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Intellectually Automated Wheelchair

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***Abstract*: Intellectually Automated Wheelchair is an advanced IOT based wheelchair which is helpful for handicapped, aged, blind as well as paralyzed people. This is implemented on Raspberry Pi 3 using different sensors such as ultrasonic sensor, LDR sensor, pressure sensor, etc. It also provides great communication facility. Face recognition and face detection techniques are there to recognize people for blind ones. Also there is commanding for altering purpose. This paper has described about wheelchair's working and functionalities.**

***Keywords*: Face recognition, Face detection, Health-monitoring, IOT, Obstacle avoidance, Smart-fall detection, Voice commanding,**

1. Introduction

This paper is designed as an idea to ease the lives of those among us who are unfortunate enough to have lost the ability to move their legs due to paralysis, old age or accident. These types of people usually depend on others in their daily life especially in moving from one place to another. Wheelchair users need continuous help from someone for wheelchair handling. Using an electrical wheelchair leads to a large amount of independence for persons with a physical disability who can neither walk nor operate a normal wheelchair alone. In some cases, the disability causes someone to lose the ability to use his hands; so, in this case, the way of controlling a power wheelchair can be done using voice commands for hands-free patients leading to an interesting and promising outcome. But, still, the availability of smart wheelchair solutions is often limited because of the high costs and not-so-friendly operation. Smartphone or joystick is used to control the movements of wheelchair along with obstacle avoidance. The project also incorporates the use of ultrasonic sensors to detect obstacles and notifies the system and stop the wheelchair until further command. In this work, Smart Wheelchair control using Raspberry pi 3 and Wi-Fi module via android application is presented. Face recognition is used especially for blind people. Health-monitoring system helps to keep track of the patient's health with the help of the heartbeat sensor. A pressure sensor is used for smart fall detection and the responsive website pops up the notification about the accident. To make system energy efficient solar panel is used to charge the battery. A smart charging technique is used while charging the battery, means when a battery is full, automatically charging get stopped and when a battery is low it automatically triggers the charging. LDR (Light Dependent Resistor) is used to measure an intensity of light and according to per that, it turns ON/OFF the light system.

2. Methodology

Raspberry Pi is the heart of an entire system. Various sensors are connected via raspberry pi to do a particular task. Each sensor is connected to GPIO pins (there are 40 pins in total). There are different tasks which are performed by wheelchair with the help of Raspberry Pi such as:

Obstacle Avoidance: - Ultra-Sonic sensors are used to achieve this task. An ultra-sonic sensor has one transmitter and one receiver to detect an object. Specific range is given to the sensor through python code.

Health-Monitoring System: Heartbeat sensor is used for tracking the pulse rate of the patient to observe his/her heart condition.

Voice-Commanding: Some useful commands are given to the patient for example reminder of medicines, diet reminder, etc. through the website using text to speech generation.

LDR: Using LDR sensor lights are turned ON/OFF according to per the intensity of the light.

Smart-fall Detection: Pressure sensor is used to detect the accidents and immediately informs the user through the website/smartphone

Raspberry Pi processes sensor data with the help of python code and produces output. Necessary results are reflected on the website for analysis and communication purpose. Basically Raspberry Pi acts as CPU of this system. With the help of dedicated RAM, storage capacity as well as graphics and great processing speed it can process data in a better way.

HAAR algorithm is used to implement face recognition. For this, first we have to take some number of images of the person that we want to recognize and we have to store all these images into our database. HAAR algorithm analyzes different images and works on different facial parts such as eyes, mouth, nose, etc. and predicts the face. For this camera is used to track the face of the person which is in front of the person which is blind. It is mainly useful for blind people to communicate. A camera is also useful for observing the patient's condition if needed. The responsive website plays an important role in communication between patient and user. It also keeps the record of schedules of the person which is using wheelchair

Table 1
Literature Survey

Name	Author	Description
Robotic Wheelchair	Phaeton Osaka	Works on panoramic camera of 360° for computer vision. Also Has two operating modes: obstacle avoidance and person tracking.
Internally Mapped Wheelchair	Senario Tide	Uses obstacle avoidance and autonomous navigation based on internal map. Works on neural networks for localization, and distributed control architecture
Smart Wheelchair	Siamo University of Alcala, Spain	Works on different inputs such as voice, face/head gestures, provides obstacle avoidance. Uses both laser and IR to detect drop-offs.
Intelligent Wheelchair	Osaka University, Japan	Uses two cameras, one faces user, second faces forward. User gives input to system with gestures which get interpreted by inward-facing camera. Outward-facing camera traces targets and gives control to user of wheelchair with gestures when out of wheelchair.
Sonar-Based Wheelchair	Stanford University, U.S.	Sonar system is used to detect user's head position. Works on different operating modes such as: collision avoidance, target tracking, and wall following.
Voice-cum-Auto Steer Wheelchair	CEERI, India	Wheelchair travels to destination by following tape tracks on floor. IR sensors used to prevent collisions and follow tape tracks.
Deictic Wheelchair	Phaeton Northeastern University, U.S.	Wheelchair is controlled by user through deictic interface; user selects object from video screen and then wheel chair takes that object as a destination.
Dead Reckoning Wheelchair	National University of Singapore	Works on dead reckoning to keep wheelchair on prescribed path. User can also leave path to achieve obstacle avoidance, and controls speed of wheelchair along path. GUI or walkthrough defines the Path of travelling for his wheelchair. Torque sensors which are used in push rims sense user input. Small motorized wheels are there to apply force to regulate the wheelchair wheels.

such as medicine timings, diet plans, daily tasks, etc. All these schedules can be modified or updated with the help of website for flexibility. The website also has a web view over a smartphone to increase accessibility of the popped up notifications.

Wheelchair mainly controlled with the help of either joystick or using a smartphone. It gives instructions to motor drivers according to per the destination. These motors are instructed by python coding according to per joystick/smartphone and can be managed by ultrasonic sensors as well for obstacle avoidance. The entire system is powered with the help of rechargeable batteries so for making it more energy efficient there is a solar panel to charge the battery. Also, this solar system works on smart charging mode, means it triggers the charging only when batteries are low and automatically stops the charging when a battery is full. It saves lots of energy as well as increases battery life.

3. System architecture

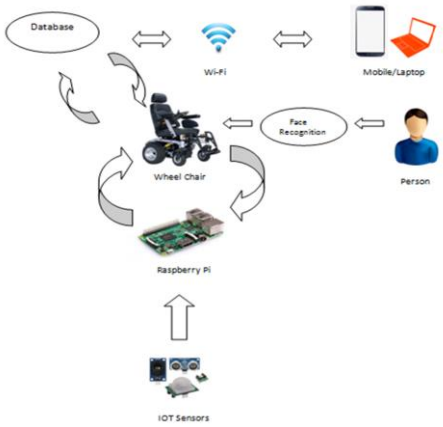

Fig. 1. System architecture

4. Conclusion

Implemented wheelchair covers more and useful functionalities in efficient way compared to other existing wheelchairs. This Intellectually Automated Wheelchair is a good solution for handicapped, blind, paralyzed as well as aged people. It is energy efficient due to solar panels and also a good communication service in case of emergency.

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