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Smart Wheel Chair for Differently Abled Person

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Abstract: In India, our Prime Minister started Digital India and the Smart India concept. This Concept helps a lot to people. The differently-abled people facing the problem and they deserve a beautiful life. For their better life, we came to an idea of a small wheelchair for a differently-abled person. This wheelchair trying to provide better features at a lower price.
Keywords: Smart Wheelchair, Differently abled person, Eye movement, Automatic working, Automatic Detection, Image processing, Wheel.

I. INTRODUCTION

Today, many facilities are provided for normal people but few of them help to Differently abled people and few not. Most of the time they have depended upon other normal people for their daily activities. Starting from activities between early mornings till night they are dependent on the other. Their daily movement depends on a wheelchair which handled by others. The Smart wheelchair is a little bit contribution to them hence they can be independent for their movement. The Small wheelchair is the Gift for differently-abled persons but today, the cost is ranging from 1 lac to 2 lac. As an engineer, it becomes our moral responsibility to help our society and support our people. With this, we came with an idea of a Smart Wheelchair at affordable prices. This Smart Wheelchair is independent of anyone. This Smart Wheelchair is fully controlled by eye movement. This automation is done by a small microcontroller i.e. Raspberry pi.

II. RELATED WORK

A. Traditional Wheelchair

Traditional or manual wheelchairs are dependent upon other people. The cost of power Wheelchair is high that's why a middle-class person cannot afford it. This wheelchair works manually and needs a person for relocation from one place to another.

B. Power Wheelchair

Power wheelchair slightly makes differently-abled people independent for their movement. The Movement of this wheelchair is controlled by the joystick. The Disadvantage of this wheelchair is it can't help for a handicapped person. For this power, wheelchair caretaker is also involved hence it further become dependent. Also, more power is required for working. Increasing power effect on price. Hence middle-class people can't afford it.

III. PROPOSED SYSTEM

Traditional and Power Wheelchair has some advantages and disadvantages. On thinking of the advantages and disadvantages we proposing a new Smart Wheelchair. This Smart Wheelchair is financially suitable for common people.
So we proposed a Smart Wheelchair which is more convenient and financially suitable for a differently-abled person. This system controlled by microcontroller i.e. Raspberry Pi 3. The controller accepts the eye movement of the person.

IV. HARDWARE DESIGN MODEL

A Smart wheelchair contains raspberry pi, camera, sensor, motors, and switch. All components need a standard power supply. The following figure shows the functionality of this model.

A. Hardware Description

1) *Raspberry pi:* Raspberry pi having its operating system known as Raspbian. Raspbian is a Linux based operating system. Raspberry pi is the brain of the system. All the other components are connected to the Raspberry Pi board.
2) *Motor:* Two 12v DC motors are used in this project. Using this motors wheelchair can move forward, reverse, left and right direction.
3) *Web Camera:* Image capturing is done by a web camera. All movements of eyes get captured using this camera.
4) *Ultrasonic Sensor:* To Detect and obstacles in the path of wheelchair we use the ultrasonic sensor. The ultrasonic sensors measure the distance between wheelchair and obstacles. The data of the ultrasonic sensor used to start or stop the motor.

B. Software Description

1) *Python Language:* A python is an object-oriented high-level programming language. Python having easy syntax also reduce the cost of program maintenance.

2) *Putty Software:* A putty is open-source software. To connect the desktop to raspberry pi board putty software is used.

3) *OpenCV Image Library:* OpenCV is free for academic and commercial use. OpenCV has C, C++, Python and Java interfaces. It also supports Windows, Android, Linux.

V. DESIGN METHOD

According to eye pupil's movement, an algorithm used for image processing. Using Eye-tracking and Eye detection method we collect all information about the movement. Detecting the face is an important task. If multiple faces are detected then it shows error. After collecting all the required information for detecting face our system starts working for image processing. Web camera capturing eye movement. By pointing the rectangular area over the eye and it determines the center point by using some image processing technique. The system will crop the region of interest and it will draw all possible circles on that area to detect eyeball. The corner of the eye is detected by the corner detection method. to measure the distance between the center point and eye circle center point using a coordinate system.

The minimum value indicates the eye pupil in the left and maximum value indicates the eye pupil in right. If there is no movement of the eye it indicates the eye is in the middle position. When the eye moves left, the left motor will run and when the eye move in right, the right motor is run. If the eye will be in the center, both motor run and wheelchair move in the forward direction. If any obstacle is detected, the system will stop and move toward the left or right direction. Eye blinking logic will be decided to start and stop operation. OpenCV library is used for image processing.

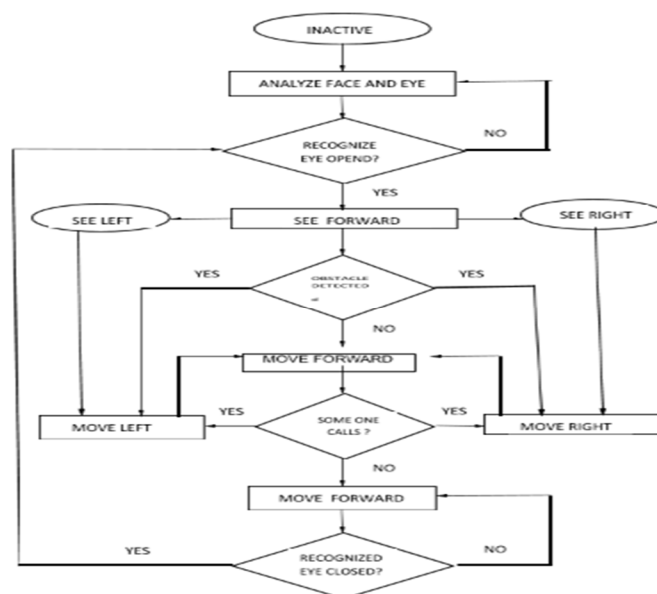The figure shows the flowchart of the system.

Fig. A Flowchart

VI. IMPLEMENTATION AND SYSTEM DESCRIPTION

The Raspberry Pi 3 is used with low power consumption, Raspberry Pi has 40 pin GPIO, 4 USB ports, UART, PWM, HDMI port and Ethernet adapter port for internet connection via a wireless or wired connection. Raspberry pi has a 512 MB RAM and capable of up to 32 GB external memory, controlled based on ARM architecture camera is directly connected with the Raspberry Pi board. The camera captures the images continuously, the distance between the eye and the camera device is fixed. It may be 10 to 15 cm. To find the exact pupil location used Haar Cascade algorithm. Many algorithms are used to calculate the center point of the eye and the corner. This gives the correct information eye movements. With raspberry pi board motor driving circuit is connected, relay for controlling the motor driving IC. To perform the required operation like left, right, forward and stop System continuously generates the directive signal. Ultrasonic sensor for obstacle detection.

VII. SYSTEM INSTALLATION

A Raspbian operating system is installed on Raspberry pi. OpenCV library is used for image processing.

VIII. EYE TRACKING

Detection of movement of the eye is a measuring factor of our project. Image processing uses different methods to detect that direction. According to the movement of an eye, our wheelchair changes his direction.

IX. RESULTS

According to image processing and based on eye movement our system gets resulted data. It sends the command to the motor driving circuit. Then based on eye direction our wheelchair change his direction. The ultrasonic sensor is used in this system for obstacle detection. It measures the distance between wheelchair and obstacle. When an obstacle is very close to the wheelchair, motors will stop the wheelchair.

X. CONCLUSION AND FUTURE WORK

A. Conclusion

Using this project differently-abled person move wheelchair independently in any direction. In the real-time application, we can use web cameras and ultrasonic sensors depend on their application. The wheelchair movement operation with some delay time. The performance degrades in dark light. To tracking of the eye, pupils are difficult in dark light.

B. Future Work

Using some sensors and functions the system would be more interactive with patients Delay time may be further reduced to a second. The operation of the system depends on the eye movement of totally specially-abled patients. Thus wheelchair moves in all required directions.

XI. ACKNOWLEDGMENT

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