

INTERNET OF THINGS (IoT): SMART HOME FOR CRIPPLED PERSONS

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Abstract:

The smart home encompasses household activities such as control of all electrical appliances such as Light, Fan, and provide security which would improve the quality of life for the crippled persons who might otherwise have to oblige their caretakers. The smart home aims to support the persons by controlling the electrical appliances in an ease. With the expeditious growth in the number of persons of the internet over the past years has made the Internet a part of life. The Internet of Things (IoT) is the recent and emerging internet technology. IoT is a developing network and it makes a communication from machine to machine. To create an environment for crippled persons to become aware of the activities taking place within their living area. Besides healthy people, crippled persons also need such systems to make their life easier. The Brain Computer Interface (BCI) is a process that empowers severely crippled persons to communicate and connect with their electrical appliances using their attention and meditation level of their brain waves. Smart home system using Sensor - based BCI system to enable the automatic control of electrical appliances like a fan. The smart home consists of three components-Physical Component, Control System, and Communication System. Thus the smart home technology can be used to support crippled persons providing the safe, secure, and empowering environment.

Keywords — Brain Computer Interface, Electroencephalography, Brainwaves, Bluetooth communication.

1. INTRODUCTION:

The Internet of Things (IoT) is heralding in a societal revolution anything and everything can be connected straight away. IoT makes the human and computer together connected in the world. It avoids the gap between virtual and physical world. It is a new phenomenon, enabled by miniaturization of devices, an emergence of the internet as a favored communication method and the proliferation of powerful and smart mobile devices. People who cannot use their limbs are unable to control objects in their environment. The smart homes have the potential to enable crippled persons to steer autonomous life in their own living area. Persons with crippled to live more independent, allowing them to take control turn ON and OFF electrical appliances. A brain computer interface (BCI), also referred to as a mind machine interface (MMI) or a brain machine interface (BMI), provides a nonmuscular channel of communication which allows the user to control the fan by using only his/her own thoughts. The signal which arises from electroencephalography (EEG) is recorded from the scalp. The Sensor technology comprises sensors, relay switch, Arduino and also short distance wireless communication technologies includes Bluetooth, Wi-Fi. Electroencephalography (EEG) signals are taken from the scalp. EEG is an electrical activity generated by the brain structures and recorded from the scalp surface through electrodes. Nerve cells interact and communicate information through electrical signals. This creates a neural pathway for information flow or a neural network. The way in which these pathways are arranged can account for our thoughts and emotions. These emotions can be detected by brainwave sensor and it transmits data by using Wi-Fi medium to

the relay switch. Using Sensory-based BCI system helps the crippled persons to control the electrical appliances (ie., turn ON or OFF the fan).

2. BRAIN COMPUTER INTERFACE:

A Brain Computer Interface is a human to machine communication system that measures the brain signals. The human brain is composed of neurons. The nerve cells connected to one another nerve cells by dendrites and axons. Neurons communicate with each other by sending and receiving electrical signals and listen to the signals with Sensor based BCI system. All interaction of person needs accurate communication between the human brain and the muscles.

2.1 ELECTROENCEPHALOGRAPHY:

Electroencephalography (EEG) is a recording of the electrical activity of the brain. Noninvasive BCI systems use EEG signals i.e., the brain activity recorded from the electrodes placed on the scalp. It records the brain wave patterns. EEG electrical activity of the brain appears as a pattern of waves. EEG is calculated with both attention and meditation level of the human brain. The Attention Level increases when a person focuses on a single thought or an external object for a specific time interval. The Meditation level increases when the person relax the mind and decreases when they are uneasy or stressed.

a) MEASURING EEG:

EEG measures voltage fluctuations resulting from the ionic current. EEG waveforms are generally classified according to their frequency, amplitude on the scalp at which they are recorded. The five brain waves are Delta, Alpha, Theta, Gamma, Beta.

The alpha waves are resting state of the brain. Alpha waves aid overall mental coordination and calmness. The Beta waves are dominated our normal waking state

of consciousness when attention is directed towards cognitive tasks and the outside world. It is the fast activity.

b) ELECTRODES:

The electrodes are placed along the scalp along the specific position. Electrodes are used to measure EEG and they are to be used with integrated gel. These positions are using the international 10/20 system.

c) ELECTRODE PLACEMENTS:

The electrodes are placed on the Frontal and temporal lobe. Electrodes used in EEG recording do not discriminate the electrical signals they receive.

2.2 BCI COMPONENTS:

BCI consists of several components. The commands from the persons are converted into action. The process can be divided into five stages.

a) Measurement of EEG

EEG is measured with electrodes. EEG waveforms are generally classified according to their frequency, amplitude on the scalp at which they are recorded. An EEG electrode will mainly detect the activity in the brain region.

b) Preprocessing This includes the acquisition of signals, removal of artifacts and enhancement of the resulting signal. Analog EEG signal is digitized.

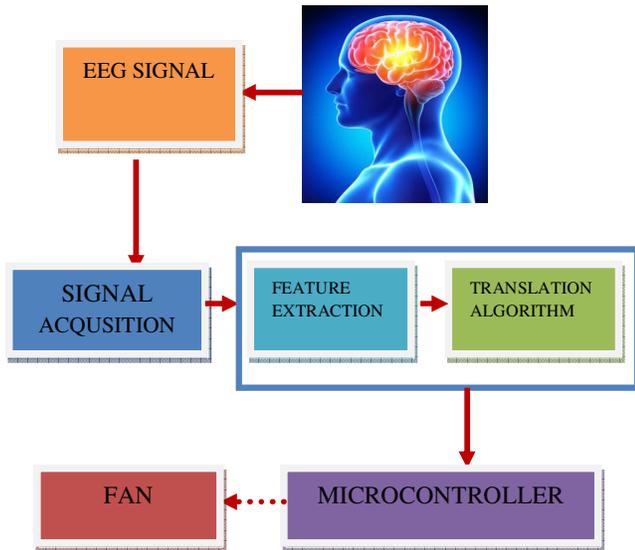
c) Feature extraction At this stage, scheme which is meant to determine a feature vector from a regular vector.

d) Device control The above output is the input for this device control. The command is from the users intent (i.e., commands is converted into actions).

3. EXISTING STATEMENT:

The smart homes have the potential to enable crippled persons to steer autonomous life in their own living area. The smart home makes the people more comfortable and leads the life easier. Surgery to the brain might be risky and cause brain death. There are chemical reactions involved in the brain which BCI devices cannot pick up. EEG systems have a drawback of being cumbersome and impose some restrictions on the patient. BCI represents a strong improvement to maintain communication with paralyzed patients as it does not need muscle engagement for its use. Environment and usage can affect measurements and it requires additional hardware. Crippled persons can control the electrical appliances by wireless through their thoughts for the entire home environment. To overcome this Using Ear EEG, it will be possible to develop a simplified device that can be made wearable for daily usage. Smart devices can help prevent and minimize damage. Having a smart security system also qualify for insurance savings.

4. METHODOLOGY:



The main aim of this project is to control the electrical appliances such as fan based on EEG signal. It acts as a communication between men and machines and it is received from the human brain through Sensor based BCI system. Emotions and thoughts can be detected by Brainwave sensor. The signal acquisition process is obligatory to capture the electric signals of the brain. Feature extraction means extracting signal features The unwanted signals may bias the analysis of the EEG and may lead to wrong results. So, the digitized signals are subjected to feature extraction procedures. The translation algorithm, in which it translates the extracted signal features into device commands orders that carry out the user’s intent. The command is transferred through the Wi-Fi to the relay circuit. The Microcontroller consists of Arduino, Relay circuit, Wi-Fi chip. Relays are switches that open and close circuits electromechanically or electronically. These are used

where a safe low-voltage circuit controls a high-voltage circuit. It helps the crippled persons to control the electrical appliances (ie., turn ON or OFF the fan).

5. RESULTS:

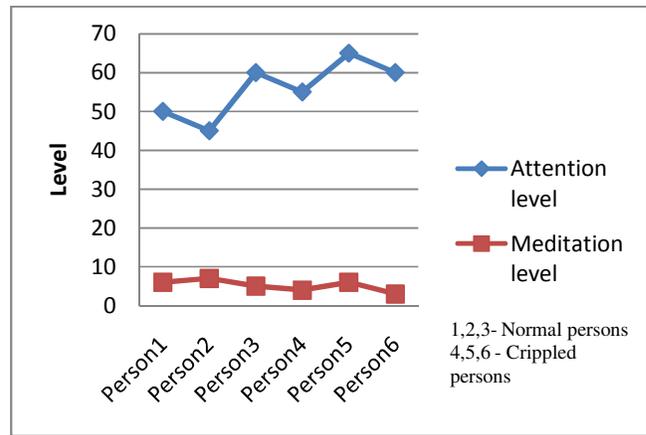


Figure 1: Attention and Meditation Level for 10 minutes

The Attention and Meditation level chart is often used to visualize a trend in data over intervals of a time. Thus the results of Normal persons and Crippled persons have traced accurately.

6. CONCLUSION:

This project gives effective solution for the problems faced by the crippled person every day. One of the biggest requirement for crippled people is to continue their daily life activities when they are alone at home. In this project, we suggested a new perspective use of Sensor network and Sensor-based BCI system to build smart home systems. Thus the smart home for crippled persons provides their life easier and comfortable.

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