Accessible Display Design to Control Home Area Networks

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ABSTRACT:

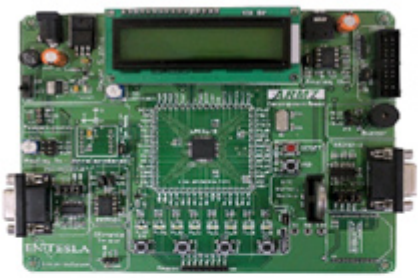
Recently, the social inclusion and technical aid to assure autonomy to people with disabilities are getting attention all over the world. This work presents a display design for accessible interaction in home area networks. Based on a research on the accessible interfaces state of the art, an interface design was proposed. This interface was implemented over a Tablet that controls domestic devices through a home network controller prototype. In order to evaluate the design, a research was conducted, interviewing people with disabilities in Brazil. This research consolidated a feasible accessible interface to control home area networks pointing out the main requirements considering a diversified group of impairments.

INTRODUCTION:

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.

PROPOSED METHOD:

In addition to the interface design, this work presents the solution to implement home automation and a sensor network to acquire context and to identify emergency situations. This project relies on power line communications. 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 order to integrate this interface with a home automation system, a development board with an embedded microcontroller was used.The interconnection between the android and the automation system was made using a Wi-Fi connection that is currently available in most android models..



LPC 2148 DEVELOPMENT BOARD

SENSORS

HOME APPLIANCES

Architectural overview:

The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of microprogrammed Complex Instruction Set Computers (CISC). This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core. Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory. The ARM7TDMI-S processor also employs a unique architectural strategy known as Thumb, which makes it ideally suited to high-volume applications with memory restrictions, or applications where code density is an issue. The key idea behind Thumb is that of a super-reduced instruction set. Essentially, the ARM7TDMI-S processor has two instruction sets:

- The standard 32-bit ARM set.
- A 16-bit Thumb set.

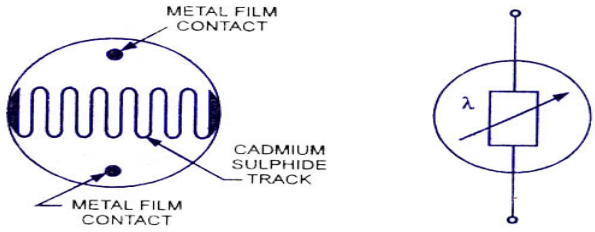
TEMPERATURE SENSOR:

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full –55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies.

LIGHT DEPENDENT RESISTOR:

An LDR is an input transducer (sensor) which converts brightness (light) to resistance. It is made from cadmium sulphide (CdS) and the resistance decreases as the brightness of light falling on the LDR increases. LDR's or Light Dependent Resistors are very useful especially in light/dark sensor circuits.

Normally the resistance of an LDR is very high, sometimes as high as 1,000,000 ohms, but when they are illuminated with light, the resistance drops dramatically.



(a) Basic Structure (b) Symbol

LDR

Liquified Petroleum Gas (LPG):

This is the generic name for a number of low-pressure, liquefied hydrocarbon gases. The most common are butane and propane. They are readily liquefied by pressurizing at atmospheric temperatures and are used in the vapor phase as a fuel with air or oxygen.A flammable liquid is defined as one having a flash point below 100°F (37.8°C) with a vapor pressure not exceeding 40 psi (276 kPa). They are volatile in nature, constantly giving off heavier-than-air vapors that cannot be seen with the naked eye. Combustible liquids have a flash point at or above 100°F (37.8°C). When heated above their flash points, these liquids take on many of the characteristics of flammable liquids.

DESIGN EVALUATION:

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 [13] [14]. Products developed without usability requirements can cause poor performance and a reduction in quality of product for users [15] [16].

Design methodology chosen to usability evaluation was Empirical Usability Method with participation of users [17]. 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; know opinion of user about product; suggest priorities for solving usability problems based on the test results.

CONCLUSIONS:

Despite working with a considerably varied group of users, with different needs, an interface suitable to them was achieved. Our interface integrates accessible interface ideas in a single portable interface that can contribute to people with disabilities' autonomy at home.

Despite being a potential solution to improve the autonomy of people with impairments, the interviews have shown that home automation is not even considered as a possible solution to these people's reality. They consider home automation a high technology solution out of their reach. It points out to the demand for researching and developing lower cost and simpler solutions.

As the next steps to this research are the improvements of the interface with the interviewees' feedback, to integrate the new explore-by-touch features available in the new tablets' operating systems libraries and the repetition of the described experiments with larger groups of users.

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