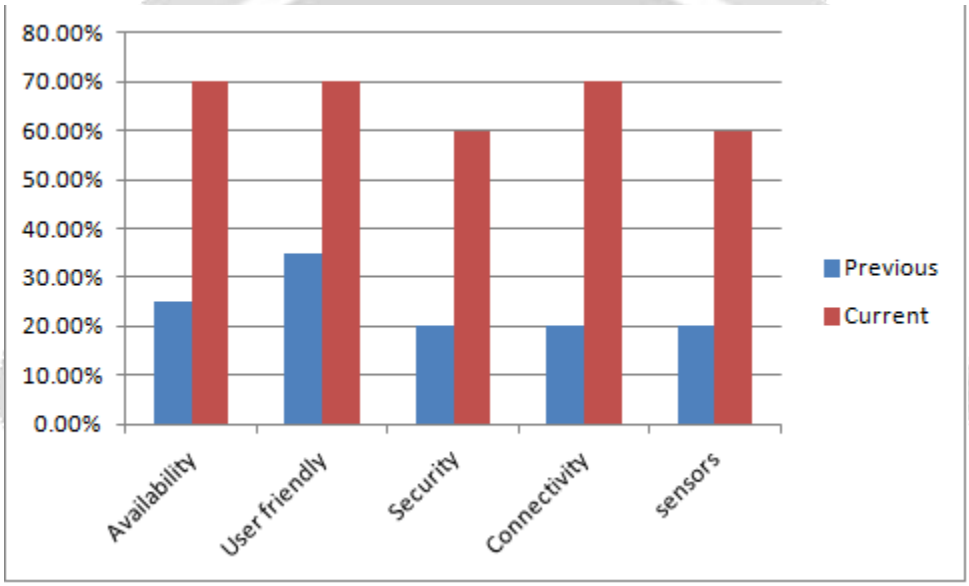


Chart - Comparative Chart of previous system and our system

4. ALGORITHM

1) Start.
2) Login if user is registered, else go to registration page.
3) Show the UI displaying rooms, appliances and their current status(ON/OFF) to users
4) If pressed ON, switch on the appliance if not ON, or Vice versa.
5) On button pressing, send a post request to the Pi server and the status of the device is changed accordingly.
6) If a person enters the room, the Lights are switched on automatically.
7) End.

5. PROS and CONS

5.1 Pros

a) Scheduling function to turn on and turn off electrical device worked as planned.
b) [2] Database used on Raspberry Pi could maintain the last state of the switch. Thus, in a case of system failure, whole system will be restored to prior condition before the failure occurred.
c) Web based interface could be deployed to control electrical device remotely. Those would work on any platform that support web browser [2].
d) Voice command could be used in future to manage the state of electrical device.

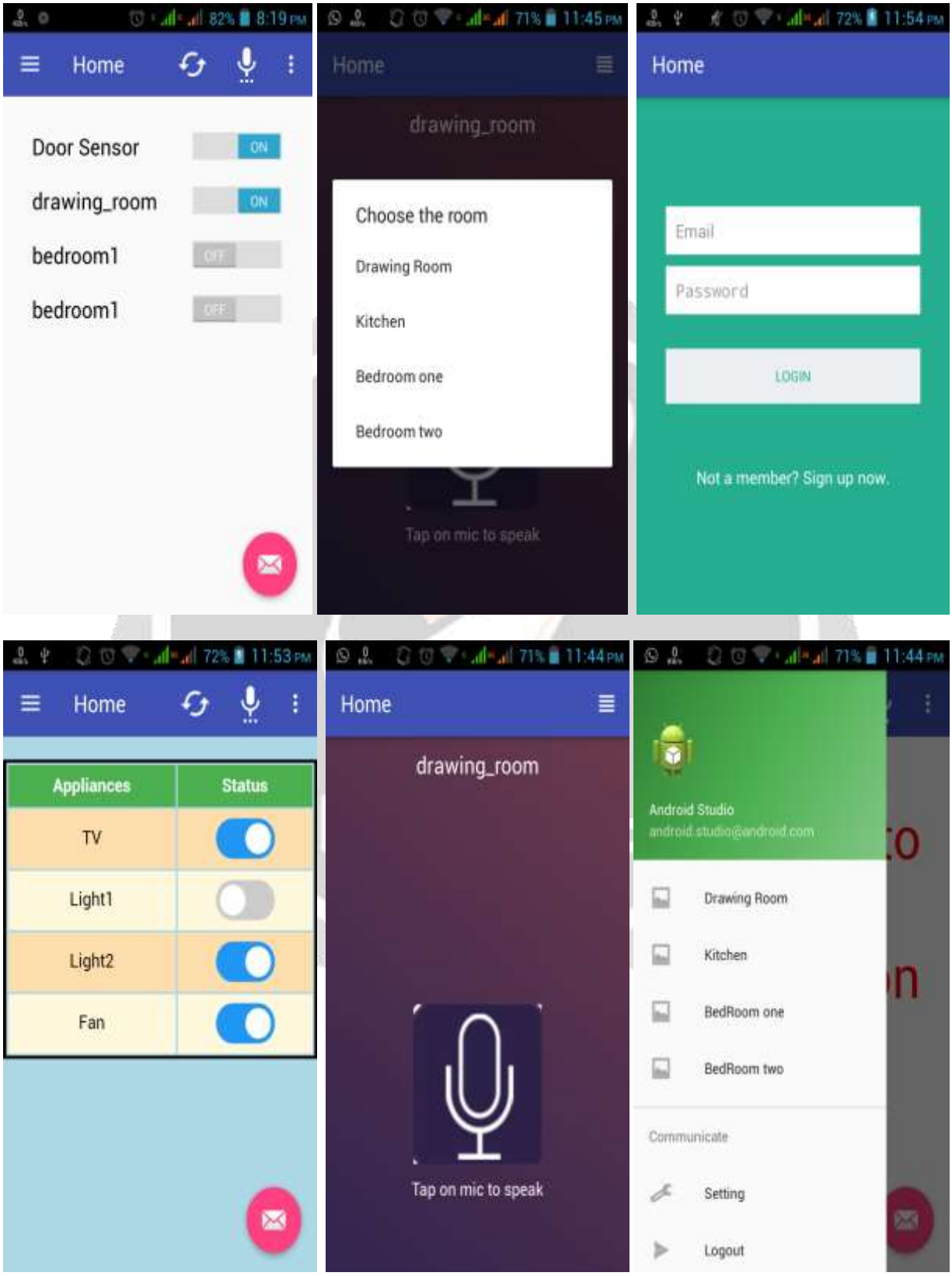
5.2 Cons

a) The system could only monitor digital state of the switch. Thus, this system could not manage ambient device.
b) Scheduling system activated approximately 1 minute after raspberry activated [2].
c) [2] Voice command controller performance is relied on internet connection therefore it is expected to have a noticeably delay on poor internet connection area. Obviously could not be used without internet connection.

4. CONCLUSIONS

This paper shows that the automated home could be build using relatively cheap and widely available SBC like Raspberry Pi[2]. This main contribution of this research is providing automated home or smart home with seamless operation of the system by the means of voice command, offering new experience in their home. However, detailed configurations of the system could be performed remotely via web [2]. User could use computer, laptop, table or even Smartphone as long as it has web browser.
The remote control includes software and hardware components such as web server, smart phone, Raspberry pi card and an interface card [5]. Many codes have been developed and stored in the web server, smart phone and the raspberry pi card. An interface card has been realized to update signals between the actuator sensors and the raspberry pi card. The application has been installed and tested. [5]
This work can be generalized to remote command of multiple domestic equipments.
In addition, it may be more autonomous, more practice, and quite scalable saw the giant step and progress in the areas of technology and communication in our time.

5. GUI IMAGES


Home
Door Sensor
ON
drawing_room
ON
bedroom1
OFF
bedroom1
OFF
drawing_room
Choose the room
Drawing Room
Kitchen
Bedroom one
Bedroom two
Tap on mic to speak
Email
Password
LOGIN
Not a member? Sign up now.
Appliances
Status
TV
Light1
Light2
Fan
Android Studio
android.studio@android.com
Drawing Room
Kitchen
BedRoom one
BedRoom two
Communicate
Setting
Logout

6. COMPARATIVE ANALYSIS

Parameters	Traditional HACS	HACS Using raspberry pi
Gas sensing	Yes(Uses Analog O/P)	Yes(Uses Analog as well as Direct Signal O/P which responds quickly)
Automatic presence detection	x	Owing to RIP (Rapid Infrared Radiation)
Scalability	Comparatively less	Owing to Pi face rack
Voice based Commands	Less accurate and pre-recorded	Owing to Google API, more accurate and uses generic voice
Interrupt Alert	x	Present
Delay	More	Less(Depending on Internet Speed)

7. RESULT

The User is successfully able to change the status of the devices or appliances in the house using the Android Application. This application provides the user two ways to manipulate the devices. a) Provides the User interface displaying different rooms and the corresponding buttons for appliances. b) Prompts the user to give the voice commands in a specific pattern or manner.

The Login System helps to avoid any external access to the household devices. To avoid the tedious job of login in every time the user opens the app, we have created a UserSessionManager Class in the App which help manages the Log in sessions.

User also has the option to enable and disable the sensors present in the house. In case, for local network, the raspberry pi is assigned a different Ip address, then also the user can use the current ip of Raspberry Pi using the app without making changes to the Code, making it user friendly.

The server is running on the Raspberry Pi 3 model B. The Open source Server Software named Apache helps to create a server on Pi. The LAMP (Linux, Apache, Mysql, Php) is installed on Pi. Mysql Database server is running on Pi which stores the essential information of the Users in the house, the rooms and their devices with the current statuses. Database helps to retrieve the last status of the devices when the system starts up.

Python Scripts are used in order to handle the electronic components like sensors, Relay board, etc. This System is real time. When the user voice is given in as input, delay occurs depending on the internet speed.

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