

Internet of Things concepts applied to home automation pursuing a smart house for the elderly and persons with disabilities

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Abstract

The purpose of this project is the development of a smart house to improve the independence and the life quality of the elderly and those with disabilities. The major objective is to build a network using low-cost hardwares, resulting in a accessible and a smart solution.

Key words:

Home automation, Smart house, Internet of Things

Introduction

Several initiatives relating Internet of Things (IoT) and home automation are appearing on the market, but most of them are projected to expand our comfort and usually with high cost. On the other hand, the diffusion of low-cost embedded systems and prototyping platforms increase the Do-It-Yourself (DIY) projects possibilities^[1]. Considering this scenario, this work aims to use low-cost hardware and open source software to develop a smart house with features that can help the elderly or persons with disabilities in some everyday simple tasks. This way, they can be more independent, comfortable and safer.

Results and Discussion

The project's network consists in an arrangement of sensors, actuators, radio transmitters and receivers, microcontrollers and a microcomputer. It was designed considering a house with a living room, a kitchen, bedrooms and an external area. The automation rules were developed based on the needs and challenges that the elderly and disabled persons may face while doing everyday tasks.

using the ZigBee protocol and XBees attached to the microcontroller and to the actuators. Pursuing a cost reduction, an XBee can control more than one peripheral - the hardware supports 8 I/O pins. While the Arduino controls the automation rules, a microcomputer (Raspberry Pi) gathers the peripherals information and provides it on an online server. This way, one can remotely monitor the house activity. Some examples of peripherals that were implemented on this project are: temperature sensors, relays, water sensors, RFID tags, smoke detectors and brightness sensors.

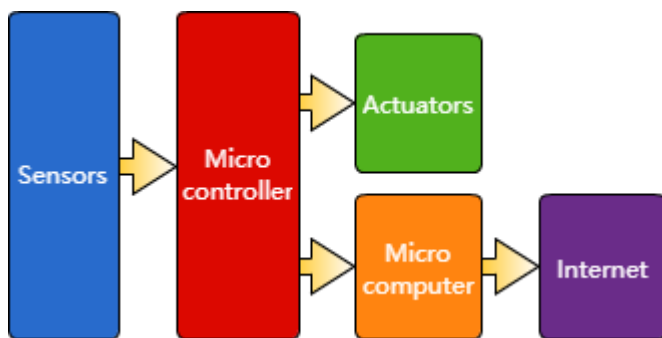


Image 1. Network block diagram

The communication initiates with digital or analog sensors coupled with an XBee. The data acquired from the sensors is transmitted wirelessly to a microcontroller (Arduino Uno) – also coupled with an XBee – using the ZigBee protocol. Arduino's embedded code has several automation rules programmed and, if necessary, a command for an actuator can be sent immediately. Again, the data is sent

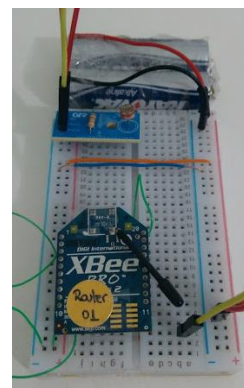


Image 2. Brightness sensor connected with an XBee acting as a transmitter

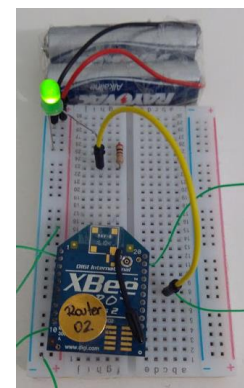


Image 3. LED coupled with an XBee acting as a receiver

Conclusions

The project is under development and we truly believe that it is a low-cost solution that can improve the life quality of the elderly and those with disabilities. Besides the help with everyday tasks, this assistive network can also be applied to nursing homes and hospitals.

Acknowledgement

This work was supported by the National Council for Scientific and Technological Development (CNPq) and the School of Electrical and Computer Engineering (FEEC) at the State University of Campinas (UNICAMP).

¹ Uckelmann, D.; Harrison, M.; Michahelles, F. and Huffmann, F. *Architecting the Internet of Things*. 2011, 279, 315.