Real Time Implementation of Accessible Display Design to Control Home Area Network.

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Abstract— Recently, the communal inclusion and methodological support to pledge autonomy to people with incapacities are getting courtesy all over the world. This work presents a display design for accessible interaction in home area networks. Grounded on a research on the accessible interfaces state of the art, an interface design was projected. In this paper by using technologies such as Android and Some Google API services, the handicap persons will interact with appliances through a mobile phone. The scheming of GUI is very modest so anyone can interact easily. By this concept, the physical handicap person accesses the appliances remotely.

Keywords— Employment, Arduino, HC-05 Shield, COB LED.

I. INTRODUCTION

Embedded Systems are now becoming a part of people’s life beginning with smartphones that help them to stay intact with the digital world to embedded web servers that are capable of interconnection digital devices. At the same time, the rapid development in Internet Technology made internet-based remote monitoring increasingly common. As with the growing needs for automation of appliances and maintaining a network that can monitor and control these appliances, it is a major challenge to develop a cost effective and reliable system. Focusing on the use of home area networks to improve disabled people’s autonomy at home, this paper presents a display design for accessible home control [3].

With rapid advancements in computer technology and with the emergence of high-performance embedded processors the electronics market is undergoing a revolution. In the presently existing system, controlling home networks is by switching the board which needs some human effort. Thinking about users with disabilities, it is necessary to invest efforts in the research and development of accessible interfaces, through the perspective of a universal design which is easy to learn and use as well. This paper proposes an accessible display to develop an interface based on Arduino board which is used for controlling various appliances at home using Bluetooth shield wireless ensuring autonomy to especially abled people. The design strategy of the display was to use few large graphical icons with horizontal captions describing their function. This improves legibility and accessibility of the design and it is easy to use and learn for everyone. The design approach can be called as Universal Design-design for all. In order to bring Smart home papers closer to the reality, this accessible display can be a luxury item for many people, which could play a key role in assuring the autonomy of people with disabilities and making human’s life easier [4].

Automation has become a de facto standard in our daily lives. The number of home automation systems installed is estimated to reach around 200 million by 2011. 

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Many firms have begun investing in technologies such as the RF ID to meet the increasing demand of providing real-time information to the home automation networks.

The internet is currently the most efficient way to control or monitor home appliances. The “smart home” concept has emerged in the early 1980's when “smart building” concepts started to be used. In those years,
smart homes were designed only for user convenience [5]. “Smart homes” have smart technologies having remote or centrally controlled functions and services. In a smart home, the inhabitants’ wishes and needs concerning all or some part of equipment and functionality have priority [2]. Employment to Population ratio has increased drastically with increasing living standards. Home Automation plays an important role in maintaining these living standards of employed population by providing a secure & convenient environment. The Home Automation Systems not only benefit the employed population, but it also helps the disabled and elderly population. The aim of our system is to build a perfect companion for someone to be at home. Our system is a computer-based system user have to send the command to ON/OFF the light.

The figure 1 illustrates that the accessible display design to control Home area network in that “Accessible” word indicates that this concept will be useful in industry, school, colleges, office etc. “Display Design” directs the adequate GUI model. The “Control Home Area Network” directs the managing the home appliance such as ON/OFF or controlling.

This research could consolidate a feasible interface to control home area networks pointing out the main requirements for home area networks considering a diversified group of impairments [3].

![Image](image_url)

**Figure 1 Overview**

**II. LITERATURE REVIEW**

(a) Accessible Display Design to Control Home Area Networks: They present a display design for accessible interaction in home area networks. Based on a research on the accessible interfaces state of the art, an interface design was proposed. This interface was implemented over a Tablet that controls the domestic devices through a home network controller prototype. This interface integrates accessible interface ideas in a single portable interface that can contribute to people with disabilities autonomy at home [1].

(b) Accessibility in Digital Television: Designing Remote: This paper describes that, Brazilian free to air television is the population’s main communication and entertainment media. However, the lack of assistive technologies, keep the people with disabilities excluded in many ways. They made such an interface of remote which is attached to wheel chair [7].
(c) **Soft Remote Control System in the Intelligent Sweet Home**: In this paper, we describe the “Soft Remote Control System” that provides easy control of home installed appliances to improve the inhabitant’s comfort. This system is feasible to control various home appliances naturally by recognizing the user’s hand gestures in the “Intelligent Sweet Home” [10].

(d) **Health Smart Home - Towards an assistant tool for automatic assessment of the dependence of elders**: This article presents an approach enabling the activity recognition for an elder living alone in a Health Smart Home equipped with noninvasive sensors [11].

(e) **A Comparative Study of Musical Navigation Methods for Visually Impaired Users of GUI Systems**: Graphical user interface (GUI) systems were considered as obstructions for the visually impaired users since it relied too much on visual channel. Thus, various auditory stimuli combined with speech served as complementary communicating methods in these systems [12].

(f) **The Design of a portable touchscreen interface for power line domestic**: This paper concerns the study and the realization of a portable touchscreen interface designed for the control of domestic systems, Used IR to interact with appliances [13].

(g) **Integration of Wireless Fieldbus and Wired Fieldbus for Health Monitoring**: In this paper we introduce how to combine a wireless Fieldbus to an existing wired Fieldbus by presenting an example for health monitoring of elderly people in an automated home environment [14].

(h) **DEVELOPING A VOICE CONTROL SYSTEM FOR ZIGBEE-BASED HOME AUTOMATION NETWORKS**: This paper presents the design and implementation of a voice control system for ZigBee-based home automation networks. In this system, one or more voice-recognition modules have been added to the ZigBee-based networks. The recognized control messages are sent by these modules then be routed to the target device, and finally be carried out by controlling circuit [15].

III. PROPOSED WORK

![Figure 2 General Block Diagram](image_url)
Table No.1 Home Appliances and controlling structure

<table>
<thead>
<tr>
<th>Sr No.</th>
<th>Device</th>
<th>Room Name</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Bulb</td>
<td>Bed Room</td>
<td>1. On</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. OFF</td>
</tr>
<tr>
<td>2.</td>
<td>LED</td>
<td>Kitchen</td>
<td>3. ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4. OFF</td>
</tr>
<tr>
<td>3.</td>
<td>LED Control</td>
<td>Hall</td>
<td>5. Level 20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6. Level 40%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7. Level 60%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8. Level 80%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9. Level 100%</td>
</tr>
<tr>
<td>4.</td>
<td>AC</td>
<td>Drawing Hall/ Bed Room etc.</td>
<td>10. ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>11. OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>12. Temperature ++</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>13. Temperature --</td>
</tr>
<tr>
<td>5.</td>
<td>TV Remote</td>
<td>Guest Room</td>
<td>14. ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>15. OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16. Channel Up</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>17. Channel Down</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>18. Volume Up</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>19. Volume Down</td>
</tr>
</tbody>
</table>

IV. IMPLEMENTATION

The following flow chart depicts the main theme of this concept. In this concept have the five main modules shown in the chart.

Main Module:
The algorithm is as follows
Step 1: Initialization of process
Step 2: Launch the Android app.
Step 3: Check the HC-05 shield Connection
Step 4: Sends Android command to Arduino
Step 5: If connection is made properly and command received by Arduino then go to further
Else go to Step 3.
Step 6: Select any module.
1. Bulb Controlling
2. LED Controlling
3. LED Brightness Controlling
4. TV Remote Controlling
5. AC Controlling.
Step 7: Stop the Process.
Bulb Controlling Module

In this module, the user will launch the android app when user will click on this app the MAC address of Bluetooth is already provided in code which will directly connect to the cell phone. There is no need of pairing and all. Figure 4 shown the bulb controlling flow chart.

Programming Techniques

Android Side:

```java
// SPI UUID service
private static final UUID MY_UUID = UUID.fromString("0000180e-0000-1000-0000-00805f9b34f1");

private static String address = "00:0D:33:F8:11:33";
```

Figure 5 HC-05 MAC Address

```java
@Override
public void onResume() {
    super.onResume();

    Log.d(TAG, "...onResume - try connect...");

    // Set up a pointer to the remote node using its address.
    BluetoothDevice device = btAdapter.getRemoteDevice(address);

    getRemoteDevice();
```

Figure 6 Auto Connect to Bluetooth.

In figure 5 UUID is an immutable representation of a 128-bit universally unique identifier (UUID). There are multiple, variant layouts of UUIDs, but this class is based upon variant 2 of RFC 4122, the Leach-Salz variant. This class can be used to model alternate variants. In this, the MAC address is directly provided through coding. So the user need not to worry to pair and need not to provide passkey.

The MAC address is taken from above the process will start in this snippet. By using the address can be called. Later the code can be put into the try and catch block for the possibility of errors.
Figure 7 depicts the command send to Arduino kit via Android. In this code the android will send command sendData(“1”) that means the android will send a command to Arduino and the Arduino will receive it and will do further operations. The sendData() is a user defined function.

Arduino Side:

Figure 8 depicts the Arduino operation, the Arduino will receive the command from android from figure 7 the android send command 1 and 2 that will receive by Arduino shown in figure 8. The digitalWrite(2,HIGH) means the bulb will ON and digitalWrite(2,LOW) means the bulb will OFF.
LED Controlling Module.
In this module, the COB LED can be controlled using this concept.

**Figure 9** shows the connections and command sending flow to ON/OFF the LED.

LED Brightness Control
To control LED brightness is more important in day to day life we used the LED in the home, office, school, colleges etc. If we use the LED with full brightness the electricity required more unnecessarily. If we use the LED brightness as we require then electricity will save.

**Figure 10** shows the percentage level of brightness, this brightness can be control automatically or manually both mode. If we use the Auto mode the by using LDR, the light intensity will measure and as the environment light intensity the LED will adjust its brightness.

<table>
<thead>
<tr>
<th>Device</th>
<th>Room Name</th>
<th>Level of Brightness Percentage</th>
<th>Voltage Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED Brightness Control</td>
<td>Hall/ Bedroom etc.</td>
<td>Level 20%</td>
<td>110V - 130V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Level 40%</td>
<td>131V - 180V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Level 60%</td>
<td>181V - 200V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Level 80%</td>
<td>201V - 220V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Level 100%</td>
<td>221V - 240V</td>
</tr>
</tbody>
</table>

**Figure 11 LED Brightness Level and Voltage Required**

The above table shows the brightness level and required voltage as per the level of brightness. By this scenario the electricity definitely save.

TV Remote
By this concept the remote of TV also control, there is no need to search remote of your television you can directly control the TV remote by using the android cell phone.

**Figure 12 TV Remote Control**

**Figure 13 AC Remote**
Figure 12 shows the controlling of TV Remote, here control only ON/OFF, Volume up/Volume Down, Channel Up/Channel Down.

- AC remote

By this concept, the AC remote can also be controlled as shown in flow chart figure 13.

V. RESULT

The blind people faced some challenges with the tablets boarding that is the non-functional glass area around the screen. Our model had around 1 centimeter boarding around the displaying area, where the touchscreen was out of range [1].

Figure 14 shows the output screen 1, in that it has 4 sections Bedroom, Manual Control, TV remote and AC remote control and Auto control LED. The blind people can also easily interact with this screen because the size of each button is large to access.

Figure 15 shows the Output screen 2, in that it has two buttons only for ON/OFF the bedroom light.

Figure 16 shows the Output screen 3, in this it has manual control mode for controlling LED brightness. The buttons show the percentage level to control brightness.
**CONCLUSION**

The system described in this paper is economically feasible and flexible. By this system the handicapped person interact very easily. The accessible interface is simple and easy to use which does not entail any prior knowledge for operation. This concept is related to the “Green energy” that means energy saving, the LED brightness controlling is based on this concept. The “Smart Grid” is nothing but the control appliances automatically mode not the manual mode. It addresses the primary objective of accessible interfaces and also serves the purpose of commercial applications. With trivial alterations, it can be easily useful in numerous fields such as home automation, industrial control, and intelligent appliances. Consequently, it has the wide variety range of application prospects and great promotional value. The functionality of system could be further extended with the help of embedded web server technology that extends the accessibility of system through the internet with the help of web browser.

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