Accessible Display Design to Control Home Area Network

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Abstract:

The project aims in designing a system which makes operating of electrical appliances in home through Android mobile phone possible. The controlling of electrical appliances is done wirelessly through Android smart phone using the Bluetooth feature present in it. Here in this project the Android smart phone is used as a remote control for operating the electrical appliances. Android is a software stack for mobile devices that includes an operating system, middleware and key applications. Android boasts a healthy array of connectivity options, including Wi-Fi, Bluetooth, and wireless data over a cellular connection (for example, GPRS, EDGE (Enhanced Data rates for GSM Evolution), and 3G). Android provides access to a wide range of useful libraries and tools that can be used to build rich applications. In addition, Android includes a full set of tools that have been built from the ground up alongside the platform providing developers with high productivity and deep insight into their applications. Bluetooth is an open standard specification for a radio frequency (RF)-based, short-range connectivity technology that promises to change the face of computing and wireless communication. It is designed to be an inexpensive, wireless networking system for all classes of portable devices, such as laptops, PDAs (personal digital assistants), and mobile phones. It also will enable wireless connections for desktop computers, making connections between monitors, printers, keyboards, and the CPU cable-free.

The controlling device of the whole system is a Microcontroller. Bluetooth module, 4-Relays board are interfaced to the Microcontroller. The data received by the Bluetooth module from Android smart phone is fed as input to the controller. The controller acts accordingly on the Relays to switch connected electrical appliances. Also, In achieving the task the controller is loaded with a program written using Embedded 'C' language. .

Keywords

Android, Home area network, display, remote control, Bluetooth, radio frequency (RF), Embedded C.

1. Introduction

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2. Literature Review

L. C. P. Costa, N. S. Almeida, M. K. Zuffo, Accessible display design to control home area networks: The project Assistive Housing was developed focusing on the elderly comfort, allowing home automation by using the television set and its regular remote control as an interface. The design strategy used to improve the legibility and accessibility of the home automation accessibility of the home automation interface on the television screen was to use few and large graphical icons, with horizontal captions describing their function. The interaction is made through numbers as shortcuts avoiding navigation with keys. The idea of having a clean design, with few and large icons and the use of a consumer Electronics appliance that is already familiar to the user will be exploited in our work.[1]

M. Ghorbel, F. Arab, M. Monhtari, Assistive housing case study in a residence for elderly people: 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. In the past years, computational devices have turned faster, smaller, connected and cheaper. It brings the "intelligent house" vision, promised for decades, closer to reality. This pervasive, intelligent home, a luxury item for many people, could have a key role in assuring the autonomy of people with disabilities. 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 that is easy to use and to learn how to use. The design for all, also called universal design.

In this perspective, accessibility is defined as "a condition for autonomous and safe use of space, furniture and urban facilities, buildings, transport services and devices, systems and media and information by people with disabilities or reduced mobility." It is worth stressing that accessibility is not the creation of exclusive spaces for people with disabilities, which could be a form of discrimination, but rather of thinking of systems and environments, which can be used by everyone. The work was developed starting with an interface design proposal, based on the research on accessible interfaces state of the art. The interface was deployed targeting Tablets and Smart Phones interoperability. It was integrated

to control a home gateway prototype. 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. This paper is an extended contribution to the work[2]

X. H. B. Le, M. D. Mascolo, A. Gouin, N. Noury, Health smart home - towards an assistant tool for automatic assessment of the dependence of elders: The works on user interface for home automation for people with disabilities are very specific. There are works focusing on elder lies, visually impaired people, hearing impaired, people with motor impairment and cognitive disabilities. The project Assistive Housing was developed focusing on the elderly comfort, allowing home automation by using the television set and its regular remote control as an interface. There are two other relevant projects to monitor elderly using sensor networks and integrating home automation, but they do not explore user interface design .In Mainardi's work, the project is designed for people with manual dexterity and mobility impairments, but it could be widely used. The idea is to have a portable touch screen device with the proposed interface. Another work presented the use of touch screen devices combined with voice control, allowing the interaction of people with limitations in their upper and/or lower limbs, replacing the standard devices (mouse and keyboard) . The voice control systems in the state of the art are suitable for interactions with menu screens. Some works present systems based on a hardware software codesign that allows speaker independent speech recognition at an accuracy rate of 95%, without voice training .Other works present solutions of image processing for interacting without traditional interaction. A gesture based control system was developed to simplify the home automation interaction to people with mobility impairments in the Intelligent Sweet Home project. [3]

E. Mainardi, Design of a portable touchscreen interface for power line domotic systems: Domotics, Smart Home Systems, Ambient Intelligence are all terms that describe the intelligent cooperation of several different equipment's to manage the home environment in an intelligent, safe and comfortable way. The same idea is also applicable to bigger constructions, and in that case it takes the name of Building Automation. Whatever term one wants to use, it refers to a multidisciplinary field that includes informatics, electronics, automation and telecommunication, and also touches fields like building constructions and architecture. In fact, during the process of designing a building, people have to consider appropriate spaces for the electric plant, and if the presence of a domotic system is planned, it is better to take it into account during the

design phase, just to optimize spaces, the amount of used wires, and the position of the modules and so on. [4].

3. Design and Implementation

The "Accessible Display Design to Control Home Area Network" using ARM7 microcontroller is an exclusive project which is used for automatic controlling of devices depending on the input given through Google android mobile phone using Bluetooth wireless technology.
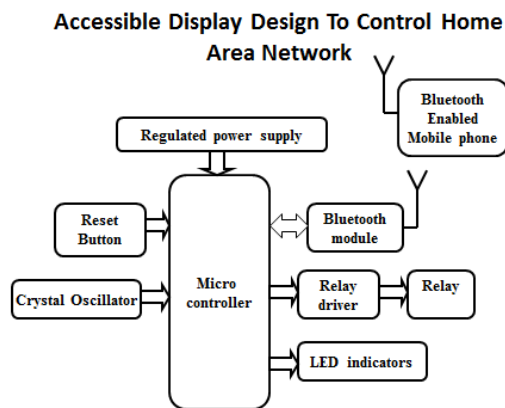

Fig 1 Block diagram of Accessible Display Design to Control Home Area Network

In order to develop a widespread and easy-to-use interface, a design approach based on icons was adopted quadrants and touch screen. The touch screen choice was made based on three factors: the widespread use of this technology on mobile devices, the touch screen intuitiveness and the possibility to include people with upper limbs impairments. Considering that people with disabilities have more locomotion difficulty, the possibility to have the home control interface on a portable device such as a smart phone or a tablet is an extra advantage. The interaction mechanism was based on "touch" and "hold pressed" events. The "touch" event selects the key and a "hold pressed" event triggers the action related to the key. The action could be to send a command or to go to a next screen in the interface. The user can say the name of any screen or key in order to trigger an action. The central button on the main menu screen activates the all control mode.

In order to integrate this interface with a home automation system, a development board with an embedded microcontroller was used. The interconnection between the tablet and the automation system was made using a Bluetooth connection that is currently available in most tablet models. A commercial Bluetooth module was used connected to the development board in order to execute the experiment.

The development cycle of our prototype included usability evaluations by users. Usability of a product is analyzed by considering user satisfaction in an approach that values your expectation and experience of use. Products developed without usability requirements can cause poor performance and a reduction in quality of product for users. Design methodology chosen to usability evaluation was Empirical Usability Method with participation of users.

In this method, real users perform tasks with the product while being observed by evaluators. Therefore, it is important to review the test conditions, making sure they are the same for all participants. Among the objectives of this method, are: predict usability problems such as learning difficulties and run-time task in the operation with the product diagnose what may be inconsistent with the standards implicit and explicit usability see, observe and record usability problems during interaction with the product calculate objective metrics for effectiveness, efficiency and user productivity through interaction with the product no opinion of user about product suggest priorities for solving usability problems based on the test results.

4. Testing and Debugging

In order for the hardware to function, the firmware code for the system has to be written. Theoretically, software that resides in the non-volatile memory and handles the operation as well as function of a system is known as firmware. The firmware holds the information that the microcontroller needs to operate or run. Thus, it needs to be free of bugs and errors for a successful application or product. There are various types of software that could be used to program ARM microcontroller.

Programs can be written in variety of languages such as C, Basic, Pascal or even Assembler. In this project, program would be written in C language to generate the required firmware for the system. The CAN protocol supports two message frame formats. The "CAN base frame" supports a length of 11 bits for the identifier , and the " CAN extended frame" supports a length of 29 bits for the identifier .Based on the CAN Standard being used either standard or extended format, the data being transmitted or received through the CAN bus has to be programmed according to the protocol.
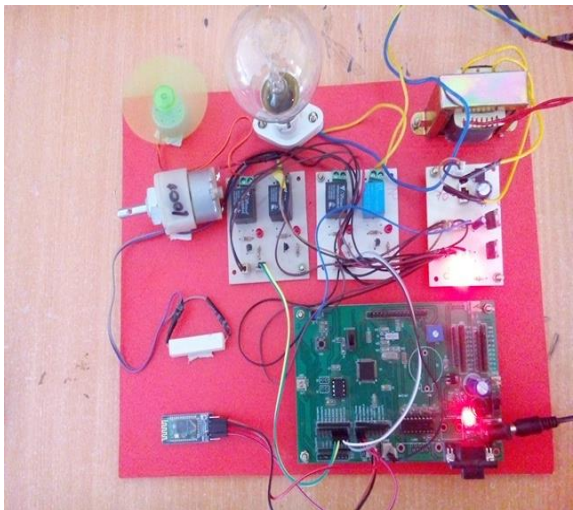
5. Simulation Results

After making all possible hardware kit connections and android mobile Application with Bluetooth the following observations are made

Step 1: we want to pair with Bluetooth for kit and mobile app

Step 2: from Mobile app we select the one key it is for fan device to turn on and off.
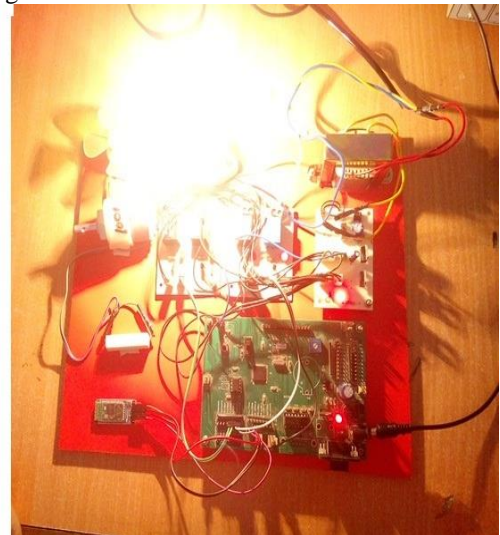

Step 3: from Mobile app we select another key it is for motor device to turn on and off.
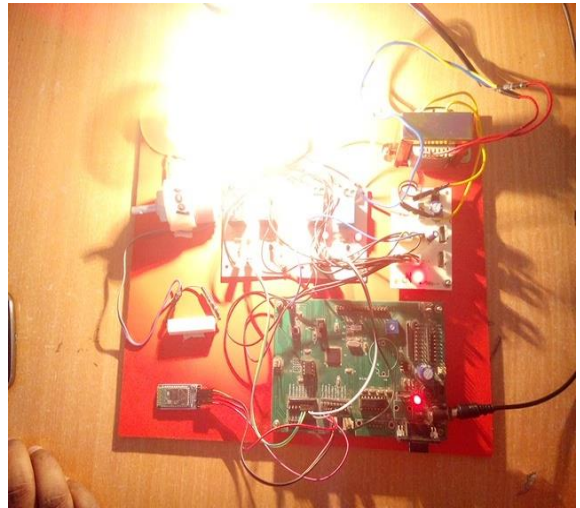

Step 4: from Mobile app we select another key it is for heater device to turn on and off.

Step 5: from Mobile app we select another key it is for light device to turn on and off

Step 6: from Mobile app we select the Top key it is for all devices to turn on and middle key it is for all devices to turn off

6. Conclusion

The project "Accessible Display Design To Control Home Area Network" was designed such that any device of electrical home appliances at homes can be operated through Android mobile phone. The controlling of electrical appliances is done wirelessly through Android smart phone using the Bluetooth feature present in it. Here in this project the Android smart phone is used as a remote control for operating the electrical appliances.

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested.

7. Future Scope

Our project "Accessible Display Design to Control Home Area Network" is mainly intended to control the electrical home appliances using Google android mobile phone. This project has a Bluetooth module, a 4-relay board to connect the home electrical appliances which are interfaced to the micro controller. The Micro Controller is programmed in such a way that depending on the received data from the Google android mobile phone the devices are operated that is will be switched ON/OFF automatically based on the input received by the Bluetooth module.

This project can be extended by adding ZigBee module and GSM module. ZigBee module can be used to monitor and control the appliances of multiple devices like lights, fans, coolers, etc. GSM module can be used to monitor the devices which are being operated from anywhere in the world.

8. References

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