Review On: Home Automation System For Disabled People Using BCI

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ABSTRACT :*The development in home automation is moving forward towards the future in creating the ideal smart homes environment. Optionally, home automation system design also been develop for certain situation which for those who need a special attention such as old age person, sick patients, and handicapped person. A brain–computer interface (BCI), often called a mind-machine interface (MMI), or sometimes called a brain–machine interface (BMI), it is a direct communication pathway between the brain and an external device. A brain–computer interface (BCI) is a device that enables severely disabled people to communicate and interact with their environments using their brain waves. Most research investigating BCI in humans has used scalp-recorded electroencephalography or intracranial electrocorticography. The use of brain signals obtained directly from stereotactic depth electrodes to control a BCI has not previously been explored. In this paper, we present a smart home automation system using brain–computer interface. The scope of this research work will include the control and monitoring system for home appliances from Graphical User Interface (GUI) using brain–computer interface that use an input source and being control wirelessly. The research methodology involved is application of knowledge in the field of radio frequency communication, microcontroller and computer programming. Finally, the result will be observed and analyze to obtain better solution in the future.*

Keywords -*Smart home, Microcontroller, Home automation, Brain Computer Interface*

I. INTRODUCTION

A concept on smart home application and development includes various implementation techniques and is never limited. Smart homesystems are created based on analysis on client needs and budget to cater for the system. With technologies available today, efficient integration of this system could be achieved. Home automation, also referred to as smart home concept, it is not new to consumers. It encompasses the ability to control electrical and electronic devices at home remotely thus providing ease of access to home users. This concept may be applied in various manners to fit the requirement of a smart home. Now, advancement in wireless technology introduced new ideas such as Bluetooth and Internet linking; Wi-Fi, which has been slowly replacing the conventional wired technology which requires wire bonded interconnection between electrical devices. The main advantage of wireless interlinking includes diminishing the need of wires for connection.

Smart Homes, also known as automated homes, intelligent buildings, integrated home systems or domestics, are a recent design development. Smart homes incorporate common devices that control features of the home. Originally, smart home technology was used to control environmental systems such as lighting and heating, but recently the use of smart technology has developed so that almost any electrical component within the house can be included in the system. Moreover, smart home technology does not simply turn devices on and off, it can monitor the internal environment and the activities that are being undertaken whilst the house is occupied. The result of these modifications to the technology is that asmart home can now monitor the activities of the occupant of a home, independently operate devices in set predefined patterns or independently, as the user requires. Smart home technology uses many of the same devices that are used in assistive technology to build an

environment in which many features in the home are automated and devices can communicate with each other.

Existing smart home technologies

Home based system automations can range from systems as simple as for heating, ventilation, and air conditioning, Lighting control, or Audio and Video distribution to multiple sources around the house, to more complicated systems such as for security (involving presence simulations, alarm triggering and medical alerts) and robotics for home care or home management.

Smart home applications; or task automations in a general household can be grouped by their main functions such as,

> i) Alert and sensors – heat/smoke sensors, temperature sensors
>
> ii) Monitoring – Regular feed of sensor data i.e. heat, CCTV monitoring
>
> iii) Control – switching on/off appliances i.e. sprinklers, lightings
>
> iv) Intelligence and Logic – Movement tracking i.e. security appliances
>
> v) Telecare/telehealth – distress sensor, blood pressure monitoring

Current smart home devices are usually a customized hybrid of one or more of these applications for broader applications. Access to these applications can be generally grouped into 4 access types that are the hardwired type using busline or powerline based technology, as well as the wireless type utilizing radio, infra-red or Bluetooth technology. Future smart-home appliances are moving towards the wireless environment and hence the Bluetooth and radio spectrum will be widely used. It is to date, a rather new technology that needs to be further proven in terms of stability and security.

Providers of this technology will have to take into accounts used frequency bands for current appliances such as Bluetooth, cordless phones or Wi-Fi routers to ensure devices are robust from interference. The use of radio frequencies such as at 2.4 GHz for wireless LAN and 8.643 MHz (Z-wave UK) enable the systems to be designed for high bandwidth data flow.

Currently one of the existing issues that are associated to smart home applications are the fact that in a home with all sorts of automated application, there will be too many remote controls or monitoring terminal, if the user installed a range of proprietary applications from different providers. There is also the fact that the access range to remotely control these devices are limited by either length of cables or wireless network coverage in a personal area network. It is a widely known fact that an important example of wireless technology application is the mobile phone technology. Mobility' is now a lifestyle adopted by all walksof the society, where a United Nation survey has recently revealed that 60% of the world population has a mobile phone subscription [2]. Taking into account a mobile phone's necessity in the majority of our society, this solution will attempt to transfer the functionalities of a smart home device's remote control to a mobile-phone, to achieve a truly remote access convenience. Enabling a single remote access to a single corresponding server in a smart home household will also resolve the issue on 'too many control terminals' as discussed previously

II. PROBLEM STATEMENT

The main objective in system is to Detection of electric signal near eye area and using electrodes system will try to identify the changes in electric pulse in order to conclude the motion to be taken. As a proof of concept system will be enabled to control different platform and devices like computer or the hardware system as per mentioned below.

Appliances control: This module will deal with the controlling of hardware appliances using the electronic relay based switching circuit. Actual home appliances are connected to this circuit and the circuit will be then connected to the computer. It work as a middle ware between actual appliances and the computer.

Computer cursor and application control: Likewise user can control the computer cursor and the applications using electric signals. This will enable disabled patients to have good access over computer system. To implement this there will be a microcontroller to USB interfacing circuitry which will convert microcontroller signals in to computer understandable signals which will then get processed by software program.

Sensor based security alerts: As a part of the security module proposed system will having the motion detection, gas sensor, heat sensor which will alert user in critical condition. If configured then it can send a SMS based alert to assistant user.

Web based: As all these module work together and to make these module accessible through the web interface, the proposed system will have a web service which can be accessed through any web client or the web browser.

III. LITERATURE REVIEW

Integration of Bluetooth and Wi-Fi technology in Controlling home appliances can help and improve lifestyle of all user groups especially to the disabled and elderly people in term of safety and comfortable. The implementation of combined wired and wireless systems would be of most practical in designing a smart home system especially in cutting the system's installation cost for conventional home.

The smart elderly home monitoring system (SEHMS) is divided into three different modules which are safety monitoring system, telehealth system and telecare system. The smart phone is then connected to the monitoring system by using the TCP/IP networking method via Wi-Fi. A graphical user interface (GUI) is developed as the monitoring system which exhibits the information gathered from the system. The GUI opens an option to the user to examine the fall as well as making the confirmation or cancellation. A remote panic button has also been tested and implemented in the same android based smartphone. In addition, the monitoring system can also answer the call automatically after the emergency alarm has started.

The SunSPOT development kit will be used to simulate smart home devices. In this paper, the functionalities of a digital home temperature reader, as well as light switches will be demonstrated on the SunSPOTs. Possibilities of remote access to the SunSPOTs can be breakdown into two alternatives that can be either through the Internet cloud or through the GSM cloud.

Appliance control subsystem enables the user to control home appliances remotely whereas the security alert subsystem provides the remote security monitoring. The system is capable enough to instruct user via SMS from a specific cell number to change the condition of the home appliance according to the user's needs and requirements. The second aspect is that of security alert which is achieved in a way that on the detection of intrusion the system allows automatic generation of SMS thus alerting the user against security risk. In addition, the monitoring system can also answer the call automatically after the emergency alarm has started.This project will also not be a research or analytic based system to monitor human behavior. It will only provide ease of access to control house appliances and also monitor certain areas of the house. In terms of connection variant, this project proposed mixture of wired and wireless connection, where wired connection will run from the home appliances to the main control board whilewireless connection will only exist in between the main control board and the UI platform, which is the phone or PC connected via Bluetooth.

IV. METHODOLOGY

Human brain mainly works on electric signals transmitting all over the body to send the information in order to operate the body parts. Even while rotating eye ball body increases or decreases the resistance near eye area. This variation in electric signals can be measured using electrodes or the myoelectric sensors. By implementing these signals processor we can interface different devices to control on demand. Hence proposed system is designed to control computer and hardware system using brain waves electric signals. Proposed systems will detection the variations in electric signal strength through voltage level near the eye area and generates a wireless radio frequency signals in order to control the home automation prototype model. By implementing this system we can further extend it to bio enabled human body parts to control through brain waves.

Electroencephalography (EEG) is the most studied potential non-invasive interface, mainly due to its fine temporal resolution, ease of use, portability and low set-up cost. But as well as the technology's susceptibility to noise, another substantial barrier to using EEG as a brain–computer interface is the extensive training required before users can work the technology.

For example, in experiments trained severely paralyzed people to self-regulate the slow cortical potentials in their EEG to such an extent that these signals could be used as a binary signal to control a computer cursor. (Birbaumer had earlier trained epileptics to prevent impending fits by controlling this low voltage wave.) The experiment saw ten patients trained to move a computer cursor by controlling their brainwaves. The process was slow, requiring more than an hour for patients to write 100 characters with the cursor, while training often took many months.
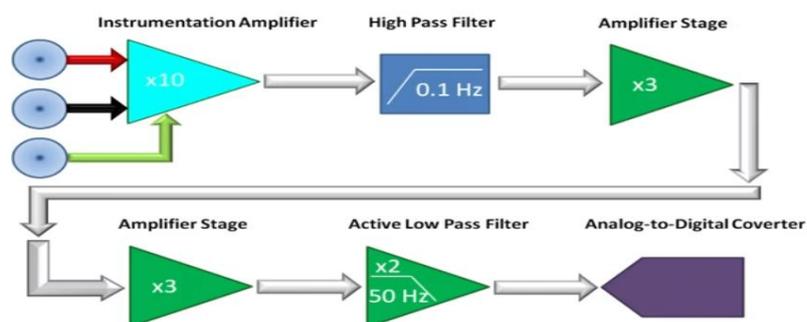
V. SIMULATION AND RESULTS

Proposed System will incorporate temperature sensor, fire sensor, motion (obstacle) sensor, Light detector sensor, Water sensor. These sensors are connected to the central system and once any of the sensors gets activated then system will send alert message. Multiple Sensor Based Home Security System is very practical. It can be used not only in the home environment but also in a business environment too. It canmonitor the surrounds to not only protect our properties but also our lives. Besides, it can be highly customized to suit each one's need and preference. So Multiple Sensor Based Home Security System is very useful for us as well as other people. After successful implementation of the system it is expected that outcome of the system should be able to identify the human brain wave to control the home appliances with fast reaction and it is also expected that system should react at highest priority in case of critical conditions.

The system will sense the signal from brain sensor of disabled person and follow the commands accordingly and he can comfortably operate or handle the home appliances.

Complete system can be monitored externally by the person using android system as well as alert signal will also be provided.

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