Presence Detection and Home Automation Using Bluetooth and Android Application

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ABSTRACT: Wireless communication has been and will always remain an interesting subject for years. They represent the need of ease of use and flexibility of communications in the computer world without jeopardizing the communicated content. Busy environment and personal limitation has the market going towards the home automation and networking andBluetooth is an ideal solution for this purpose[1]. This report demonstrates a simple home automation system[2] which may be used not only to control electrical appliances but also to avoid power wastage at home and workplaces.

KEYWORDS: Bluetooth, Arduino, home automation, networking, HC-05, MIT App Inventor, Android, power wastage.

I. INTRODUCTION

Bluetooth is a wireless technology standard for exchanging data over a short distance using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz, from fixed and mobile devices and building Personal Area Networks (PANs)[3].
In this project, we have used an arduino circuit to connect the Bluetooth module HC-05 wirelessly to our smart phones. We have built a custom android application using MIT app inventor 2, which can detect the presence of user within a work place/home. When the user is at home, they can control each appliance individually using the app[4]. They can save their settings. When they go out of their house, all appliances are automatically turned off and when user returns home, the saved settings are again resumed.

II. RELATED WORK

To design this system we first need a custom application. This app was created on 'MIT App Inventor 2'[5] as shown by [11] we can easily create a home automation application on android. Then we installed this application on our Smartphone devices. We already hard code the Bluetooth address of the Bluetooth module which we want to access for usage. Once we establish the connection automatically as shown by [9] when the application is started we can switch on or off whichever devices we want as a universal remote, which are accessible through the application e.g. Lights, fans, Wi-Fi router. But the difference here is that whenever the user's smartphone is not around the micro-controller senses the same and saves the settings and switches it off only to resume when the user is back[6]. Although the maximum distance after which connection is lost, when not manually switched off, is around 30 feet for an HC-05 module which is enough to switch off the devices in a country like India where house are not so big[7]. Of course, this can be improved by allotting separate controllers for each room and calibrating the range of Bluetooth module therein for that particular room.

III. SOFTWARE

A. *Designing the Application:*

Figure 1: MIT app inventor blocks[8].

Above blocks shows that smartphone proceeds to connect to the default saved Bluetooth address, whenever the application screen initializes to sense the presence of user or display an error message if he/she is not around any recognized devices[9].

Figure 2: The program for the app contd.

There is also provision made to connect to any other paired modules around to control them, manually. These devices can be found in the list picker.

Figure 3: The program for the app contd.

Here you add all the recognized devices into a list picker.

Figure 4: The program for the app contd.

Then comes the part to send instructions to the micro-controller over Bluetooth. To ensure the data is received correctly by the micro-controller it is surrounded by start and end markers, '<' and '>', respectively[10].
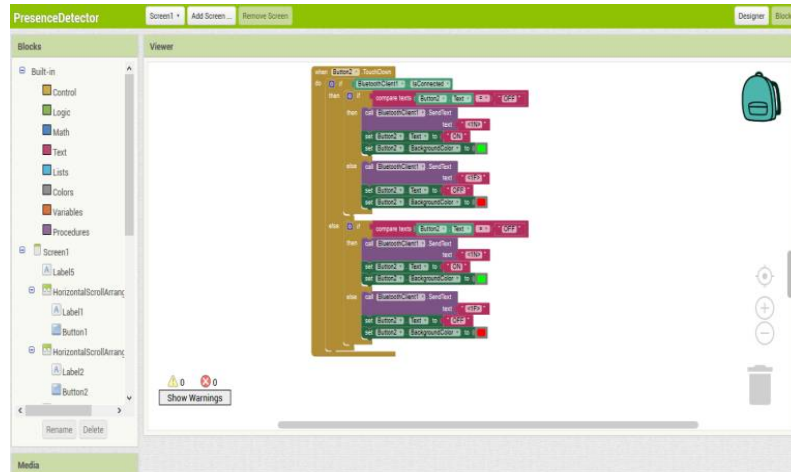
Figure 5: The program for the app contd.

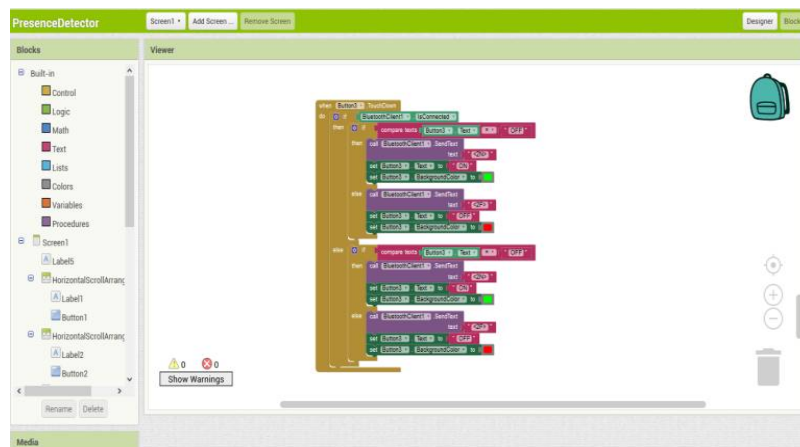Then you customize the colours and text according to the action made.

Figure 6: The program for the app contd.

After this, you save the application as an apk file and then install it on your android phones.

B. *Programming the Arduino:*

We have used Software Serial library for serial communication between the devices and recvWithStartEndMarkers function is used as mentioned above to receive data correctly. This function is looped to check if there is any new data and if yes then parseData function will deal with it, which is explained wonderfully by Martin Currey on his Arduino website[11].

The addition here is that we use HC-05 state pin as an indicator for proximity of user to his/her workplace. Whenever the state pin turns low all the current settings are saved in memory and are resumed whenever the state pin turns high again.

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```
void loop()
{
  if (BTserial.available() > 0)        {
    recvWithStartEndMarkers();
  }
  if (newData) {
    parseData();
  }
  state = digitalRead(statePIN);
  if (!state) {
    if (flag == LOW) {
      pin1 = digitalRead(LEDpin1);
      pin2 = digitalRead(LEDpin2);
      pin3 = digitalRead(LEDpin3);
      flag = HIGH;
    } digitalWrite(LEDpin1, LOW);
    digitalWrite(LEDpin2, LOW);
    digitalWrite(LEDpin3, LOW);
  }
```
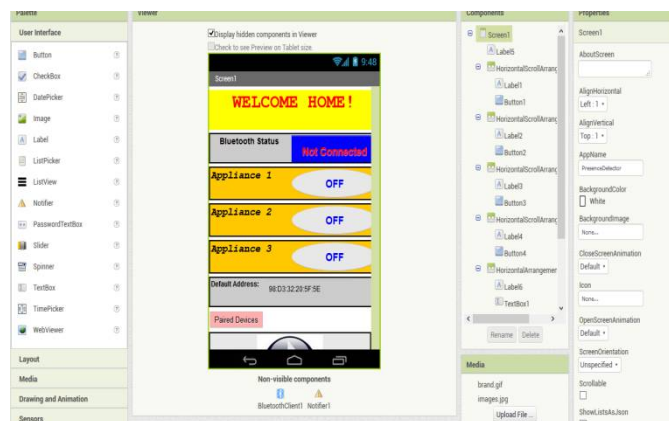
Figure 7: Arduino Sketch.

Figure 8: Application Design.
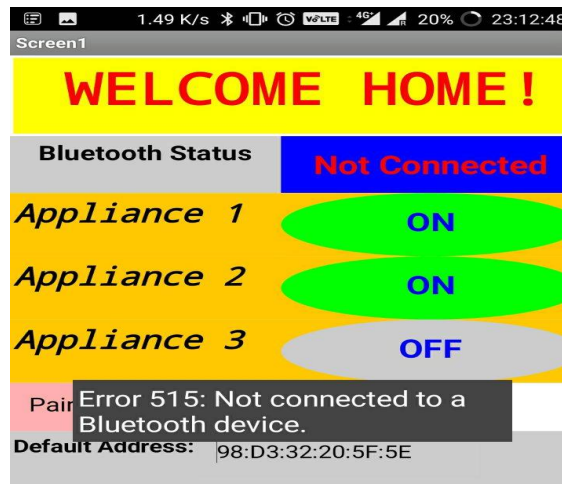
IV. SIMULATION RESULTS

Figure 9: Display of the app on the mobile.

This is how the application will look like on our smartphones. You need to enable Bluetooth on your phone and pair the device at first.

Figure 10: Saved Bluetooth addresses.

This is the list picker where all the previously used devices can be found.
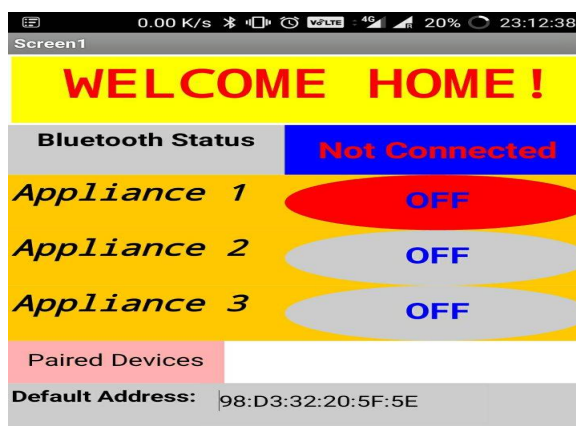
Figure 11: Saving Customizations.

You can customize the settings you want as scene above.

V. SETUP AND COST

Sr. No.	Component	Model	Cost (INR)
1.	Microcontroller	Arduino Uno	~ 400-500
2.	Bluetooth Module	HC-05	~ 300
3.	D-cable and battery.	Li-Po. 9V. 1200 mAh	~ 1000
Total			Rupees 1800

Figure 12: Setup.

VI. CONCLUSION

Electricity wastage is one of the most common issue in India. Even if a fraction of energy is saved in urban areas we can provide the same energy to the rural villages of India were electricity is desperately needed. Nevertheless, as technology progresses, electricity-friendly products have to be manufactured. Our project has the same motive. It helps in saving electricity and although it is a very crude solution but it still manages to avoid unwanted electricity wastage and also reduce our electricity bill.

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