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Wireless Gateway for Internet of Things

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ABSTRACT: Now days as technology improves the use of wireless devices are incorporated in all fields. This paper illustrates the development and implementation of a wireless gateway for multiple sensor parameters measuring systems and controlling system used for home automation. Control of all these devices have two major parts one is local control and another one is cloud based control. This system is designed for good transmission range, flexible network structure with special emphasis on the wireless node side on efficient power management and to bring cloud based control and local control on a common mobile terminal. Because of Internet of Thing (IoT) devices have become cheap, they have become wireless and they are so small and low power devices they can be embedded into home appliances. However controlling of these devices is to be simplified by commonly used terminal is mobile phones. The advantage of using mobile phone is less learning curve, cheap platform and very sophisticated wireless message platform. We have try to build a control interface on the mobile platform, however the mobile platform has to communicate to the IoT devices without have to going to Internet using Intranet if it is perceives that IoT devices in direct range else if it is perceives that it is out of range then it has to automatically switch over to Internet. When it switches over to Internet used cloud based synchronize mechanisms to talk to devices remotely and do the same function.

KEYWORDS: Gateway, IoT, ZigBee, Router.

I. INTRODUCTION

A communications protocol is a system of digital rules for message exchange within or between computers. In the field of automation the gateway provides access to the embedded devices to be controlled remotely, however with modern wireless communication technology, it is possible to enable the user to operate such controls wireless from a remote location. Such a system provides several advantages such as through the integration of information technologies with the embedded environment, avoiding energy wastage among wireless technologies. Information communication and control has becomes adapted with IoT's with worldwide standard that enables seamless integration of home appliances, devices in offices and home automation system to be controlled by remote control using standard mobile phones and laptop over Internet. However it is not necessary that one should use Internet for controlling devices within house when they are in house [3]. Require an intelligent bridge to connect various types of devices to Internet or Intranet and enables seamless common control mechanism on user interface on standard phones and laptop etc. to control heterogeneous and that's how convention of building this gateway. Why it is called gateway main thing is on one side that devices have heterogeneous protocol to control in a communication devices. It should not bother about what is the meaning of message it is going inside gateway [4]. It should only bother about how to handle and transmit communicate from one end to another for given message. The actual meaning need to be known only on cellphone side and device side in between we no need to know what is the meaning is. However various devices have took different type of interface it is necessary for a gateway to be able to talk to devices which have different interface on one side and the common internet protocol on other side. In such scenario due to the legacy people will not change all home appliances because they have to use internet. It is important adapt whatever common standard therefore the gateway required in between. The gateway we build which take care heterogeneity in protocol. On device side it might be Wi-Fi connection or it might be ZigBee connection or it might be Bluetooth connection these and all heterogeneity present on device side [5]. It would be 2G connection or it might be landline connection or it might be simple SMS based

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connection we cannot distinguish. The purpose of gateway it might be any device does not bother about what we are using on the coming to home need not worry about whether on other side device may be Bluetooth, Wi-Fi or ZigBee whatever all heterogeneity mapped away by gateway. Conventional home devices can connect this through Internet and through the gateway any internet device can communicate to the home appliances that define the purpose of gateway. With this, it will become possible for example, for a user to switch on the air conditioners while leaving his office so that the house is warm by the time he reaches home. Yepeng Ni et al. made discussion that the ZigBee network that used in development of smart home [2]. For gateway purpose they made use of S3C2440 controller. VT6656 Wi-Fi module connected to controller through USB and JN5148 ZigBee module connected to it. The IoT gateway for wireless sensor network bridging and Industrial wireless gateway adapted ZigBee and GPRS protocol [1]. We have done the gateway in exhausted way such that the gate can choose any protocol to communicate for example Bluetooth, ZigBee Wi-Fi etc. not only that when it in the range user feel that the devices are controlled by using these communication protocol when out of range it automatically switch over to cloud based control. We adapted the IoT it makes the gateway cheaper low power consumption compare to the all earlier gateway.

II. SYSTEM DESIGN

A) System Overview

The overall block diagram of the proposed system is shown in Figure 1. The gateway has two type of control first one is local control and another one is cloud based control .Local control is for when gateway in range to any

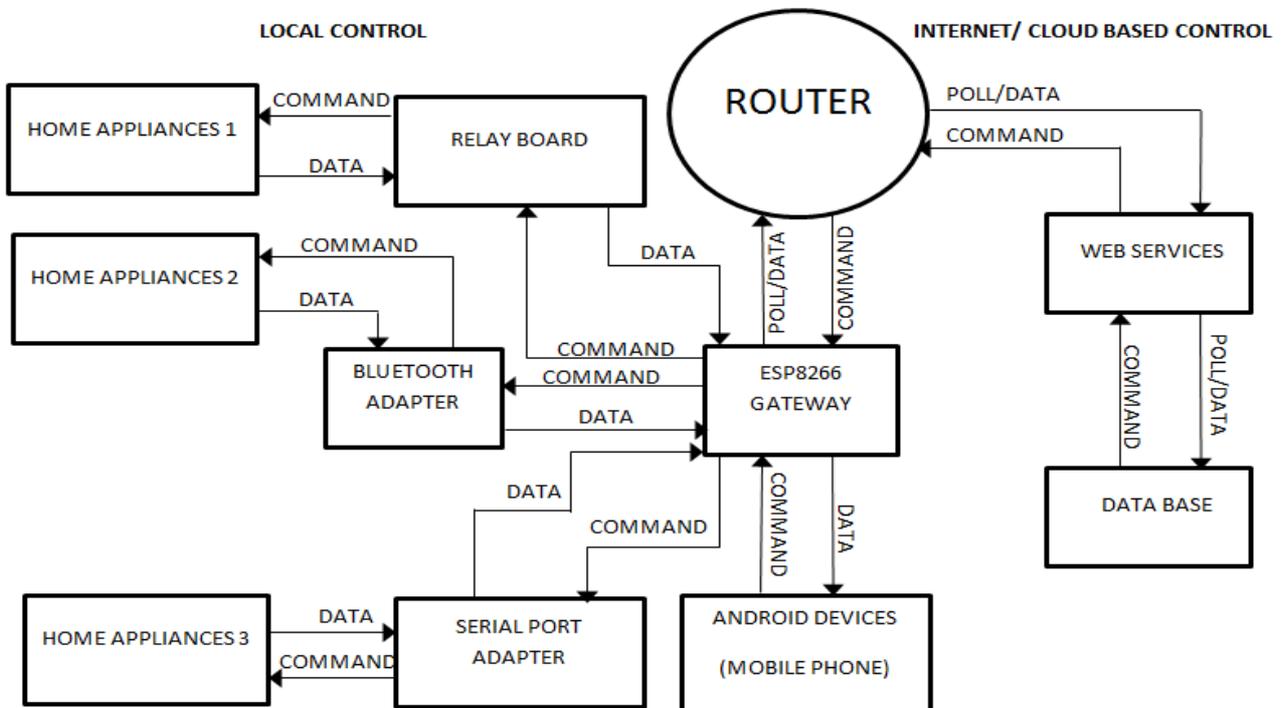


Figure: 1 Overall block diagram of the wireless gateway.

Android devices and cloud based control for out of range control.

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B) Work flow

Gateway has Bluetooth Wi-Fi and ZigBee communication protocols when any user wants to connect his mobile to gateway it can be choose any communication protocol which is comfortable. After choosing particular communication protocol it should select the particular MACID for the Bluetooth if it selected Bluetooth or SSID for Wi-Fi and press the content button to join the gateway. When phone connected to gateway it will posturize same on mobile phone. After connection what all control can be done are displays on screen of phone. For an example if it switches on the light which present at hall then it should be select the particular button which is assigned for that. When user selected that button the command goes to gateway and process that command and send the command to switching on the light. Once light got switch on then the acknowledgment will be sent back to gateway the same acknowledgment sent back to phone such that phone will realize that light in on condition. If gateway in out of range then mobile need to communicate with web services for sending command for the acknowledgment mobile phone ask for database where the response are stored.

C) Data flow

User selected switch on the particular light which is display on the screen of mobile phone that command will come to gateway in the gate way we put intelligent to process that command to detect which device user feel to switch on. To reduce the payload of data which transfer to gateway and easy processing we given a particular id for all the devices this is displaying on the screen of mobile. If the user wants to switch on lamp he will select the lamp name that is displaying on screen when he select that lamp assigned id will come to gateway and process that send command to switch on the particular lamp. For separating control signal flow to houses and security reason we used separate MACID, SSID and password for particular user. Only known person can be able to connect that gateway and send command. All the information about gateway user id device id is encrypted and sends in SOAP format and it will be having SSL certificate.

D) Control flow

The user want to send command for switching on any devices which is automated it need to connect mobile phone to gateway. As mentioned earlier there are two types of control one is local control when the devices are in range it will select the local control if the devices are not in range the mobile need to be detect the condition and switch over to the cloud based control. For the detection of device out of range first user need select all communication protocol one by one. After all communication protocol no one getting enough range it automatically switches over to cloud based control and send command. For the acknowledgment also mobile phone need to ask web services and get acknowledgment from data base.

E) Algorithmic flow

Figure 2 shows the Algorithmic flowchart for wireless gateway. Here mobile phone looking for local control searching for Bluetooth Wi-Fi or ZigBee any one in the range mobile phone connect to gateway module and send command. When gate way receive that command process that send same command to device. If the devices are in the out of range it will connect to nearby router and call web services and database do the process same as local control for acknowledgment again it will call database. In algorithm it is also mentioned when particular phone ask to connect to gateway that will display on screen it will ask for the particular password to connect this help to maintain the security.

III. TEST AND RESULT

For the test purpose we selected one biomedical device connected to Bluetooth adapter to gateway, For the Wi-Fi communication protocol we selected a light source and for ZigBee we connected to sensor devices to ZigBee adapter then all this devices will connected to gateway. All these devices are showing on the screen of the mobile phone.

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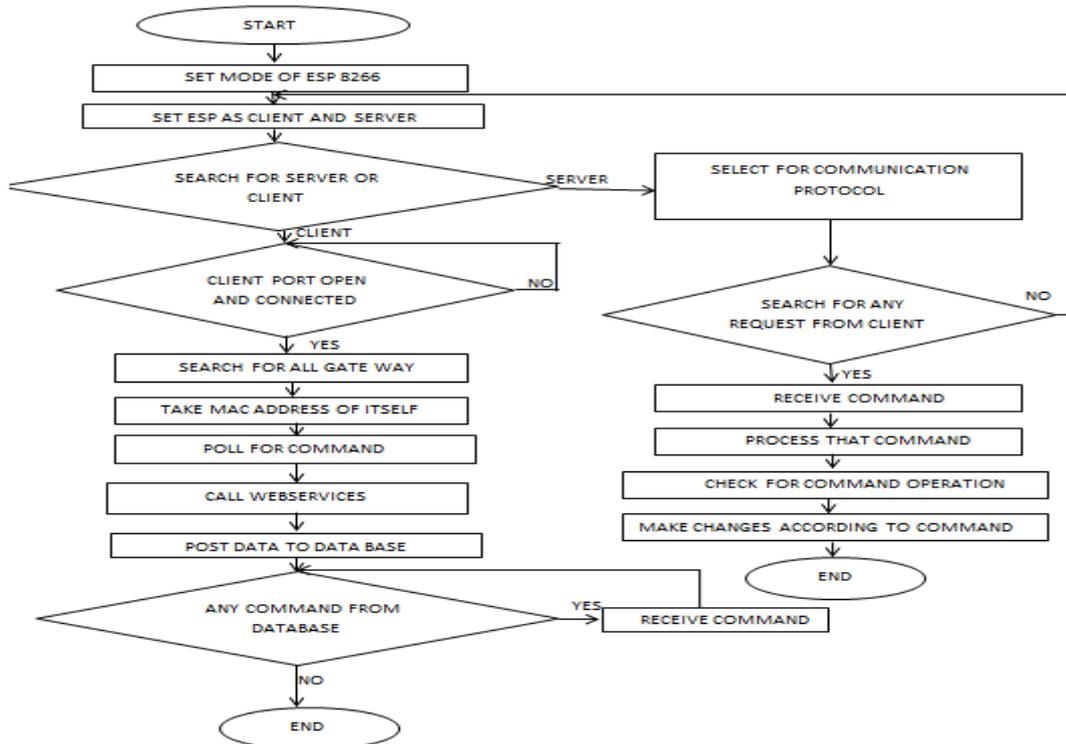


Figure: 2 Algorithmic flowcharts for wireless gateway

If we want to control the biomedical device which is connected to wireless gateway through Bluetooth adapter it needs to select Bluetooth in mobile phone and make connection send command and we observed that command received on device side for all Communication protocol which we used in gateway.

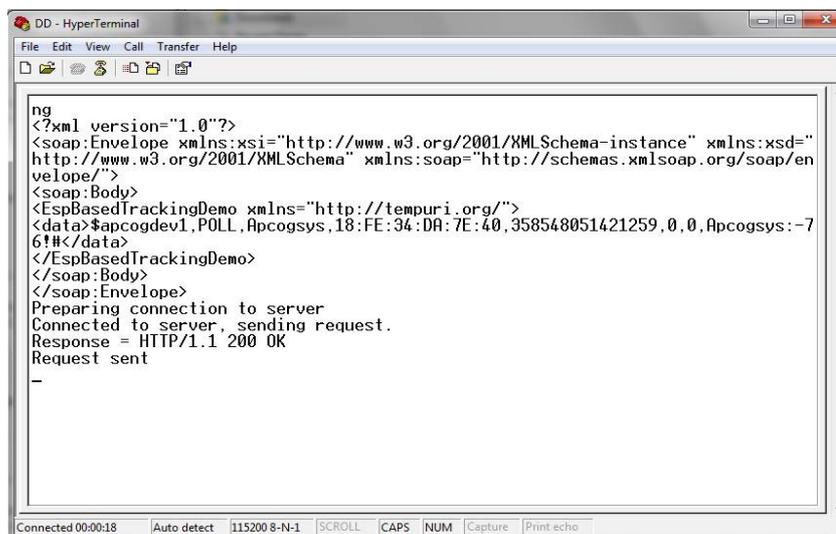


Figure: 3 Response form web service

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For the cloud based controller controlling signal came from web side here also gateway distinguish for particular communication protocol and transfer command and data. We also used router as mobile we used 2G SIM card and tested we used 3G SIM card and tested and also directly connected to a router and observed the result showing in Figure 3. Also we checked for latency for the Wi-Fi it took 10 seconds to connect to gateway even if port is open for Bluetooth it took 4 second. If more devices are connected to gateway it need to give some delay for the connection once it connected it can communicate continuously.

IV. CONCLUSION

Wireless gateway for IoT is bridge between networks which follows different network protocol. It can adapt any communication protocol to communicate. When gateway in the range it will provide the range up to 100m to 150m and it require very less power compare to all other earlier gateway because of IoT. It can be used in various fields such as home appliances, medical technology various industrial application. Future this gateway can be improved such way that reduce the latency of connection and improve the number of devices connected to single gateway.

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