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Home Automation and Wheelchair Control using Air Gesture: A Survey

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Abstract: Mobility is one such field that has flown with the wave of technology. The initial wheelchair i.e. mechanical wheelchair required external force for movement. The new technology has improved the living style of disabled people. Moving the wheelchair based on gesture recognition is the latest trend in the technology. This paper concentrates on showcasing the popular methods of wheelchair control and other appliances, thus helping the disabled.

Keywords: Video Processing; Survey; Gesture; Image Processing; Navigation; Smart Wheelchair; Home Automation

I. INTRODUCTION

Over 65 million people out of the global population suffer from disability in mobility. Wheelchair invention was very important discovery during this field. A chair will be accustomed provide physically handicapped persons quality. The road to movement for the disabled was designed mostly through the invention of a mechanical chair. Formerly, there was no replacement possibility than manual wheelchairs that concerned a great deal of physical effort and therefore the constrains on dependency created it not possible to Human computer interface (HCI), as an incredible adaptive era, aids people with motor disabilities to ease their day-to-day activities. There are several interfaces that make within the movement of the chair however aren't ideal for independent mobility. There is scope for associate interface with lowest time delay and easy-options for navigation and movableness of the wheelchair for physically disabled.

Accessing home appliances without dependency is just as necessary as self-reliant mobility for basic independent lifestyle. Home automation is the process of automating and controlling all the home appliances like fans, lights, TVs among others, using a single interface. WIFI and Bluetooth technology are mainly used in home automation applications. For physically disabled people to be self-sustained, an interface that provides easy-to use features for home automation with mobility using wheelchair is essential.

This paper provides a brief research of distinct interfaces that can be used for gesture recognition, home automation and wheelchair navigation. Techniques for recognizing gestures include video processing, image processing, and sensors. This study provides an overview of methods that can be used to provide an optimized interface that would facilitate people with physical disabilities.

II. PROBLEM DEFINITION

Self-reliant mobility is crucial for physically impaired people to evolve physical, cognitive, communicative, and social skills. Consequently, the battery powered wheelchair's high price makes it impractical for most people. The primary issue for the wheelchair is the fact that the person with a disability cannot use it, so that the type of artificial aid that a disabled person needs to move around would be largely dependent on the level of his or her incapacity. People in wheelchairs encounter doors every day with accessibility issues. Getting a door to open is tough. Furthermore, the electric wheelchair's high price makes it unfeasible for most people. So we have chosen to investigate if we can develop a wheelchair that is cost-effective and user friendly.

III. REVIEW

In Nobuyuki Otsu [9], The paper demonstrates how automatic thresholding is being used to segment the image. Here, the selection of the optimum threshold increases the separability of the levels of gray in the result obtained. This method from the discriminant examination, provides mechanically selecting a best threshold for the evaluation of the associated edge. Only the 0th and 1st order accrue moments of the grey-level histogram are maintained at the start.

In Julian Balcerek et. al. [7], A video processing approach helps the pedestrians detect automobiles. The proposed system detects the vehicle by putting a video camera on the pedestrian's back, and then notifies it by sending signals. Segments of the videos are examined using histograms. This system's efficiency is very high otherwise the delay does not assist the pedestrian to act immediately. The system uses mainly the technique of video processing and Machine Learning.

In Jochen Triesch et.al.[6], A vision system has been created which is used for hand posture recognition. The model takes Elastic Graph Matching (EGM) as its basis. The computer science has many pattern recognition techniques. One of which is trying to match with Elastic (EM). EM is also recognized as matching nonlinear templates, deformable templates or flexible matching. EM is explained as a problem of 2D idealization distorting the verification of respective pixels between targeted images. Image processing and video processing are the primary concepts covered.

In B.G.Lee et. al.[2], The glove type device is used for the detection and interpretation of sign language. The device consists of 5 flex-sensors, 2 pressure sensors and a 3-axis inertial motion sensor to distinguish the characteristics in the ASL alphabet. All sign languages are translated into text sent to receiver. Also a mobile application that can run on Android was built with a text-to-talk interface that interprets the received text into the output of the speech. Research results show that the classification of the correct sign language in the 1st version with no sensors is 65.7 percent accurate. A second version of the approached glove type system with a mixture of pressure sensors on the middle finger significantly maximizes the classification accuracy to 98.2 per cent. Implementation relies mainly on gesture recognition, ML, and Android app.

In Francesco Camastra et. al.[5], The Learning Vector Quantization (LVQ) system provides the hand detection. LVQ is comprised of 2 modules. The 1st module is used for processing of a data glove feature. The 2nd module is the LVQ-implemented identifier. This test is performed on 4000 hand gestures obtained by diverse human beings. Gesture recognition and ML are the oriented domains.

In Arathi P.N. et. al.[1], Most home appliances are automated and handled simply with gestures. The image capturer captures the patterns and is used for the processing. Parts of implementation programming is done using MATLAB-based algorithms. The proposed study is said to use an Object Detection Algorithm. Initially, the image is captured by the image capturer and MATLAB is used for processing, if the existing pattern matches the given gesture the data is forwarded to the microcontroller, then the home devices are checked. The project mainly works on image processing, Machine Learning and Artificial Intelligence.

In Rakib Hyder et. al.[11], The paper uses Recursive Circular Hough Transform (RCHT) to show the automatic sensitivity and radius detection of the pupil movement. It uses a mobile phone camera with low resolution to photograph from which pupil point is detected. This wheelchair could be controlled only by those with working eyes. Video is continuously captured here, and the data is forwarded for execution to the Personal Computer. Picture frames are then frequently drawn from the video. It then transforms RGB image to Grayscale image in resize. To increasing the contrast of the output image, Image Adjustment is made.

In Celia Shahanaz et. al.[4], The paper shows the necessity for disabled people to have automated electric wheelchairs. Here an electric wheelchair is implemented, where a large group of people decrease the cost of the device. There are also various features such as-rough surface detection, torque adjustment, slope and obstacle detection and therefore safety is ensured. The system obtains input from a microphone, joystick, sonar sensors, and rotary encoders and afterwards processes them using a microcontroller and drives the motors proportionally with a motor driver's aid. It integrates automatic speed control which can gradually increase and decrease the speed. There is also a Sonar that is enabled to detect obstacles.

In Keerthi Kumar N et. al.[8], A wheelchair that moves based on the user's brain wave has been developed. Systems like the Brain Computer Interface (BCI) are used for transactions between physical and human brain devices. It uses a concept called Electroencephalography (EEG) to acquire brain waves and pass them on to the physical device for the input processing and the wheelchair motion accordingly. The acquisition of data can only be held out if the person is wearing the specified headset. Works on Machine Learning, Brain Computer Interface, and Electroencephalography.

In Prannah Dey et. al.[10], This project presents a smart wheelchair that will switch with respect to different head movements. Micro-controller used as the main part of the control. Microcontroller, accelerometer sensor, LDR and ultrasonic sensor are often used. The Accelerometer sensor is used to maneuver the wheelchair according to various head gestures in 5 various directions. Two DC motors are used to move the wheels in different directions. Relays used for wheelchair directions have driver motor in Arduino UNO. It uses solar panels. A photon detection sensor is used which would make navigation in dim light easier for the user. Ultrasonic sensor identifies the obstacles, the light is released by LDR and the indicator is sent to the microcontroller. The seat belt sensor is used as a provision for secure movement.

In BiswajeetChampaty et. al.[3], a wheelchair was created utilizing eye signals. This machine was produced for individuals with insignificant developments. An EOG signal recognition framework was first constructed and afterward flags got were prepared to give the control signs to the wheelchair dependent on the sufficiency and timing of the signs. Electrooculogram signals are favored right now it has an interesting example for each eye

development. It for the most part focuses on the field ElectroOculography (EOG)

In Abhijit M et. al.,[13], the home mechanization is finished utilizing a hand motion. The signals are perceived utilizing the gyrator, magnetometer and accelerometer on the 3-Dimensional hub. The client needs to wear a removable glove for the motion acknowledgment. A center is utilized to control all the home machines. The information is sent to the center through a remote channel like the Bluetooth.

In Siri. T. Bhat et. al.,[14], the wheelchair is constrained by the utilization of hand motions. The client wears a glove called as sparsh gloves which consists of sensors to investigate the client input. The wheelchair seat tallness is likewise made movable. This wheelchair is likewise used to caution the clients when there is a hindrance before the tire and furthermore behind the wheelchair.

In Sayeed Shafayet Chowdhury et. al.[12], the proposed wheelchair can be valuable for the individuals with inabilities utilizing simple finger activities on a little white foundation paper. A tough plan of finger movement location is proposed for the bearing control of a wheelchair. Idea of foundation subtraction and morphological activities are utilized to gain the fingertip zone utilizing a finger-movement discovery conspire. The technique utilized right now ready to make sense of finger movement continuously from photographs taken. Pictures are taken utilizing basic PDA cameras and fingertip is recognized utilizing picture preparing procedures. The control activity among the mobile phone and wheelchair is finished remotely with the assistance of Bluetooth time. Suitable control pointers are dispatched through Bluetooth to the wheelchair control board. This paper determines philanthropic applications, for example, control of adaptable bed for patients and even aides in home robotization for simplicity of life.

IV. COMPARATIVE STUDY

In Prannah Dey et. al.[10], the task presents an astute wheelchair which will move as for different head signals. Head signal is unrealistic on the grounds that numerous individuals may feel queasy while moving their heads around. At whatever point the individual needs to go for a long separation, he/she needs to either continue moving their head or keep their head in still position which may be difficult.

In Rakib Hyder et. al.[11], it utilizes Recursive Circular Hough Transform (RCHT) to exhibit understudy development recognition. Since this methodology utilizes a low goals camera to acquire the understudy developments, the individual ought to consistently have an eye to eye connection to the camera. In the event that there is no immediate eye to eye connection, at that point the wheelchair could be wild. This wheelchair could be constrained by individuals with working eyes as it were. 100% proficiency can't be given in diminish condition. Tingling or aggravations could happen inevitably.

In Keerthi Kumar N et. al.[8], a wheelchair was built up that moves dependent on the client's cerebrum wave. The person should be able to have a good control over his/her brain, so that it helps the person to have a well concentration. This interface is a slight change in fixation likewise it makes the wheelchair to move aimlessly. The individual can have the option to control the wheelchair just if the individual is wearing the predefined headset. This is a methodology which has some considerations happening in the cerebrum, which might mess up development of the wheelchair and also does not allow the person to have a good control and may not be able to move the wheelchair whenever required.

V. PROPOSED SYSTEM

The air signals made by the handicapped individual are recorded by the camera. The air motions can be made either utilizing just fingers or complete hand where in the arm of the individual will lay on the wheelchair. The individual sitting on the wheelchair should simply wave his/her finger or hand and consequently no extra endeavors are important. The individual can draw the signals without utilizing any gloves. The web camera sends the live video casings to the video processor that houses a calculation that can comprehend the air motions. On the off chance that the motion compares to wheelchair movement, this data is sent to engine control board and it controls the wheel, while, on the off chance that the signal relates to controlling home machines, at that point the home apparatuses are controlled through a Bluetooth interface. Here, structuring a video preparing calculation utilizing programming as determined beneath which will distinguish the air motions. Besides, android example can be attracted air before camera to access various rooms in the house.

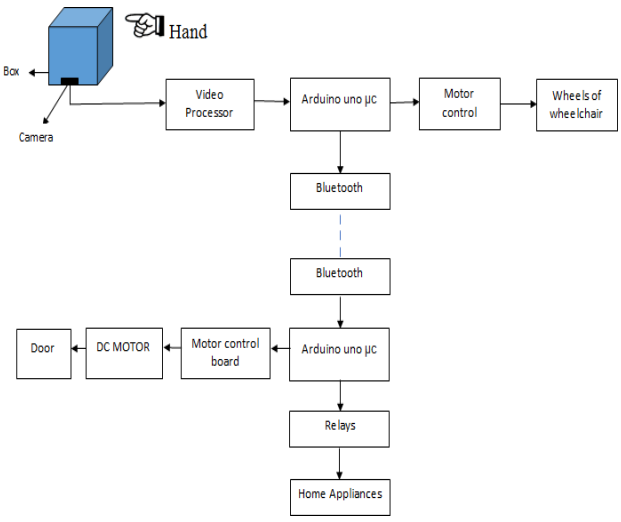

Fig 1. Block-diagram of Air-Gesture Interface for Home Automation and Wheelchair Navigation

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