JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

HAND GESTURE WHEEL CHAIR CONTROL WITH FALL DETECT SYSTEM AND LOCATION ALERT

[1]ABHISHEK J, [2]CHETHAN G, [3]CHETHAN KUMAR J,[4]CHETHAN KUMAR T, DR.ANITA P

STUDENT, STUDENT, STUDENT,STUDENT,ASSISTANT PROFESSOR ECE DEPARTMENT BANGALORE INDIA

Abstract : 'hand gesture' based easy to operate navigation mechanism using the wireless technology in the form of wheelchair control system is presented in this work. This work proposes an integrated approach for detection, tracking and recognition of hand gestures in real time. The approach uses acceleration technology to establish a reliable medium of human-machine interaction for the movement control of an intelligent wheelchair. The remote-control facility up to 60 meters and obstacle avoidance technology provided for additional comfort during navigation task for elderly or disabled people. The wheelchair motion is controlled by employing Arduino microcontroller interfaces with accelerometer sensor, motor driver unit, and edge detection sensors. The designed system was tested with five experiments by two subjects independently.

IndexTerms **- Tracking and recognition of hand gesture, Intelligent wheelchair and motor drive**

I. INTRODUCTION

The wheelchair is one of the most commonly used assistive devices to promote mobility and enhance quality of life for people who have difficulties in walking (e.g. a person with spinal cord injuries resulting in quadriplegia or paraplegia, muscular dystrophy, etc). Wheelchair mobility opens up opportunities for wheelchair users to study, work, and engage in social activities and access services such as healthcare. In addition to providing mobility, an appropriate wheelchair benefits the physical health and quality of life of the users by helping in reducing common problems such as pressure sores, progression of deformities and improves respiration and digestion. To ensure effective mobility, wheelchair users need a wheelchair which fits them correctly and meets their specific needs. However, statistics show that about 10% of the global population, i.e. about 650 million people have disabilities and of these, some 10% require a wheelchair. It is thus estimated that about 1% of a total population, or 10% of a people with a disability, need a wheelchair, i.e. about 65 million people world wide.In addition, it was estimated that in 2003, 20 million of those require a wheelchair fo mobility did not have one. There are indications that only a minority of those in need of wheelchair has access to them ,and of these very few have appropriate wheelchair.

II LITERATURE SURVEY

[1] AMUNDSON JS Over the years, several approaches, gesture and chain-based control mechanisms, have been proposed to help physically disabled people reduce their level of dependence on others for movement. An image-processing-based approach has been proposed to control a wheelchair. This approach relies on image processing to recognize a gesture.

[2] A MURAKA M.SRIDHARAN AND KUPIERS The proposed approach is easy to handle and operate by users. However, it requires wired controller to perform the operation, which makes it unreliable and difficult to use. A gesture-based wheelchair approach has been proposed in to control a wheelchair using hand movements for disabled people. The proposed approach uses the MEMS sensor connected to the hand and 3-axis accelerometer with digital output (12C), which detects and converts and gestures to

the 6-bit digital values. The main drawback of this approach using a remotely controlled system, is that the manner of holding the remote control may inconvenience users.

[3] SHILPAGULATI ,BENJAMIN KUPIERS The work seeks to create a personal assistant that lets consumers engage with home appliances via speech and A smart wheelchair prototype based on hand gesture control has been proposed to help disabled people control a wheelchair. Many wired hardware components are required in this prototype, which makes it inconvenient for users. A model for a hand-gesture-controlled user interface has been presented in to control a wheelchair using hand movements by using an accelerometer sensor. The main drawback of this model is its low accuracy.

[4]MARHIC .B makes the model inapplicable for users with low confidence. In addition, wired devices such as a global system for a mobile communications (GSM) modem are required, making the use of the model more difficult for the elderly and physically disabled people. A hand-gesture-based approach using a touch sensor for users to control a wheelchair effectively has been proposed in Ref. 7. This approach however uses a wired hand gesture hardware component, which makes it difficult for the elderly and physically disabled people to use. the authors proposed a hand-gesture-based approach to control a wheelchair.

[5] L.JOSEFESSONAND P This approach relies on the use of the global positioning system (GPS) and GSM to identify locations, which makes it unreliable to use in noisy environments. The hand-gesture-based approach that uses Raspberry pi and image processing techniques to control a wheelchair has been proposed in This approach relies on an image processing technique and a USB web camera to recognize gestures. The main drawback of this approach is that it is difficult to handle and operate by users, and it requires a wired web camera to perform the operations. An accelerometer-based-gesture approach has been proposed in to control a wheelchair using GPS and GSM navigation.

[6] R.GHODSSI ,P LIN in this approach, a wheelchair component should be transmitted to a control room and the location of the user is determined by a navigation application. the authors presented a framework to help people who cannot walk owing to physiological or physical illness. The proposed framework involves the use of computer-controlled wheelchairs, which will be unfamiliar to the elderly and physically disabled people. A model for a hand-gesture-wired-controlled user interface has been presented in this model uses an accelerometer sensor to control the direction of a wheelchair using hand movements.

[7] R.C. SIMPSON The main drawback of the proposed model is that the transmission control is wired, making it difficult for users to handle and operate. the authors developed hand-gesture-based methods to control wheelchair movement using MEMS and acceleration technologies. The main drawbacks of these methods are their non-cost-effectiveness and difficulty to use and operate because they are unfamiliar to the elderly and severely physically disabled people. A gesture-recognition-based approach has been proposed to control a wheelchair using an android application.

[8] MAZIDI A smartphone and a connection should be used to control a wheelchair. Using the touch screen of the smartphone, the user has to choose the direction specified within the four quadrants on the screen, which is difficult for users to use. the authors present a hand-gesture-reorganization approach using a real-time tracking method and a hidden Markov model that introduces the hand gesture reorganization system to recognize continuous gestures before a stationary background. In this approach, the motion of the object gives important and useful information for object localization and extraction. However, to recognize the gesture, the complexity is higher and the accuracy is lower, so it is not beneficial and not compatible with the users.

[9] HARPIT SINGH A visual-based human–machine interface (HMI) solution has been proposed in Ref. 20 to control a wheelchair by head gestures, which were recognized by detecting the position of the nose on a user's face. The proposed approach is uncomfortable and not applicable to all users, which requires constant shoulder or neck movements. The head of the user should always be within the range of the sensor; otherwise, the user cannot control the movement of the cursor., the authors presented an approach using closeness matching to detect hand motion, whereas in the authors presented a method that utilize a strategy for signal coordination the utilization of the ARM 11 Raspberry pi and Zigbee module. Another approach that uses wearable hand gloves to capture hand movement to control a wheelchair has been proposed in the authors described their work on gesture reorganization applied to wheelchair control. In this case, gestures are recognized through a three-axis accelerometer.

[10] ASEBRANDT ,SUSANNE AND AGNETASTA wheelchair is such a type of mechanical device, which is used by the elderly patients and the people who are physically unable to move properly due to some kind of accident or neural disease. Most of the electric wheelchairs used in Bangladesh are imported. Moreover, these wheelchairs are above the level of affordability of most common class people here in Bangladesh due to higher cost. Several works have been done in the wheelchair design project with various techniques to design low-cost version. But those techniques are not efficient enough and not much affordable.

[11] REN C.LUO ,TSE MIN CHEN ,CHI -YANG HU AND ZU In 1953, invented the electric-powered wheelchair. worked for the National Research Council of Canada, to assist injured veterans . But this chair had no extra safety intelligent systems that could make the life of the operator easier. Many research works have been presented since then and there are different versions with different technologies of wheelchairs what we see today in the market such as eye movement control, voice control, electromyogram signals (EMG), electroencephalogram (EEG).

[12] YOSHINORI KUNOTL AND YOSHIAKI SHIRATI Tongue controlled and joystick-controlled technologies [4]. But not all of them are available in Bangladesh except for a joystick-controlled wheelchair. Along with the higher buying and

maintenance costs, there are some other drawbacks to those types of wheelchairs. For controlling the wheelchair through eye movement, there would be a screen always in front of the operator/patient. The wheelchair won't move without the perfect detection of the movement of the eye/eyelid [5]. In a voice-controlled wheelchair, the wheelchair is being operated by the voice command through a speech processing system. However, in a real-life environment, noise around the user may mix with the user's speech. This may make the operation of this device difficult in noisy environments.

[13] DONALD P.MASSA It In 1953, George Klein first invented the electric-powered wheelchair. But this chair had no extra safety intelligent systems that could make the life of the operator easier. Many research works have been presented since then and there are different versions with different technologies of wheelchairs what we see today in the market such as eye movement control, voice control, electromyogram signals (EMG), electroencephalogram (EEG), Tongue controlled and joystick-controlled technologies But not all of them are available in Bangladesh except for a joystick-controlled wheelchair. Along with the higher buying and maintenance costs, there are some other drawbacks to those types of wheelchairs.

[14] S.FIORETTI T.LEO AND S .LONGHI For controlling the wheelchair through eye movement, there would be a screen always in front of the operator/patient. The wheelchair won't move without the perfect detection of the movement of the eye/eyelid In a voice-controlled wheelchair, the wheelchair is being operated by the voice command through a speech processing system. However, in a real-life environment, noise around the user may mix with the user's speech. This may make the operation of this device difficult in noisy environment.

[15] PIE JIA ,HUOSHENG H HU,TAO LU KUI YUAN In a voice-controlled wheelchair, the wheelchair is being operated by the voice command through a speech processing system. However, in a real-life environment, noise around the user may mix with the user's speech. This may make the operation of this device difficult in noisy environments. might even cause undesirable accidents due to misinterpretation .

[16] RAJESH KANNANMEGALI NGAM ,RAMESH NAMMILY NAIR Moreover, different people have different accents which could create difficulties for the processor while processing a user's speech who is a native speaker [6]. To control the wheelchair with the tongue the user has to wear a headset. A magnetic pallet is placed within the headset of the user to touch the pallet with his tongue to use tongue-controlled wheelchair. Patients with the oral disease should not be using such devices. Sensors that are being used to www.ijcrt.org © 2023 IJCRT | Volume 11, Issue 12 December 2023 | ISSN: 2320-2882 IJCRT2312810 International Journal of Creative Research Thoughts (IJCRT) www.ijcrt.org h227 detect command of the user through tongue may have short longevity due to being continuously touched by saliva [7]. Practical solutions of these problematic issues have been tried to solve by proposing this hand gesture-controlled wheelchair.

[17] PROF .VISHAL V.PANDE It's an Arduino based standalone platform. Hence the power consumption by this device is less. The reasonable cost of production is useful for the handicapped persons and can easily be controlled by the hand gesture of his own. Moreover, if any difficulty occurs in the patient control system or any authorized person wants to control the wheelchair it can be done by the Bluetooth and the location of the wheelchair can be determined through IOT based network. The following sections of this paper describe the design principle, the sensors used and the overall functionality of the proposed system.

III METHODOLOGY

Gesture Recognition Technology Utilize sensors such as cameras, depth sensors (like LiDAR), or wearable devices (like gloves with sensors) to capture and interpret hand gestures accurately. Machine learning algorithms or computer vision techniques can then recognize these gestures and translate them into control commands for the wheel chair .Fall Detection System Incorporate sensors, accelerometers, or gyroscopes to detect sudden changes or unusual patterns in the wheelchair's orientation that indicate a potential fall. These sensors should seamlessly integrate with the gesture recognition system. Algorithm Development Develop algorithms that can discern between intentional hand gestures used for controlling the wheelchair and movements indicative of a fall. This requires training algorithms to recognize specific gestures while also distinguishing them from accidental or irregular movements that might occur during a fall. Control Mechanism Connect the gesture recognition system to the wheelchair's control system, enabling it to respond to recognized hand gestures A wheelchair has to be created to control the direction using hand gesture movements. The objective of this project is to develop a smart wheel chair which sense the Gestures of the hand to run the wheelchair. Here two sections are included, one for the transmitter block and other for the receiving block. Both sections need to be designed and implemented separately. Accelerometer Is used as the sensor to detect the tilting of the hand, which in turn transmit the signals though the RF modules.

IV BLOCK DIAGRAM

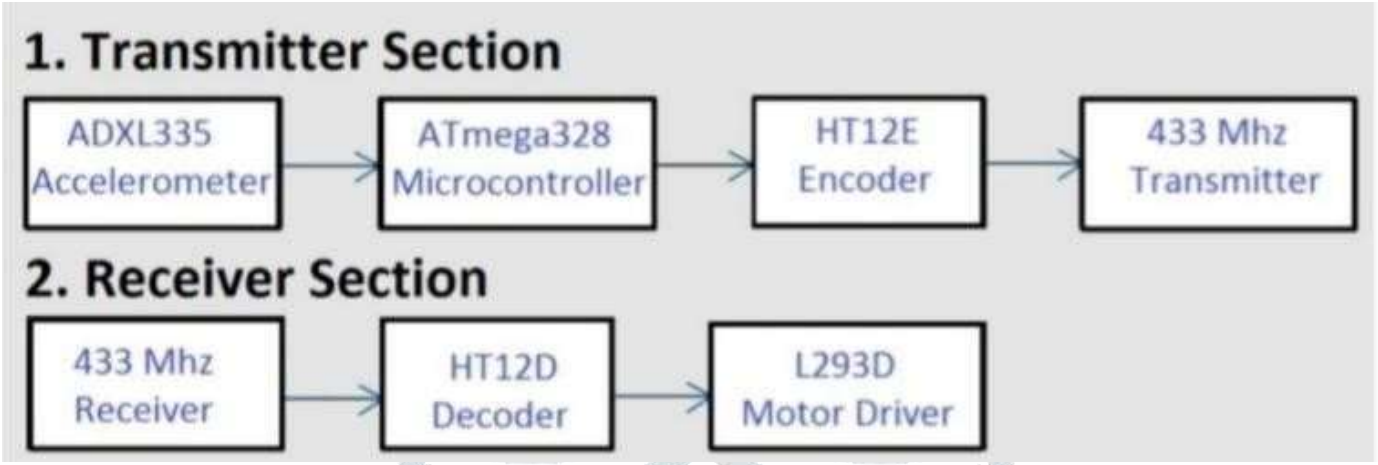


Fig. 4.1 Block Diagram of gesture recognation

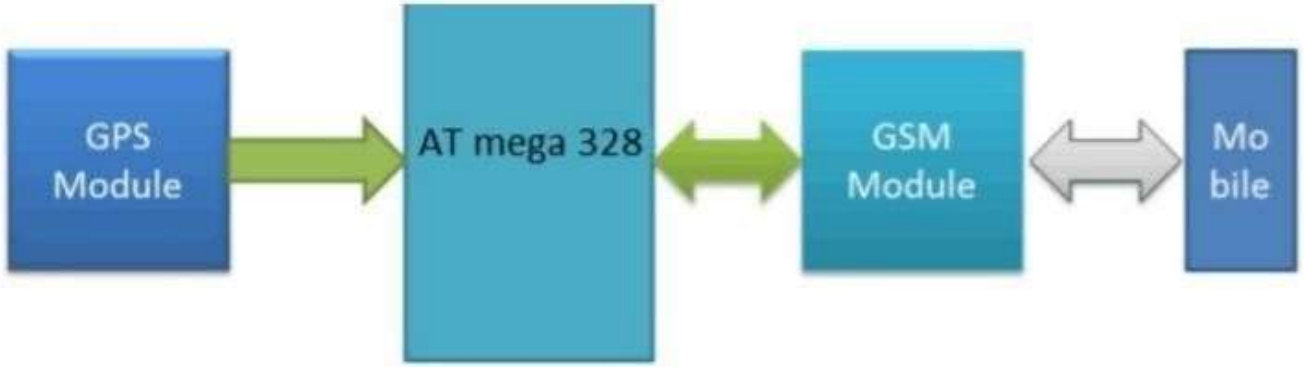
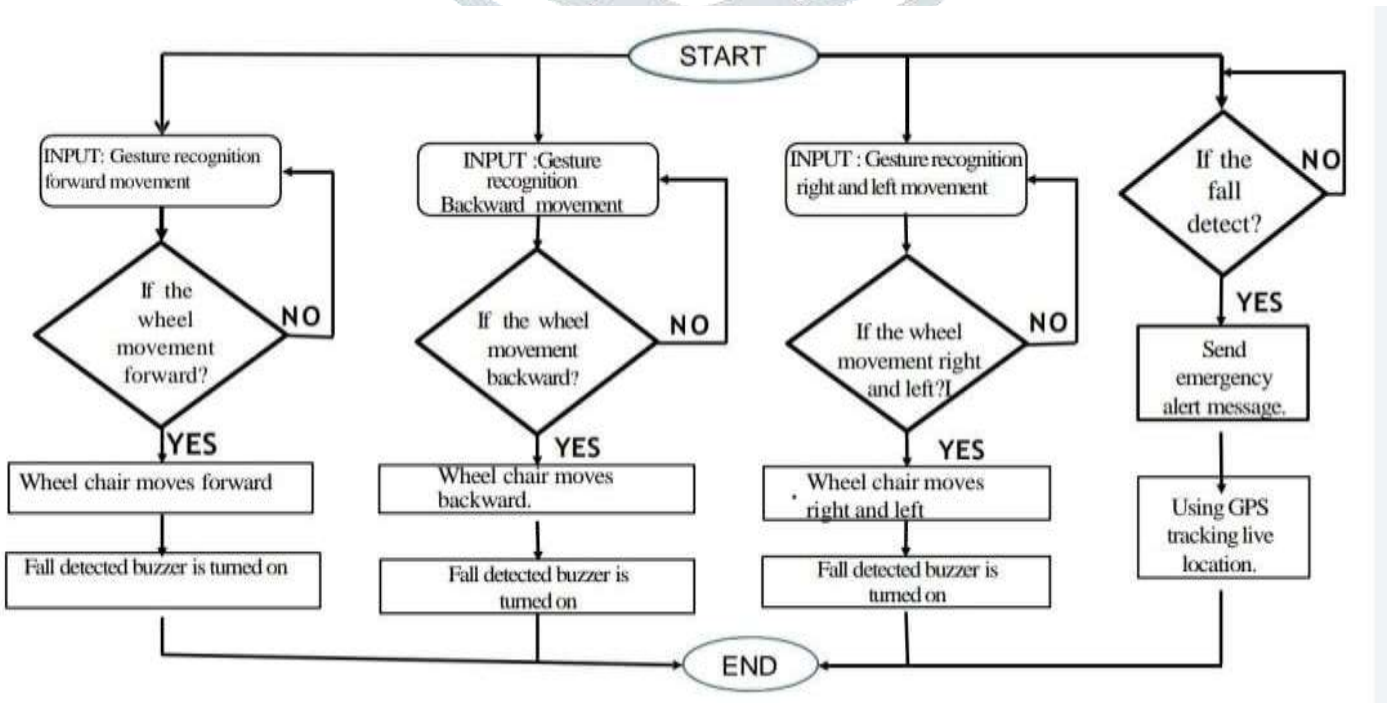


Fig. 4.2 Block diagram of fall detect system

V FLOW CHART



VII. RESULT

Fall Detection The system can accurately detect when a person has fallen based on sensor data, such as accelerometers or gyroscopes. This can trigger an alert to notify caregivers or emergency services. Location tracking If the system is integrated with GPS or indoor positioning technology, it can determine the precise location of the individual who has fallen. Alert Notification once a fall is detected, the system can send alerts to designated contacts, such as family members, caregivers, or emergency responders. These alerts can include the location of the individual to enable swift assistance. Emergency Response Coordination the system can facilitate coordination between emergency responders and caregivers by providing real-time updates on the individual's location and status. User Privacy and Security it's crucial for the system to maintain user privacy and security by ensuring that location data is only shared with authorized parties and that sensitive information.

Fig 7.1 Hand gesture wheel chair

Fig 7.2 Emergency alert message and live location.

VIII. Conclusion

The conclusion of hand gesture wheelchair control systems often emphasizes their potential to enhance mobility and independence for individuals with limited physical abilities. These systems have shown promising results in terms of accuracy, responsiveness, and user satisfaction. However, challenges such as robustness in various environments and user fatigue still need to be addressed for widespread adoption. Overall, hand gesture control holds significant promise for improving the quality of life for wheelchair users. The future scope of hand gesture wheelchair control.

IX. FUTURE SCOPE

The future scope of hand gesture wheelchair control with a fall detection system is quite promising. Integrating hand gesture control with fall detection adds an additional layer of safety and autonomy for wheelchair users. In the future, advancements in sensor technology, artificial intelligence, and machine learning algorithms could lead to even more accurate and reliable hand gesture recognition and fall detection capabilities. This could improve the overall usability and effectiveness of such systems, making them more intuitive and responsive to the user's needs .Furthermore, incorporating connectivity features such as IoT (Internet of Things) integration could enable real-time monitoring and data analysis, allowing caregivers or medical professionals to intervene promptly in case of a fall.

IX. REFERNCE

[1] AMUNDSON JS "A Wearable Head- Mounted Sensor-Based Apparatus for Eye Tracking Applications" IEEE International Conference on Virtual Environments, Human-Computer Interfaces, and Measurement dated(2017)

[2] A. Murarka, M. Sridharan and B. Kuipers. 2008. "Detecting obstacles and drop-offs using stereo and motion cues for safe local motion".IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS-08).

[3] Shilpa Gulati, Benjamin Kuipers2008. "High Performance Control for Graceful Motion of an Intelligent Wheelchair". Proceedings of the IEEE International Conference on Robotics and Automation (ICRA).

[4] Maric, B. " Robotic assistance: an automatic wheelchair tracking "Intelligent Robots and Systems, 2011. (IROS 2010). 2011 IEEE/RSJ

[5] L .JosefssonandP. Persson, Conformal Array Antenna Theory and Design

[6] R. Ghodssi, P. Lin (2011). MEMS Materials and Processes Handbook. Berlin: Springer. ISBN

[7] R. C. Simpson. Smart wheelchairs: a literature review. Journal of Rehabilitation Research and Development . www.ijcrt.org © 2023 IJCRT | Volume 11, Issue 12 December 2023 | ISSN: 2320-2882 IJCRT2312810 International Journal of Creative Research Thoughts (IJCRT) www.ijcrt.org h229

[8] Mazidi,"PIC Microcontroller And Embedded system senior member IEEE

[9] HarpitSingh ,"Making Of PIC Microcontroller Instrument And Control (2020)

[10] Asebrandt, Susanne iwarsson and Agnetasta, "Older People,,s Use of Powered Wheelchairs for Activity and Participation,Taylor and Francis health Sciences. (2021)

[11] Ren C. Luo, Tse Min Chen, Chi-Yang Hu, and Zu, Adaptive Intelligent Assistance Control of Electrical Wheelchairs by Grey-Fuzzy Decision-Making Algorithm,, , Proceedings of the 2018 IEEE International Conference on Robotics & Automation Detroit, Michigan

[12] Yoshinori Kunotl, TeruhisaMurashimat NobutakaShimadat and Yoshiaki Shirait Interactive Gesture Interface for Intelligent Wheelchairs member of IEEE

[13] Donald P. Massa, Choosing an Ultrasonic Sensor for Proximity or Distance Measurement in 2022

[14] S. Fioretti, T. Leo, and S. Longhi, _A Navigation System for Increasing the Autonomy and the Security of Powered Wheelchairs,,, IEEE Transactions On Rehabilitation Engineering, December 2015(2016)

[15] Pei Jia, Huosheng H Hu, Tao Lu Kui Yuan, _Head gesture recognition for hands-free control of an intelligent wheelchair online assistant survey

[16] Rajesh Kannan Megalingam, Ramesh Nammily Nair, —Automated Voice based Home Navigation System for the Elderly and the Physically Challenged‖ Feb. 13-16-2017

[17] Prof. Vishal V. Pande, "Hand Gesture Based Wheelchair Movement Control for Disabled Person Using MEMS" et al Int. Journal of Engineering Research and Applications Vol. 4, April 2019