Gesture-Controlled Wheelchair

Prof. Varsha S Jadhav[1], Anusha Raichur[2], Manasi U Remje[3], Pruthviraj S V[4], Aishwarya S Bijapur[5]

[1]Prof. Varsha S Jadhav, Professor, Department of Information Science and Engineering, SDMCET Dharwad, Karnataka, India
[2]Anusha Raichur, Student, Department of Information Science and Engineering, SDMCET Dharwad, Karnataka, India
[3]Manasi U Remje, Student, Department of Information Science and Engineering, SDMCET Dharwad, Karnataka, India
[4]Pruthviraj S V, Student, Department of Information Science and Engineering, SDMCET Dharwad, Karnataka, India
[5]Aishwarya S Bijapur, Student, Department of Information Science and Engineering, SDMCET Dharwad, Karnataka, India

---

***Abstract*— Converting an image to a digital representation and performing operations on it to extract vital information is what image processing entails. When using specialised signal processing algorithms, the image processing system traditionally manages all images as 2D signals. In India, the proportion of disabled individuals has increased in both urban and rural areas. The unpleasant impairment could be a result of birth, medical treatment, or an accident. The purpose of this project is to develop a hand gesture-controlled wheelchair that will allow physically challenged people to travel from one point to another by merely directing their hands. The proposed method could be used on a broad scale to help the elderly and partially disabled. A well-tested machine algorithm, as well as related materials and technologies, have been merged with a microprocessor in this proposed system. By assisting the elderly and physically challenged in becoming more self-reliant, this gesture controlled wheelchair could play a critical role in increasing their confidence, function, and willpower. The goal of this research is to develop a system that recognises hand motions in real time and controls the wheelchair using an image processing method.**

***Index Terms*—Intelligent wheelchair, microprocessor, image processing**

I. INTRODUCTION

Even in this day and age of continuously expanding health and medical facilities, a substantial number of people still have trouble getting around on a daily basis. Clearly, a wheel chair is the greatest solution for them, since it may really assist them. Our mission is to assist physically challenged people who are suffering from ailments that limit their day-to-day movement. Even for a normal person, driving a wheelchair in a domestic environment is a challenging chore; this necessitates a well-designed and thoroughly tested automated wheelchair that is also user friendly. In this situation, One of the most essential steps that may be taken to improve the lives of physically challenged persons is to use wheelchairs with sophisticated navigational intelligence.

II. EXISTING SYSTEMS

The existing systems use the following different approaches:

- ACCELEROMETER SENSOR technology from MEMS (Micro Electro Mechanical Systems), which involves attaching accelerometers to the fingertips and back of the hand.. A MEMS ACCELEROMETER SENSOR is highly sensitive and detects every tilt, hence it requires the user to be very accurate with his gestures else it will end up producing an errored direction shift of the wheelchair.

- IRLED – TSOP pair of sensors organised in a predefined way to record the gesture. This circuital layout limits the area for gesture recognition. The LED arrangement could possibly generate errored results if the gesture made is outside the detection limit of the LED.

III. PROPOSED SYSTEM

The proposed system uses the following approach to overcome the problems of the existing systems:

The system will capture images in real time and send it to a microprocessor such as raspberry pi where each image will be processed and analysed using a hand gesture recognition algorithm. After this the corresponding instruction is generated and the wheelchair navigates based on the instruction.

IV. METHODOLOGY

The system captures real-time video of the user using a camera which is further sent to microprocessor (ex: - raspberry pi).

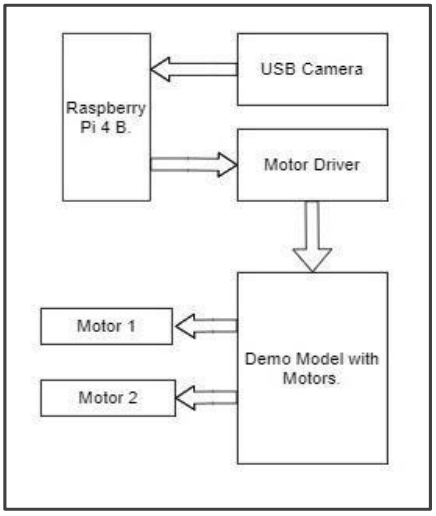
The microprocessor converts the captured video into multiple frames of images for further processing. Each image is then processed and hand gesture recognition algorithm using open cv is applied on the image. Analysing the gesture, respective instruction is generated. The generated instruction is then

sent to the motor driver. The motor driver operates the system in accordance with the instructions given and manoeuvres the wheelchair in left, right, forward, and backward directions. A user can initiate the system by switching on the system using the switch. The system will navigate the user using the wheelchair by the hand gestures of users. The system can navigate forward, backward, left and right movements. The system will stop moving if no hand gestures detected for 5 seconds (can be changed as per user requirements).

The user should be able to make hand gestures. The system must respond to the changing hand gestures quickly. The system must recognize the hand gestures through image processing quickly and precisely.

V. SYSTEM DESIGN

The raspberry pi receives the real time video from the USB camera and processes it with the machine learning library using media pipe and sends the generated instruction to the motor driver and the instruction is further sent to the respective motor for operation.



VI. RESULTS

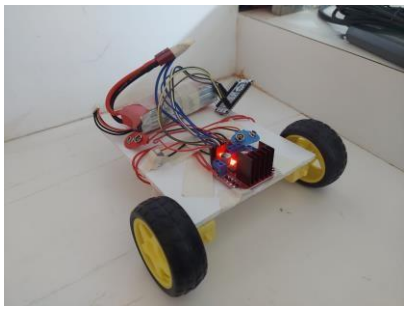
A camera is mounted over the wheelchair to capture the real time video carrying the gesture made by the user. Then this video is fragmented into multiple frames that is analysed by an OpenCV algorithm which classifies the gesture captured into the right instruction for the motor driver to steer the wheelchair appropriately as per directions. This entire procedure is carried out by the microprocessor and the respective result is obtained accurately.

Recognition of instructions

Console output

```
Forward
Forward
Forward
Forward
Forward
Speed = 75%
Speed = 75%
Speed = 75%
Speed = 75%
Speed = 75%
Speed = 75%
Speed = 75%
Speed = 100%
Speed = 100%
Speed = 100%
Left
Left
Right
Right
Stopped !!
Stopped !!
Reverse
Reverse
Reverse
Stopped !!
Stopped !!
Stopped !!
```

Demo Model



VII. CONCLUSION

A new method for hand gesture controlled wheelchair system has been presented in this paper that could successfully be applied on a large scale to the elderly and individuals with mobility disability. As showcased in this paper, an individual can operate the wheelchair by just making hand gestures which is captured by USB camera, this removes hassle of attaching sensors and wires to the wheelchair operator. This system can be implemented to enhance the confidence, and willpower of individuals with mobility disability and the elderly as it will help them be independent and live a life with more comfort and joy.

VIII. ACKNOWLEDGEMENT

The authors of this paper, are very grateful and would like to express the support and facilities provided by SDMCET, Dharwad. We would also thank our guide, Prof. Varsha S Jadhav for the support and guidance to carry out this implementation successfully. We would also like to thank our friends to keep us motivated during the period of this project.

REFERENCES

1. Yassine Rabhi, Makrem Mrabet and Farhat Fnaiech, “Intelligent Control Wheelchair Using a New Visual Joystick”, Published in Journal of Healthcare Engineering (doi: 10.1155/2018/6083565) Year – 2018

2. Fahd N. Al-Wesabi, Mohammad Alamgeer, Fuad Al-Yarimi and Adnan Albaadan, “A Smart-hand Movement-based System to Control a Wheelchair Wirelessly”, Published in Sensors and Materials (Vol. 31, No. 9) Year – 2019

3. Pushpendra Jha and P.Khurana, “Hand Gesture Controlled Wheelchair”, Published in International Journal of Scientific & Technology Research (Volume 5, Issue 04) Year – 2016

4. Konduru Sujana, and N. Gunasekhar Reddy, “Hand Gesture Controlled Wheelchair using Raspberry Pi and OpenCV”, Published in IJSERT (Volume 5, Issue 29) Year – 2016

5. Rajesh Kannan Megalingam, Clarion Chacko, Binu P. Kumar, Ashwin G. Jacob and P. Gautham, “Gesture controlled wheel chair using IR-LED TSOP pairs along with collision avoidance”, Published in 2016 International Conference on Robotics and Automation for Humanitarian Applications (RAHA) (DOI: 10.1109/RAHA.2016.7931872), Year – 2017

6. Ruchi Manish Gurav and Premanand K. Kadbe, “Real time Finger Tracking and Contour Detection for Gesture Recognition using OpenCV”, Published in ICIC (doi:10.1109/IIC.2015.7150886), Year – 2015

7. Shanelle Fernandes, Rushia Fernandes and Jessica Kakkanad, “Wireless Gesture Control Wheelchair”, Published in IJRTE (Volume 9, Issue 2), Year -2020

8. Prof. Vishal V. Pande, Nikita S.Ubale, Darshana P. Masurkar, Nikita R. Ingole, and Pragati P. Mane, “Hand Gesture Based Wheelchair Movement Control for Disabled PersonUsing MEMS.”, Published in IJERA (Volume 4, Issue 4), Year - 2