Smart Home Energy Management System in Intelligent Building

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***Abstract* - This paper focuses on human-friendly technical solutions for monitoring and easy control of household appliances. This smart power monitoring and controlling software system has the feature of interacting with the appliances remotely through internet (application). This enables user to have flexible control mechanism remotely through a secured internet web connection. This system helps the user to control the electric appliances are ON while they are away from house. The user can monitor the condition of all appliances and do the needful. This describes a platform for developing Embodied Conversational Agents (ECA) based interfaces on Android hand-held devices. The proposed platform is based on free and open source libraries. The inhabitant's comfort will be increased and better assistance can be provided.**

Keyword: Smart power monitoring, Embodied Conversation Agent(ECA), home automation, energy management

I. INTRODUCTION

It is foreseen that service and personal care wireless mechatronic systems will become more and more ubiquitous at home in the near future and will be very useful in assistive healthcare particularly for the elderly and disabled people [1]. .Wireless sensor networks (WSNs) have become increasingly important because of their ability to monitor and manage situational information for various intelligent services. There are several proposals to interconnect various domestic appliances by wireless networks to monitor and control, but the prototypes are verified using testbedscenarios. There has been design and developments of smart meters predicting the usage of power consumption [2]–[4]. However, a low-cost, flexible, and robust system to continuously monitor and control based on consumer requirements is at the early stages of development. The paper focuses on human-friendly technical solutions for monitoring and easy control of household appliances. Use of Traic with opto isolated driver for controlling electrical appliances: No microprocessor/microcontroller. Flexibility in controlling the appliances.

II. RELATED WORK

Home control system using the sensing data and special event information from the active sensor networking infrastructure deployed in home environments. It is equipped with a low power microprocessor and a narrow-band RF device that can support physical-layer functionalities of IEEE 802.15.4. It can integrate diversified physical sensing information and control various consumer home devices, with the support of active sensor networks having both sensor and actuator components. A new routing protocol LQIR (Link Quality Indicator based Routing) to improve the performance of our active sensor networks [7]. But one of demerit is Active tags comprise an antenna, microchip, and radio transceiver, increasing the cost of the system.Tag collision arises when several tags exist in a confined region.

Another method [3] introduces smart home interfaces and device definitions to allow interoperability among ZigBee devices produced by various manufacturers of electrical equipment, meters, and smart energy enabling products. It uses the PHY, MAC and network layers are used to create and maintain the communication network interconnecting individual ZigBee devices. But Zigbee does have limitations in the area of energy use restrictions for certification, memory size, processing speed of data, and size of bandwidth

The performance of an in-home energy management (iHEM) application [11]. The performance of iHEM is compared with an optimization-based residential energy management (OREM) scheme whose objective is to minimize the energy expenses of the consumers. iHEM application is more flexible as it allows communication between the controller and the consumer utilizing the wireless sensor home area network (WSHAN). A mixture of RFD and FFD devices of IEEE 802.15.4 The 802.15.4 standard defines that there are two types of devices that can participate in a network: full-function devices (FFDs) and reduced-function devices (RFDs). The standard allows a RFD to only associate with a single FFD at any one time. Should a RFD need to communicate to another RFD, it needs to do so through at least one FFD to relay the message.

There are few a mechanism [10] for estimation of elderly well-being condition based on usage of house-hold appliances connected through various sensing units. It uses Zigbee and IEEE 802.15.4. But Zigbee Compliant manufactures slow to make an appearance on the market and high battery use.

III. SYSTEM MODEL

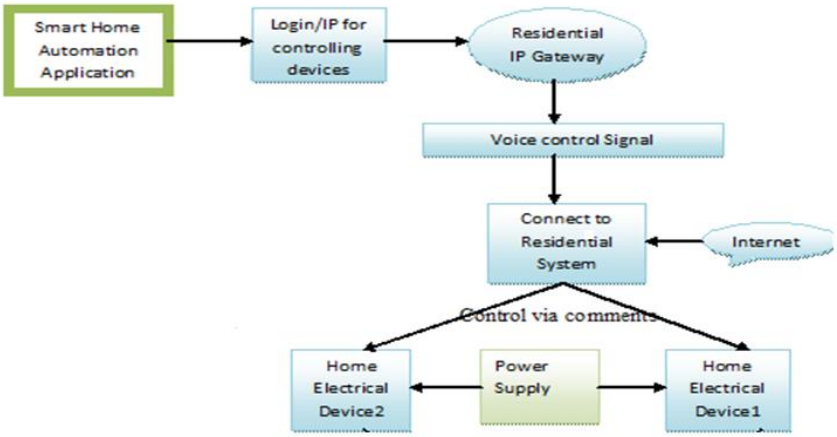

Fig. 1 System Architecture

From the above system architecture fig. 1,the home electrical appliances are controlled by using GPRS connection. Home appliances is controlled by connecting android hand held devices with system through which residential system is conrolled.

A. Voice Activity Detector:

The Voice Activity Detector's (VAD) role is to discriminate the user's voice frames from those containing noise. Figure 3.2 shows the block diagram of voice activity detector. This module reads the digitized audio samples acquired from a microphone and sends the filtered raw audio to the Automatic Speech Recognition(ASR). The actual implementation of the VAD module is based on the Sphinx Base library, which was modified so it can work with the OpenSL ES native audio libraries present on Android.

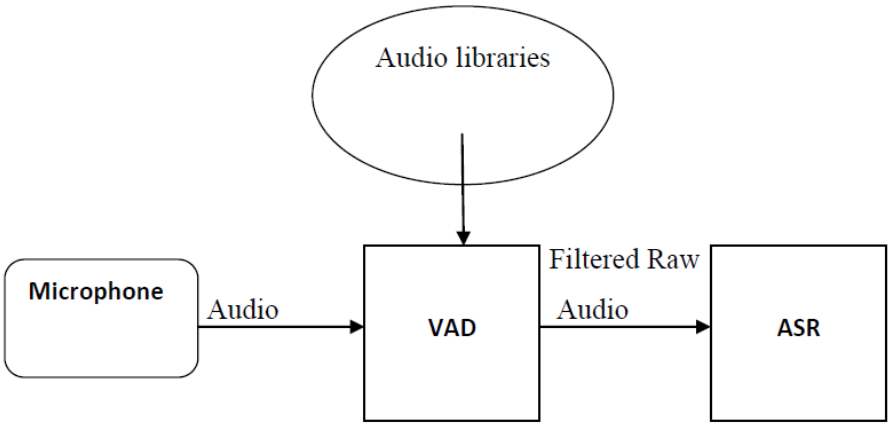

Fig. 2 Block diagram of Voice Activity Detector

B. Automatic Speech Recognition

The Automatic Speech Recognition (ASR) module performs speech to text conversion. Fig 3.2.2 shows the block diagram of automatic speech recognition. It takes as input the utterance with the user's speech that come from the VAD and sends the resultant text to the Conversational Engine(CE). In the proposed platform, the ASR module is based on the Pocket Sphinx speech recognition library.

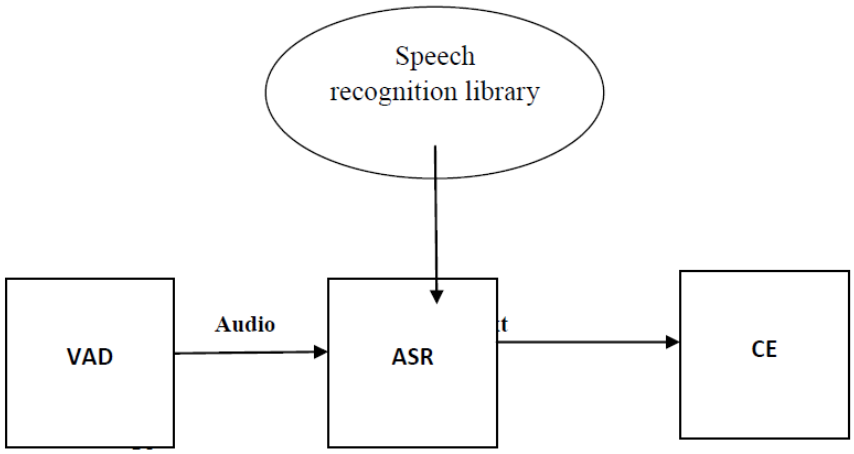

Fig 3 Block diagram of Automatic Speech Recognition

C. Conversational Engine

The Conversational Engine (CE) extracts the meaning of the utterance, manages the dialog flow and produces the actions appropriate for the target domain. Fig 3.2.3 shows the block diagram of conversational engine. It generates a response based on the input, the current state of the conversation and the dialog history. It will also add support for an object-oriented database that can decrease the dynamic memory usage at the expense of an increment of the response time.

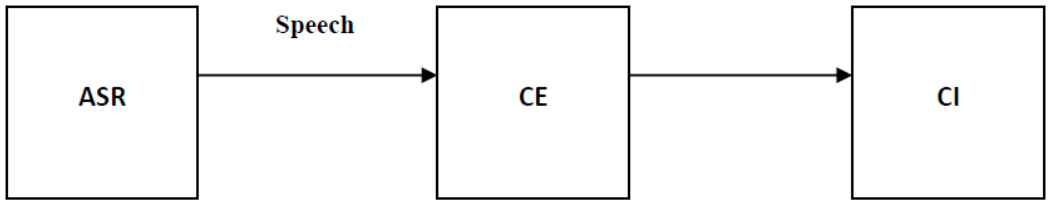

Fig. 4 Block diagram of Conversational Engine

D. Control Interface

The Control Interface translates the commands said by then user to a format that can be understood by the target applications or services running on the same device or accessible remotely. Fig 3.2.4 shows the block diagram of control interface. This module is domain-specific and has to be reimplemented or adapted for every new target application.

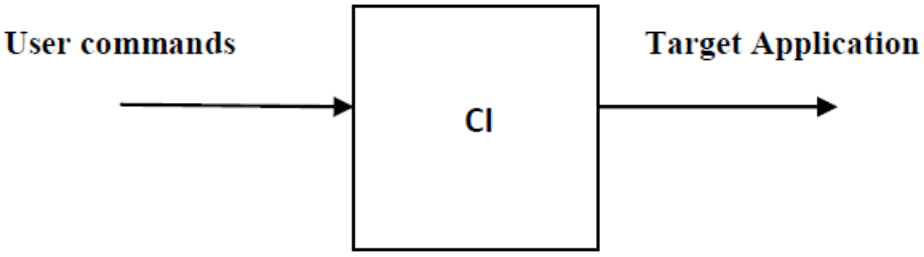

Fig. 5 Block diagram of Control Interface

E. Text-To-Speech

The TTS module implementation is based on the eSpeak library.Fig 3.2.5 shows the block diagram of text to speech. The Text-To-Speech (TTS) subsystem carries out the generation of the synthetic output voice from the text that comes as a response from the CE. it sends to the VHA module a list of the phonemes with their duration so animation and artificial speech match up.

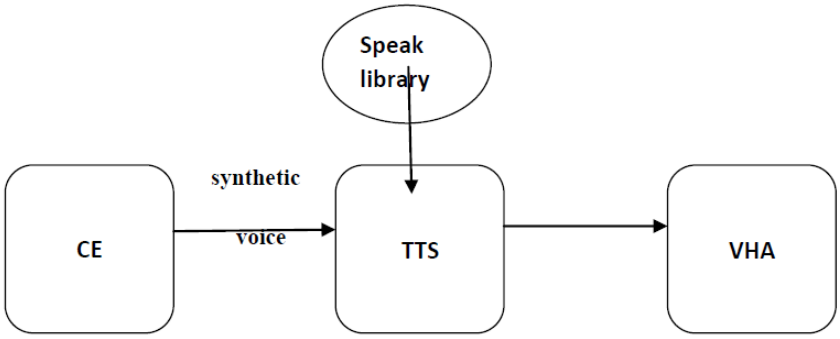

Fig. 6 Block Diagram of Text To Speech

F. Virtual Head Animation

This module receives as inputs both the mood information from the CE and the list of the phonemes' durations from the TTS module. Fig 3.2.6 shows the block diagram of virtual head animation. By processing the inputs, it generates the visemes (the visual representation of the phonemes) and the facial expression that will be rendered along with the synthetic voice

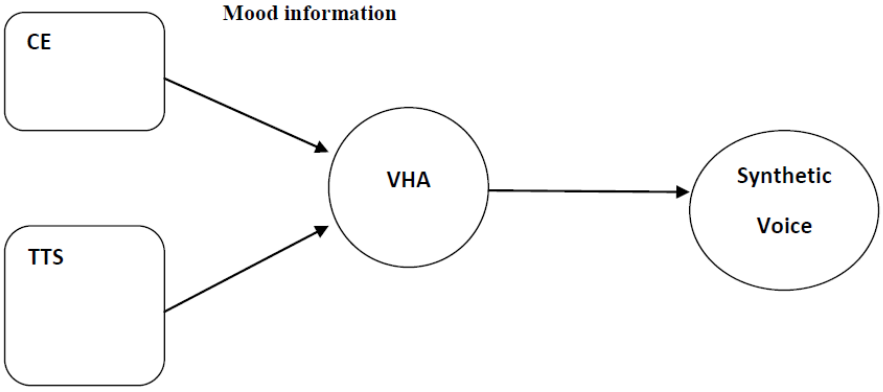

Fig. 7 Block diagram of Virtual Head Animation

IV. CONCLUSION AND FUTURE WORK

Monitoring and controlling software system has the feature of interacting with the appliances remotely through internet (application). This enables user to have flexible control mechanism remotely through a secured internet web connection. The developed system effectively monitors and controls the electrical appliance usages at an elderly home. The future work consists of to convey some experiments with real users to measure the usefulness, usability and performance of the platform. We needs to include security process that must be implements in the client side application

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