Smart Integrated and Portable System with Gesture Control using IoT

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Abstract—The ease of usability of any appliance is paramount. The traditional way of controlling any appliance requires use of switch or remote. This paper provides an aid in usability of appliance by bringing a technological change in how we control them. In this paper, we propose an integrated system that can control equipments using various gestures. In the proposed system, we are developing a smart watch that has various sensors that detects gesture and triggers the functioning of equipment according to user’s requirement. Simple movement of hands: horizontal, vertical or circular, can be used to control devices over a wireless network. The watch can be programmed as per user requirements, for e.g. Controlling Car, Controlling Robotic arm etc. The scope of this project extends over various fields having limitless applications. The main advantage of the proposed system is that the applications of this watch are vast and also provides a modernized approach.

Keywords—IoT, Smart Watch, Control Center, Smart Gesture Control, GUI

1. INTRODUCTION

Internet of Things has many definitions in literature. IoT is described as the vast network of devices connected to the Internet, including smart phones and tablets and almost anything with a sensor on it – cars, machines in production plants, jet engines, oil drills, wearable devices, and more. It has immense possibilities with various applications. One of its significant application is Home Automation. Imagine controlling all your home appliances from anywhere inside or outside your home.

In this paper, we contribute to this field of study by proposing a smart home automation system development. The proposed framework mainly focuses on three functionalities Reliability, Portability and Ease of Use. Firstly, it gives access to both user and system administrator to define set of rules called scenarios\cite{1} based on which system can automatically operate. In earlier systems as in\cite{1} [2] [4], a user could not operate devices from outside home; in our system it gives the user an ease to control devices from outside the house. Secondly, it is a portable system, user does not need to go near the device to control it as in [1]. Thirdly, it has the ability to support various kinds of end devices (e.g. Sensors and Actuators) in the market with less efforts in terms of development time and manpower. The last one is that the whole system is configurable.

2. PROPOSED SYSTEM

2.1 SYSTEM ARCHITECTURE

The system is implemented using Raspberry Pi 3 with Raspbian OS\cite{11}\cite{13}, ESP8266\cite{10}, MPU-6050 (accelerometer, gyroscope)\cite{8} and various other sensors and batteries. The Raspberry Pi 3 is used as a smart watch that selects appliance. MPU-6050, an accelerometer and gyroscope sensor, which is interfaced with Raspberry pi 3, is used to sense the gesture. The ESP8266 is used as control center\cite{2}, which communicates with appliance to perform action as per gesture. To reduce power consumption, the whole system is in sleep state initially and remains in sleep state unless invoked (started). The figure below gives an architectural overview of the proposed system.

![Fig 1. Simple Architecture of Module](image-url)
2.2 FRONT END:

**GUI:** The front end consists of a GUI for smart watch, having various applications such as calculator, notes, etc. The TkInter module is the standard Python interface which is used for developing the main application’s GUI [12]. The GUI displays list of appliances that are integrated with the system. Icons of respective appliances can be used to make interface more interactive and easy to use.

2.3 BACK END:

2.3.1 INTERFACING:

Fig 3. Interfacing Raspberry Pi and MPU6050 [9]

2.3.2 GESTURE DETECTION: MPU-6050 an Accelerometer and Gyroscope sensor on board will detect the hand gestures, which will be in accordance with the universal hand-gesture vocabulary and will generate values as per gesture [5]. After selecting the appliance from GUI, MPU-6050 starts sensing the movement, based on which operations are performed.

2.3.3 COMMUNICATION AND WORKING:

MQTT (Message Queue Telemetric Transport Protocol)[14][10] is used to transfer generated data from Raspberry Pi to the control center [2] through Wi-Fi [7]. The control center is connected to all the appliances i.e. fans, lights and doors [3]. The Wi-Fi module of control center receives the data transmitted by the smart watch and feeds it to the appliances to perform required tasks [1]. The purpose of this architecture is to minimize the physical efforts and to reduce power consumption.

2.4 ALGORITHM:

**Step 1:** Start
**Step 2:** Check whether smart watch is connected to Wi-Fi or not
**Step 3:** If not then try connecting again
**Step 4:** If yes, Go to next state
**Step 5:** Enter the sleep state where appliances are not active, until they are selected
**Step 6:** Select appliance from the list of appliances displayed on the smart watch
**Step 7:** Perform the appropriate gesture
**Step 8:** If gesture not performed, go to step 5
**Step 9:** If gesture performed, perform the required action
**Step 10:** Go to step 5, until invoked again

Fig 4. Simple Flowchart of Module
3. IMPLEMENTATION

Whenever we turn on the smart watch, it automatically searches for control center and connects to it Wi-Fi. After connection is established, smart watch enters sleep state or energy saving state [6]. When user desires an action to be performed, he has to tap on the screen of smart watch so as to wake it from sleep state. The GUI will display list of appliances that are integrated into the system. The user has to select appliance which he intends to operate. Once the appliance is selected, the backend of the system will automatically invoke the appliance [1] and thus, the appliance is ready to receive commands. Using the universal hand-gesture vocabulary, hand gesture user can command appliance as per requirement [5]. As mentioned in [5], it is important to follow a universal hand-gesture vocabulary, which specifies the tasks that will be executed by the devices on performing a particular gesture. This will not only avoid the confusion among the users as to what gestures should be performed to carry out a particular task, but will also make them understand its functionality with ease. Based on command, the actions will be taken by the appliance [1]. Once the action is performed, the watch will again go into sleep state. If the user further wants to operate some other appliance, he will have to perform the same tasks again as mentioned above. If the gesture is not performed, the watch will wait for some amount of time for the user to try again. If that does not happen, then it will automatically go into sleep state. By doing so, the robustness and the power efficiency are further increased. Also with the availability of Wi-Fi in almost every household today, the overall cost of the system is reduced.

4. FUTURE WORK AND CONCLUSION

In this paper, our proposed system not only helps in reducing the physical efforts and power consumption but it also bring about a technological change in how we manage and control our equipment. The proposed smart watch provides an innovative and creativity approach to reduce and simplify day to day activities.

In the future, we will increase the robustness and durability of our system by using advanced communication protocols. Using renewable energy such as solar energy we can extend the lifespan of battery. The smart watch can also be linked to Internet and hence we can control objects over large distances.

5. REFERENCES


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