Home Automation using Smart Watch

U. Rahul Varma
(Bachelor of Technology)
Department of Electronics and Communication Engineering
GITAM University, Visakhapatnam
Andhra Pradesh, India

A. V. S. S. Bharadwaj
(Bachelor of Technology)
Department of Electronics and Communication Engineering
GITAM University, Visakhapatnam
Andhra Pradesh, India

ABSTRACT
The process of Home automation is now widespread these days which is used in numerous day to day applications in variety of industries. This paper proposes an efficient and a quick solution for controlling of various home appliances using a smart watch. This is implemented using a raspberry pi board which uses flask framework and python programming for developing a web application that can communicate with home automation app on the Pebble Smart watch. The home automation app for smart watch is developed using JavaScript that uses Pebble API.In this paper basic variables, ON state and OFF state of an appliance are displayed in the home automation app in the smart watch.

Keywords
Raspberry Pi, Raspbian OS, cloud pebble SDK, Flask framework, Python, Java-script, Relay, Bluetooth.

1. INTRODUCTION
Home automation is anything that your home does for you automatically to make living there more enjoyable or productive. Home automation, at the intersection of rapidly developing technologies such as Internet, mobile communication, and renewable energies, has changed considerably over the course of the past years [3]. Up to recently, home automation was mainly focused on installing controllable power-outlets or light switches and wiring infrared (IR) controls around the house. The rapid developments in mobile communications have introduced a technological leap forward in home automation. Wireless networks (3G, 4G, and Wi-Fi) and smart devices, with wireless communication interfaces (Bluetooth, Zig-Bee, Wi-Fi), are omnipresent, and allow the user to take home control and building automation to the next level [3]. Home automation today can deliver capabilities that have a real impact on comfort, security, and energy conservation in residential and industrial buildings. The smartphone and tablet revolution has finally brought the personal, universal remote control device to the home. Proprietary, stationary panels and control devices are phasing out, being replaced by apps, which are easy to operate, to maintain, and to upgrade. With the improved usability and capabilities, the motivations for installing home intelligence have become broader as well [3]. The vision of a green building, capable of significantly reducing energy and water consumption, is finally becoming real. Other new applications are safety management, home automation for the elderly and disabled (assistive demotic) and remote building control. Finally, smart homes allow for integration with smart power grids, driven by renewable energy generation on the rise. Smart meters and smart gateways can only work if a home control and automation infrastructure is in place. Smart meters can contribute significant energy savings without impacting the comfort level of residents. Another application for state of the art home automation is remote building control and safety management with features such as Controlling the vacant home (temperature, energy, gas, water, smoke, wind, Presence simulation to keep out intruders, Assistive living systems allowing elderly and handicapped people to stay home safe through reminder systems, medication dispensing, blood pressure, pulse monitoring and emergency notification. Technological advances, climate change, and demographic transition have redefined intelligent homes from a futuristic niche for geeks and luxury home owners to an integral part of the life of millions [3].

2. SYSTEM OVERVIEW
Figure 1 shows the entire block diagram at higher level of the home automation using a smart watch. The smart watch is paired with the smart phone using Bluetooth and the smart phone is connected to the internet using Wi-Fi networks using a wireless router. Raspberry Pi is connected to the internet using a category 5 cable also called as cat 5 cable using the RJ-45 Local Area Network (LAN) port that is provided on the Raspberry pi board to a Router or it can be connected to the internet connecting a Wi-Fi dongle to the USB port that is provided on the Raspberry Pi board. The general purpose input output (GPIO) pins are connected the 8-channel relay according to the input pins provided on the raspberry pi board. All the appliances are connected to the 8-channel relay.

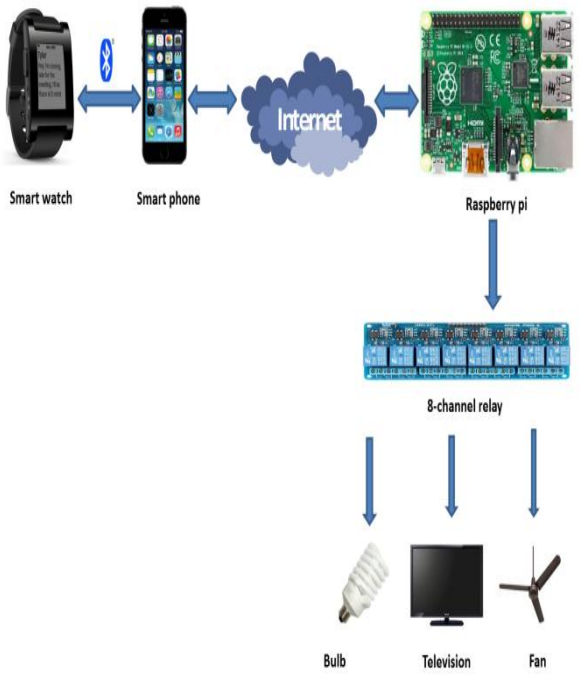

Figure 1: System Architecture

3. HARDWARE DESIGN

This section will discuss about all the hardware that is used for the home automation using smart watch.

3.1. Raspberry Pi

Figure 2 is a Raspberry Pi which is credit card sized single-board computer that uses a Broadcom BCM2837 SoC(system on chip) with a 1.2 GHz 64-bit quad-core ARM Cortex-A53 processor, with 512 KB shared L2 cache.it is powered with an 5V,2.5A adapter that is connected to Micro USB port that is provided on the board. Raspbian Operating System is installed onto a Micro SD card and it is inserted into the Micro SD slot that is provided on the board [4].

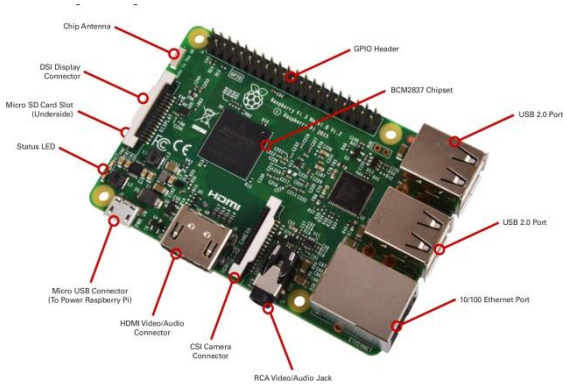

Figure 2: Raspberry Pi board

Figure 3 shows the pin labelling of the Raspberry Pi board. This board has a total of 40 pins and of these there are a total of 26 GPIO pins. The output pins are BCM 17, BCM 18, BCM 27, BCM 22, BCM 23, BCM 24, BCM 25, and BCM 04. BCM pins that are used for this are 17,18,27,22 and the leftover pins are used as reserved pins which can be further used to connect additional home appliances.

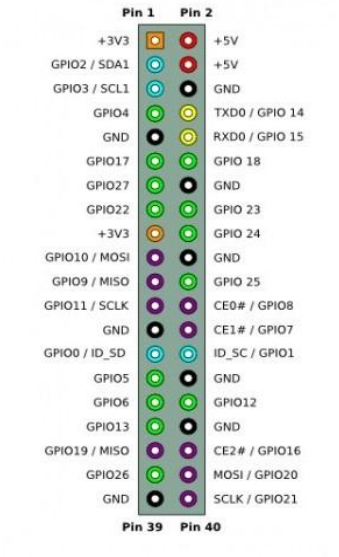

Figure 3: Pin Diagram of raspberry Pi

3.2. Smart Watch

Pebble smart watch is used for the implementation of this home automation. This watch has a 144 × 168 pixel black and white memory LCD, a vibrating motor, a magnetometer, ambient light sensors, and a three-axis accelerometer. It can communicate with an Android or iOS device using both Bluetooth 2.1 and Bluetooth 4.0 (Bluetooth Low Energy). The watch is charged using a modified USB-cable that attaches magnetically to the watch to maintain water resistance capability.it has inbuilt Lithium-ion battery. The CPU is in Pebble smart watch is STM32F205RE Cortex M3 and the RAM size is 128KB of which 84KB is used by operating system, 24KB for the App, 12KB for Background worker, and 8KB for app services [8]. Figure 4 shows the pairing of android smart phone with Pebble smart watch. Now to connect Pebble watch with any smartphone; Pebble App should be downloaded from the App Store onto the smartphone. Launch the Pebble App on the smartphone and tap on the GUI icon tap to connect your pebble and now accept the pairing request on your smart watch.

Figure 4: Android phone paired with Pebble Watch

3.3. 8-Channel Relay

Figure 5 shows the 8-channel relay module.8 Channel Relay Board is a simple and convenient way to interface 8 relays for switching application. Input voltage level support is TTL as well as CMOS. It can be easily interfaced with Microcontrollers based projects and Analog circuits.it can handle AC supply directly for home automation and this module will work same as home distribution panel board. This 8-channel relay module is operated at 5V,and each one needs 15-20mA Driver Current and each one is equipped with high-current relay, AC250V 10A ; DC30V 10A.

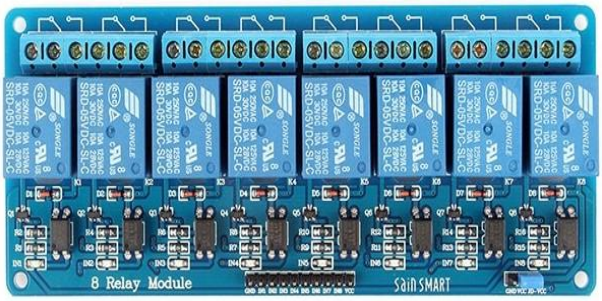

Figure 5: 8-Channel Relay Module

4. SOFTWARE DESIGN

4.1. Home Automation App

This home automation app is developed using Cloud Pebble SDK.This SDK supports both C programming language and JavaScript programming language for developing an Pebble watch App.In this home automation App is developed using JavaScript programming language.

Figure 6 shows the development environment of the Pebble SDK called the cloud Pebble

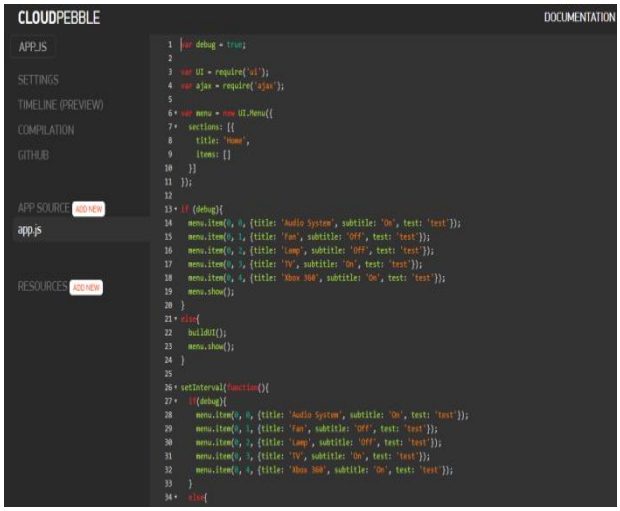

Figure 6: Pebble SDK (Cloud pebble)

This SDK also provides an inbuilt virtual emulator of the smart watch that has a screen and 4 virtual buttons that are Back, Up, Down and Ok buttons. This app has the graphical user interface (GUI) icons for all the appliances that are connected to the 8-channel relay module [9].

4.2. Web Service

A web Service is built using Flask framework and python programming language that is able to communicate to the requests from the smart watch and provide responses to the watch App.This is a RESTful API that adheres to the REST architectural constraints. It has all the standard HTTP methods like GET, PUT, POST, and DELETE.REST systems aim for fast performance, reliability, and the ability to grow, by using reusable components that can be managed and updated without affecting the system as a whole, even while it is running [6].

4.3. Raspbian Operating System

Raspberry Pi is a computer that runs on a Linux based operating system. In this application Raspbian OS is uses. This OS is mounted on a micro SD card by downloading the Raspbian OS image file and making the micro SD into a bootable card. After the OS image is mounted this card is inserted into the provided micro SD slot. When then the power supply is ON then OS starts booting and a terminal is displayed in which the default username and password are given then this will take to the home start the GUI interface [7].

5. METHODOLOGY

Figure 7 shows the algorithm for controlling the appliances using smart watch. Using this algorithm all the appliances can be turned to either ON or OFF state [1]. The smart watch which is used to control the home appliances can be accessed through a home automation app. This process is initialized by opening the home automation app in the smart watch. In this App, all the GUI icons for the appliances are displayed and controlled [1].

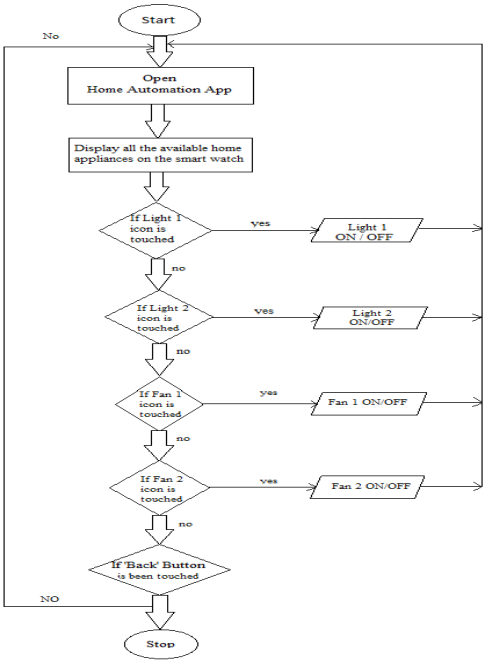

Figure 7: Algorithm for Home Automation using Smart Watch

6. RESULTS

Table 1: Experimental result

Input	Button	GPIO	Output
Light 1	ON/OFF Light 1	17	Change of state from ON to OFF and OFF to ON
Light 2	ON/OFF Light 2	18	Change of state from ON to OFF and OFF to ON
Fan 1	ON/OFF Fan 1	27	Change of state from ON to OFF and OFF to ON
Fan 2	ON/OFF Fan 2	22	Change of state from ON to OFF and OFF to ON
Exit from the App	Back	-	Get Back to the home screen of the smart watch

Table 1 shows the experimental results obtained of home automation. Each GPIO pin on the raspberry pi is assigned to a particular home appliance which serves as a control button function to turn on/off the lights and fans [1]. Figure 7 shows the algorithm of the system. When the GUI icon of a corresponding appliance is selected then this app communicates with the phone over a Bluetooth protocol. Then the app inside the phone sends the request to the web service that is based on the Flask framework, at the appliance side the raspberry pi processes this request and transitions the GPIO

pins accordingly so the relay module that is connected to this raspberry pi is transitioned from ON to OFF and OFF to ON.

To exit from the App the back button is pressed then the home automation App is exited and home screen of the smart watch is displayed.

7. ACKNOWLEDGEMNTS

Our thanks to the experts who have contributed towards development of the template

8. CONCLUSION AND RECOMMENDATIONS

This paper demonstrates themore user friendly way to control the home appliances than home automation using smart phone because it removes the necessity of searching the mobile and taking it out of the pocket every time. Using this system you can control the appliances from any location on the earth. This system can be used easily by all the age groups and especially it provides most benefits for physically challenged people as well as elderly people without the need to go towards the switches to turn them ON and OFF.

Further recommendations for this system are to enhance the smart watch App by calculating the energy usage and by collecting this data to perform analytics on them. Also additional sensors can be added to each room so that when a person enters and leaves the room the appliances automatically ON and OFF respectively. Many other concepts such as Home Intrusion Detection, Voice Recognition, and Home Security can be integrated into this flexible and customizable system. Finally this paper presents easy way to control home appliances.

9. REFERENCES

[1] Jamil, M. Mahadi Abdul, and M. Shukri Ahmad. "A pilot study: Development of home automation system via raspberry Pi." *Biomedical Engineering (ICoBE), 2015 2nd International Conference on*. IEEE, 2015.

[2] Narender, M., and M. Vijayalakshmi. "Raspberry Pi based advanced scheduled home automation system through E-mail." *Computational Intelligence and Computing Research (ICCIC), 2014 IEEE International Conference on*. IEEE, 2014.

[3] Kyas, Othmar. "How to Smart Home." *Tanggal akses terakhir* 3 (2013).

[4] Upton, Eben, and Gareth Halfacree. *Raspberry Pi user guide*. John Wiley & Sons, 2014.

[5] Lutz, Mark. *Learning Python*. " O'Reilly Media, Inc.", 2013.

[6] Grinberg, Miguel. *Flask Web Development: Developing Web Applications with Python*. " O'Reilly Media, Inc.", 2014.

[7] (2016) Download the Required Operating System. -[Online].Available:http://www.raspberrypi.org/downloads/

[8] (2016) Pebble smart watch.[online].https://developer.pebble.com/tutorials/

[9] (2016) cloudpebble SDK.[online].https://cloudpebble.net/ide/