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SURVEY ARTICLE

Application of WSN to Intelligent Home Automation and Power Monitoring Using Android Smart Phone- A Survey

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A wireless sensor network (WSN) is a wireless network which facilitates an interface that provides connectivity between various nodes and existing wired system. WSN are used in many real time house hold, industrial and research fields for monitoring and control. The aim of this paper is to survey hand-held devices equipped with Android app in Wireless Sensor Networks (WSN) which allows controlling of devices using a interactive GUI which can be used by any average user. Touch screen based interaction will provide easy control over various home appliances and it will also be useful in power monitoring.

KEYWORDS- Home Automation, WSN, Android smart phone, Power monitoring.

I. INTRODUCTION

The ratio of population has increased with increasing living standards. Home Automation plays an important role in maintaining these living standards of population by providing a secure and flexible environment. The home automation system not only maintains the living standards but also helps an elderly and disabled people to live their life in convenient way. The continuous growth of mobile devices and its functionalities demand for advanced mobile applications in people's daily lives is continuously increasing. The advancements lead to anyone, anytime, anywhere (AAA) Connectivity for things with the expectation advanced dynamic network [1][2]. Our home automation system is based on hand-held devices equipped with android app. This can accept voice as well as direct commands and process them [3]. In order to maintain a natural medium of communication, the house employs speech recognition system capable of analyzing spoken language, and extracting commands from it. The device provides the features as switching devices ON/OFF. In home automation the voice processing has increased significantly in recent years. With that the user can communicate with electrical appliances rather than interacting directly with devices. The performance of the home automation can be increased by avoiding signal distortion. The home automation cannot be able to switch ON/OFF if the speech recognition is poor. The voice commands such as Light ON/OF with some noises will be taken as an input. It sends to a speech recognition machine (SVM classifier).It makes a context search with existing database for a nearest keyword. If the keyword (Light ON/OF) is present mapping is done and an action is performed.
Another aspect other than speech processing the Home networking is used which act as a central server.

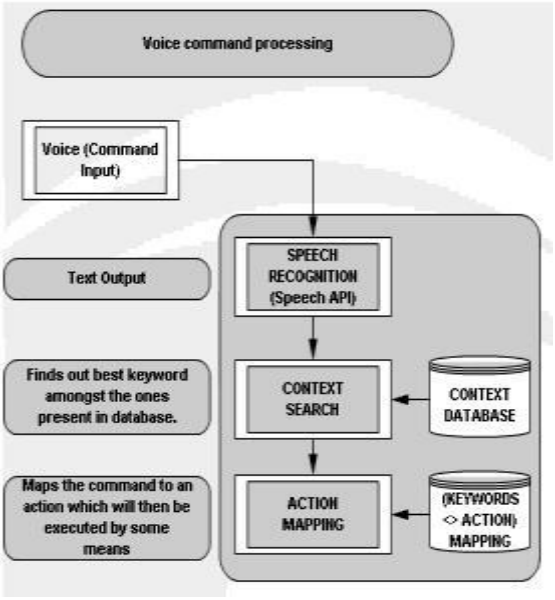

Fig. 1 Voice Command Processing

The networking in our system will use Ad hoc network to control the devices throughout the country by using efficient speech recognition machine (SVM classifier). The home automation system can be controlled in a secured way by providing a user authentication and IP address of the system.

The Ad hoc network is which it does not rely on a pre existing infrastructure such as routers. Instead each node participates in routing by forwarding data for other nodes. The server in the home networking is connected to a micro controller as shown in figure: 2, which controls multiple devices. Analog to Digital (ADC) converts sensor sensed analog signals to digital signals for the server to process. Microcontroller coordinates various actions and controls the applications. The micro controller receives the signals from various electrical appliances and performs the desired actions. The Ad hoc network used in home automation does not limits the frequency range. The microcontroller which consists of relays which is used connect the several electrical appliances.

Fig. 2 System Hardware

II. LITERATURE SURVEY

A. *Home automation in wireless sensor networks*

Home automation industry increases with increasing of user needs the automation and security is the main issue in domestic environment. As electronic technologies are emerging, the field of home automation is expanding. The home automation were designed using various technologies such as Bluetooth, Zigbee, Internet, short message service (SMS) based [1],[2]. These latest technologies give a user friendly home automation system with low cost.

The capabilities of Bluetooth are good and current cell phones, laptop, tablets have built-in-adapter that will indirectly reduce the cost of the system [1],[2]. However it limits the control to within the Bluetooth range of the environment.

Zigbee based home automation systems are used. Zigbee in home automation reduces the cost of wiring and provide reliable and secure communication. The early sensor networks were used with Routing Algorithms and RF technologies [3],[5]. The recent system have been using standard-based algorithms and RF solutions[3].ZigBee is considered as a low data rate wireless network standard as shown in table:1,with added features like low-cost, secured[7],low power consumption and fast reaction and it is most suitable for small area networks.

WIFI based home automation system uses PC based web server which connects the home devices. The system also supports a wide range of home automation devices like power management components(electrical appliances), and security components(alarm systems) .The drawback is that many devices will need to be connected to power sources, and in that some devices such as automated power outlets and need sufficient electrical power sources.

There are some challenges in designing home automation using wireless sensor networks (WSN): Single Point of Failure, scalability, Hop-by-Hop, End-to-end. The home automation system can be implemented using three alternative approaches: General packet radio service (GPRS) technology Speech and Internet. The GPRS technology used to control the signals without limiting its range. Speech is used to process the specific user commands to perform Different switching and Control systems by giving the voice signals.

A significant contribution to home automation system will be made by using the above mentioned systems. The remotely accessible home automation system is made by using Database, web server, speech recognition program and control program. The PC is used as a server that increases the cost and power consumption while others require web page hosting that adds up the extra cost. The voice recognition systems either use PC software or separate voice recognition module for speech recognition. In proposed system the speech will be recognized using Support Vector Machine (SVM) classifier and activity detection by using keyword matching algorithm by making context search in the pre-defined database as shown in figure: 1.

III. Overview Of Home Automation System

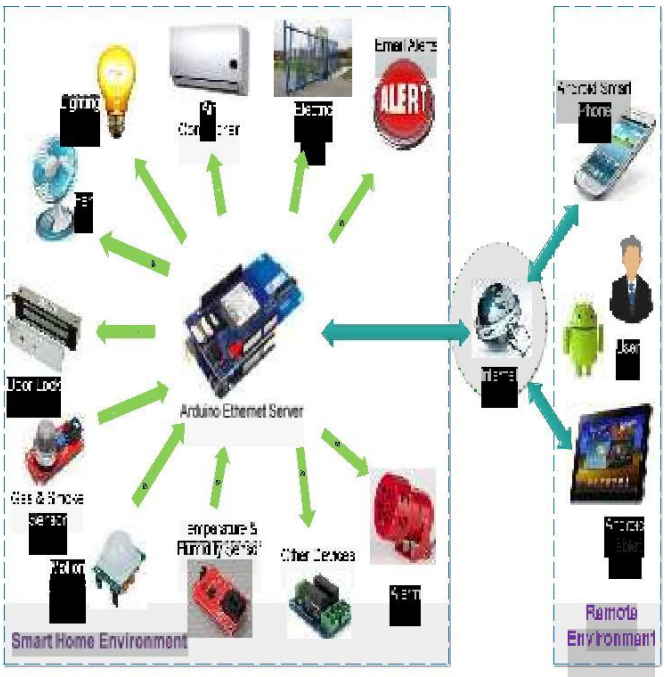

Fig 3.Overview of the proposed Home Automation system

The proposed method which uses the low cost home automation systems which controls the devices remotely by using keyword matching which is shown in Figure:1 for activity detection and SVM Classifier for speech recognition. It also uses latest technologies as hand-held devices equipped with android app for home automation and Wireless Ad hoc Network to control the devices throughout the country and providing better performance. The wireless technologies include power consumption, communication range, and security. The system consists of sensors and actuators/relays which are directly interfaced to the main controller. The home environment can be controlled and monitored using android app which will communicate to the web-server through internet. The proposed system offers the control of lighting, air conditioner, and fan. The implementation of home automation system will be based on Keyword Matching, Speech recognition using SVM classifier, Control signal program (CSP).

TABLE I
Comparison of wireless technologies

	Protocol Standard	Freq.band/ Hz	Rate/bps	Power consumption	Security	Transmission distance
Bluetooth	802.15.1	2.4G	1M	>10mW	High	10m
Wi-Fi	802.11b,802.11g	2.4G/5G	11-54M	>10mW	Low	200m
WiMAX	802.16	2-11G	70M	>10mW	Medium	30Km
	802.15.4	868/915M, 2.4G	20-250k	<10mW	High	100m

1. *Keyword Matching:* Keyword matching makes a context search with existing database for a nearest keyword. If a keyword is matched the action is performed.
2. *Speech Recognition:* A speech recognition program process voice commands by using an Android SDK and the processed voice command will then send to a CSP
3. *Control signal program:* Control signal program send a command to a microcontroller with its address and Command in bytes.

CONCLUSION

The Intelligent Home System is a voice-controlled home automation system which controls home appliances using android application over a wireless network. Voice controlling enables users a sense of comfort as no direct operation with the home automation system is required. The Android based home app communicates with the micro web-server via internet using the web service. Any android supported device can be used to install the smart home app, and control and monitor the smart home environment. A low cost smart home system has been developed in which all processing is handled by the microcontroller. Future perspectives of this work are focused towards developing an energy efficient smart home system.

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