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A survey on assistive technologies for a paralysed

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Abstract: Paralysis is a medical condition wherein either one or multiple body parts fail to respond to brain's instructions. Several factors are responsible for this condition, out of which illness and accidents take the major credit. Several technological advances have contributed to the well being of these paralysed patients. This paper focuses on the methodologies which intend to enable these kinds of people to move around. The paper also discusses the drawbacks of the same and an insight to the proposed method is also given in conclusion.

Keywords: Paralysis; Assistive; Wheelchair; Joystick; Gesture; Sign Language; Brain; Brain waves

I. INTRODUCTION

Approximately 1% of the entire world's population depend on a wheelchair due to their inability to move a certain portion of their body either because of a disease or an accident or lacking the strength to do so [1]. In order to improve the quality of life of a physically challenged person with restricted hand movement without being dependent on another person, several technologies have been proposed to help such people move around. People suffering from quadriplegia require wheelchair to meet their daily needs [2]. Most of the wheelchairs, the patients either push the wheelchair normally or use a joystick-based wheelchair [3]. However, these two techniques are used only for direction control of the wheelchair. For all the other activities the patient has to be dependent on some other person.

This paper deals with a survey of popular techniques that enable the paralysed patients to move around. The next section elaborates the same. The conclusion of the paper deals with summary of all methods and an insight to the proposed technique to easen their lives.

II. LITERATURE SURVEY

"Intelligent Wheelchair Based on Brainwave"

Li Yingda ,Yang Jinping in International Conference on Intelligent Transportation,Big Data and Smart City ,DaLian China ,2018.

Brain waves (Electro Encephalo Gram, EEG) are released when there is a potential difference between the cortical cells of the brain. Based on the frequency of brain wave, it could be classified into different bands, namely alpha, beta, gamma, delta and theta.

The brain wave generated is gathered by a brain wave module and the head deflection signal is collected by gyroscope. These devices are integrated on smart headband. The signals from brain wave module and gyroscope are sent to Android Computing Unit and then to ARM processor through wireless transmission of data packets. The ARM processor outputs the control command signal by using a simple hybrid algorithm ,which is sent to Wheel-chair system.

"Techno-Talk: An American Sign Language (ASL) Translator"

Arslan Arif, Syed Tahir Hussain Rizvi, Iqra Jawaid, Muhammad Adam Waleed, Muhammad Raheel Shakeel in CoDIT'16 - April 6-8, Malta, 2016

This paper has proposed a method which breaks the communication barrier existing between deaf/mute people and normal people. The main aim is to make a person who is not familiar to ASL understand the language. A wearable, portable hand glove model is used along with Arduino Mega 2560, flex sensors, accelerometer, VoiceBox shield and speakers. The signals from the sensors is sent to the Arduino Mega 2560 which houses an Atmega 2560 micro-controller. A look up table is built which is used to compare and select the gesture shown. The database used has 2 modes of operation. First one is a teaching mode in which database is created and a learning mode where the signs are shown. A contact sensor is also used to differentiate between 'U' and 'V' (since the 'U' and 'V' have almost same range of flex values). After deducing the sign shown, with the help of a VoiceBox and a loudspeaker the ASL is translated.

"LVQ Based Hand Gesture Recognition Using a Data Glove"

Francesco Camastra and Domenico De Felice, Department of Applied Science, University of Naples Parthenope, Centro Direzionale Isola C4, 80143 Naples, Italy in B. Apolloni et al. (Eds.): Neural Nets and Surroundings, SIST 2019.

This paper deals with a real time hand gesture recognizer using Learning Vector Quantization (LVQ) based approach which has two parts. The first one being the part that involves use of a data glove that performs feature extraction and the second being the classifier, performed by LVQ. A dataset of about 3900 gestures inclusive of that performed by people of different gender and varied physique and therefore has a high recognition rate. A feature extractor is performed by a data glove and

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represents the hand gesture by means of a five-dimensional feature vector.

"Robust Single Finger Movement Detection Scheme for Real Time Wheelchair Control by Physically Challenged People"

Sayeed Shafayet Chowdhury, Rakib Hyder, Celia Shahanaz and Shaikh Anowarul Fattah in IEEE Region 10 Humanitarian Technology Conference, Dhaka, Bangladesh, 2017.

In this paper, image processing is used to control/move the wheelchair to aid people who are physically challenged.

Initially, video is captured, and the frames are taken and an image of only the background is also captured which is further processed. For the detection of the fingertip, an algorithm is used.

Color normalization is done for the captured images which eliminates the error caused due to variation in light intensity. Gray-scale images are obtained, and background subtraction is performed to retain only the foreground.

The gray-scale images are converted into binary-images using Otsu's algorithm. Next, median filtering operation is performed on the binary images to reduce salt & pepper noise. Then, morphological opening is performed to get rid of sparse noisy pixels in the image. To further enhance the image, morphological hole filling is performed.

ROI extraction is done, and the fingertip is detected. The direction towards the location of the fingertip is obtained and the control signal is sent to the motor driver and the required task is performed.

III. CONCLUSION

As a result of the extensive literature survey performed, we found many disadvantages of the above described works.

With respect to brain waves, it requires the brain to concentrate on a single task which is very difficult to achieve practically. It requires to wear a headset all the time which may cause inconvenience [4].

With respect to the glove approach, the cost of customizing and fabricating the glove is expensive. It requires a lot of sensors to be interfaced which is tedious and causes the whole system to be bulky. Wearing a glove is compulsory and may cause inconvenience [5].

With reference to the image processing-based solutions explained above, it requires a large data set. The algorithm takes a lot of time to run [6]. As background subtraction method is used, this doubles the memory usage [7].

Thus, in order to overcome all these problems, we propose a system that uses video processing to help such individuals. The proposed method involves identification of the finger movement in real time using the data obtained by a camera. The location of finger is then calculated, and the corresponding action is taken i.e. the movement of wheelchair in a particular direction or access of home appliances (light, fan) using the concepts of video processing and machine learning. The person sitting on the wheelchair is self-reliant which therefore contributes to one's overall development.

Initially, the gesture is shown to the camera, after which image acquired. The next step involves processing the video frames based on the proposed algorithm and thereby extracting the region of interest in order to recognize the gesture. The corresponding task for the gesture shown is then executed.

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