


Toward a More Robust Home Automated System: Introducing a Voice Activation Technique via Pubnub

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ABSTRACT

The work reported in this article developed a home automated system using voice activation. This is with a view to providing users complete control over electrical appliances using simple easy to remember voice commands on an Android mobile device. This work was implemented using the Atmega 328 microcontroller, Relays and a Wi-Fi shield. The human voice is first converted to text using a Natural language processing tool from the Android based application. Thereafter, the text is sent over the internet via the PubNub to the microcontroller. The Atmega 328 microcontroller was programmed on an Arduino using C programming language and the Android based application was developed using Android Software Development Kit. Results obtained from the testing show that the implemented system achieves the mean scores of 8, 7.6, and 7.2 for ease of use, learnability and effectiveness respectively justifying the fact that the system is capable of controlling appliances by changing their state (ON/OFF) from remote a location with a response time within the reasonable limit.

KEYWORDS

Android, Atmega, Home Automation, Microcontroller, Pubnub, Voice Control

1. INTRODUCTION

Automation is currently a trending research area in this twenty-first century due to its ability to transform our daily lives and environments. It is then not surprising to see many efforts being channeled toward realizing smart homes with limited dependence on human control. While there may still be debates on whether a home with limited dependency on human intervention is beneficial to our societies, we argue that such systems bring countless benefits, perhaps the most obvious in supporting ambient assisted living. The main attraction of any automated system is therefore its ability to reduce human labour, effort, time and errors due to human negligence (Sonali et al., 2015). Various

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types of automation exist, examples are office automation, building automation, power automation and home automation as emphasized in the existing literature (Oguntimehin, 2016). As Sonali et al. (2015) suggested, the foremost aim of technology has been to increase efficiency and decrease effort.

Home automation generally allows access to control appliances in homes remotely. These appliances include lighting devices, fan, air conditioners, television set, security cameras, electronic doors, computer systems, refrigerators, etc. These appliances usually have to be designed in a special form in order to be compatible with one another as well as the control unit for most commercially available home automation (Kurian and Sandeep, 2009; Thakur and Sharma, 2013; Kumar et al., 2015). Home automation research are targeted towards needs such as sophisticated and luxury requirements and special needs useful for the elderly and the disabled (Faisal et al., 2013). Despite over a decade of disparate activity in the industry, no company has yet succeeded to launch home automation as a popular technology. The reasons for this failure include high cost of installation and maintenance, difficulty in installation, less functionality, vendor dependency, poor control interfaces, security issues and multiuser problem amongst others (Thoraya et al., 2014).

Due to the advancement of wireless communications, there have been a lot of research on how to properly adopt several types of technology such as Global System for Mobile communication (GSM), Wi-Fi and Bluetooth. Each of these technologies has its own unique specifications and applications (Sabin et al., 2014) and can be used individually or combined to control appliances in the home. Aside these technologies, existing works have shown that, the human voice can also be used to control appliances and this forms the basis for this work. Voice controlled home automation system therefore aims to improve the existing automation systems by building systems that are simpler and more effective (Ahasan, 2016; Jalde et al., 2017). Sonali et al. (2015) claimed the advantages of using voice as an interfacing medium are multifold. Firstly, there is no need of training for the operation technology. Secondly, the simplicity expected to come with such systems will lead to a wider adoption of such helping people with varied disabilities access the same technology.

Oftentimes people forget to turn off their appliances before leaving their respective homes. When they eventually remember after a period of time, they may either return back so as to switch off such electrical appliance(s) or leave the appliances on. The former decision usually results to time wasting while the later decision can lead to excessive wastage of electricity. Existing works have focused on controlling home appliances using various methods such as Bluetooth, ZigBee and infrared. These methods however limit the range at which appliances can be controlled. The need for a centralized control system capable of enabling the control of appliances from a remote location becomes imperative. The robustness of such a system will grant users access to control their home appliances which may require immediate attention even when they are not in their homes. The application of this system will improve the ease of use of various home appliances while reducing daily power consumption. Cases of occurrences for instance, leaving electrical bulbs and other appliances for too long unnecessarily can be well managed with the proposed system.

This paper presents a voice-based home automation system that uses voice activation technology through the adoption of PubNub, a data stream network to control home appliances from a remote location. In order to developed such a robust system, the objectives of the research were to design a voice-based home automation model suitable for home appliances control, we then implemented the model and evaluated the developed system in order to test its effectiveness. The developed system is capable of enabling users to change the states of their appliances remotely using voices generated from the users via an Android based application. The performance of the system was evaluated based on response time, learnability, ease of use and its effectiveness.

Following this introductory section, Section 2 elaborates on the literature review and also presents related work, while Section 3 presents the methods that have been employed in designing and implementing the proposed voice activated based home automation system. Finally, Section 4 elaborates on the performance evaluation analysis of the design system while also discussing results obtained. Section 5 concludes this paper by highlighting directions for future research.

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