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Smart Wheelchair with Medicine Reminder and Autopilot System

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Abstract - *Wheelchairs have always been a boon for physically impaired people in our society. Many people suffer from some kind of temporary or permanent illness or disability. Both manual and electrical wheelchairs are used by patients independently. There has been a progressive development of wheelchairs over these past few years. However, in several severe cases, people find it difficult to use the wheelchair by themselves. This is due to the fact that independent mobility is difficult and they have to rely on another person for help. Researchers are working on these issues to develop a smart wheelchair. The aim of this project is to work on pre-existing models of wheelchairs and discuss on future works. In this project, we have designed a wheelchair which can be controlled by voice command with the help of a mobile-based application. An Autopilot System for navigation is also incorporated. A Medicine Reminder system is also an additional feature that result in a wheelchair with multiple functionalities. Thus, the wheelchair has 3 different and distinct functions that it can do in order to make the life of the user easier and convenient.*

***Key Words*: Wheelchair, Embedded, Autopilot, Voice Recognition, IR sensors**

1. INTRODUCTION

A Wheelchair is a mobility aid which is designed to help the people with mobility impairment which is either manually operated or motor-driven. 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. Incorporating and implementing voice commands to the pre-existing conventional wheelchair model results in a voice recognition-based intelligent wheelchair. The addition of an Autopilot System allows the user to go to different parts of their house, without many physical or digital input. Such a wheelchair is a significant social aid for old-aged people as well as physically impaired people. A great added advantage to people using this smart wheelchair is that it makes timely reminders for them to take medicines, depending on when they need to take the medicine. The user can make use of the mobile application to set the timer when needed. Hence, the elderly can take the medicines on time when alone. The wheelchair moves around with an app controlled voice recognition system and an autopilot system with IR transmitters and IR receivers which allows the wheelchair to move around, detect its destination and move to the area. We hope our project would be of great significance and would play an important role in the mobility of physically impaired people. In this physical world of fast moving technology such a device would be a lifesaver for many individuals.

2. LITERATURE REVIEW

Zannatul Raiyan et al. in their work, designed a wheelchair which can be controlled by voice command for physically disabled people who have difficulty in moving hands due to various reasons like paralysis or aging. The design provided some additional features like obstacle detection for uninterrupted movement of wheelchair and a GSM based navigation system for tracking the location of the wheelchair. It can send notifications to increase the functionality of the automated wheelchair system. The system is implemented mainly using Arduino Mega2560, for voice recognition we use Easy VR3 module and SIM900A GSM module for location tracking. In the proposed design, the audio processing is done with the integrated speech processing module (Easy VR3) which helps to remove any bulky complex extra computing device. Also, the proposed technique was comparatively simple and was cheaper to implement with the commonly used and available electronic devices in comparison to the existing techniques.

In the method used by Nasirn Aktar et al. they used voice module V3 to record patients voice and recognize the voice commands given by the patient to follow the instructions given. The voice module converts the voice commands into hexadecimal code and this information is given to the Wi-Fi module and it in turn controls the wheelchair. The motor driver IC controls the movement of wheels in desired direction. They also implemented an innovative method of location tracking of the user by using GPS module in the wheelchair. The information about the location of the user is send to the to the developed smartphone application through Firebase. This system offers obstacle detection using IR sensors. The smartphone application can be used by the

user's relatives to know the location of the user. Benefits of using an Android app was that it was low cost as well as it provided a user friendly interface.

3. METHODOLOGY

- The voice control/navigation pad functions when the voice inputs (like forward, backward, etc.) are taken from the user through the mobile app, decoded by Google's Speech to Text function and then necessary instruction is sent to the Arduino on the wheelchair via Bluetooth. The Arduino then drives the motor driver which in turn controls the movement of the four motors.

- The automatic medicine reminder system gives the time at which medicines are to be taken. It is set in the app by the user and it will give reminders at the necessary timings through the buzzer that rings at the specified instant.

- The autopilot system has IR transmitters that are installed at the entrance of each room, which constantly give out IR signals of 38 KHz. These signals are constantly monitored by IR receivers mounted on top of a servo motor, on the wheelchair. Whenever a signal is detected, the wheelchair moves to the particular sensor from which the signal was received. Thus the autopilot system will make the wheelchair move in specified direction.

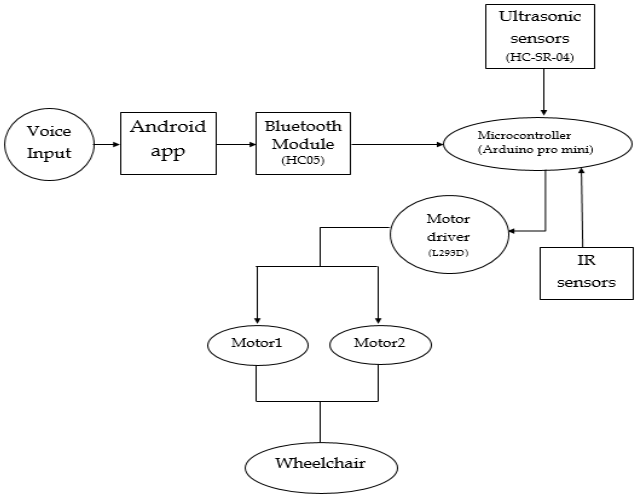

Fig-1: Block Diagram of the Smart Wheelchair

4. WORKING

The wheelchair has 3 different functionalities. All 3 have different working mechanisms.

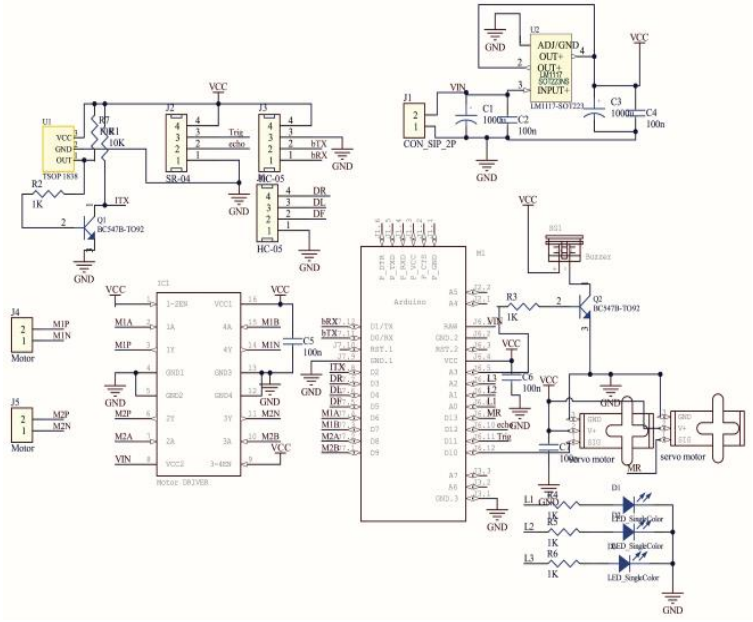

Fig-2: Circuit Diagram of the Smart Wheelchair

4.1 Voice Recognition/Navigation Pad

The voice input is taken and classified from the in-app voice recognition using Google's text to speech function that is incorporated. The user can give the instruction to move through this function. Once the google text to speech recognizes the input voice, the app determines the correct word that is to be taken from a set of words that we have preset (For e.g. "Right", "Write", "Rite" will all be classified as RIGHT). This is now encoded and sent via Bluetooth UART to the Bluetooth receiver module (HC05) that connects to the main Arduino Pro Mini based circuit. Once the instruction is received at the Arduino, the specific task is carried out. The Arduino gives the input value to the Motor Driver (L293D), that results in the four motors rotating in a specific direction based on the type of movement that is needed.

A navigation pad is also given that can be used to move in the direction that is needed in case using the voice recognition is of inconvenience. The use of an ultrasonic sensor (HC-SR-04) aids in obstacle detection to prevent mishaps due to impact.

4.2 Automatic Medicine Reminder System

The implementation of an automatic medicine reminder system which helps to assist the differently-abled person, mostly elderly, to be reminded to take medicines at the right time is also a helpful feature of the wheelchair. Through the mobile app, the user can set a time at which the buzzer will ring, indicating the time to take their medicines. The ease of using the app to set the time as the user wishes enables for maximum ease of use. Once the time is set, the mobile phone uses its own time to detect when to send a signal to the Arduino. This signal is then interpreted by the Arduino to

send a HIGH signal to the Buzzer, which rings at that instant. Hence, the wheelchair user is notified of the instant to take the medicine.

4.3 Autopilot System

The difficulty of an individual to give constant and repetitive commands is solved by this function. The wheelchair can be directed to go from one room to the next by use of an autopilot system. Our proposed autopilot system uses IR sensors, to detect and direct the wheelchair in a path to the necessary destination. In front of each room, an IR transmitter is placed. This IR transmitter works at 38Khz frequency. The IR transmitter sends signals that indicate the room (1,2,3, etc.). In order to work, each IR transmitter is attached to a module that consists of a PIC12F675P microcontroller, Timer 555IC and 9V battery with a voltage regulator. The use of TCST software allows for the formation of a series of data of 8 or 9 bits that indicate the room. This serial data is sent bit by bit at a certain delay.

The wheelchair has an IR receiver mounted on top of a servo motor (Sg90). When the command is given, the Arduino gives signal to the servo motor to rotate with a change of 45 degrees. During this rotation, the IR receiver constantly searches for signals from one of the IR transmitters. When the IR signal is received, the Arduino checks if the signal is from the room that the user need to go to. If not, the Arduino detects the relative position of the required room from the signal that has been detected. Once the required signal is detected, the wheelchair is programmed to move towards that room. It is to be noted that this only works in Line-of-sight situations and that the wheelchair is not programmed to go around obstacles.

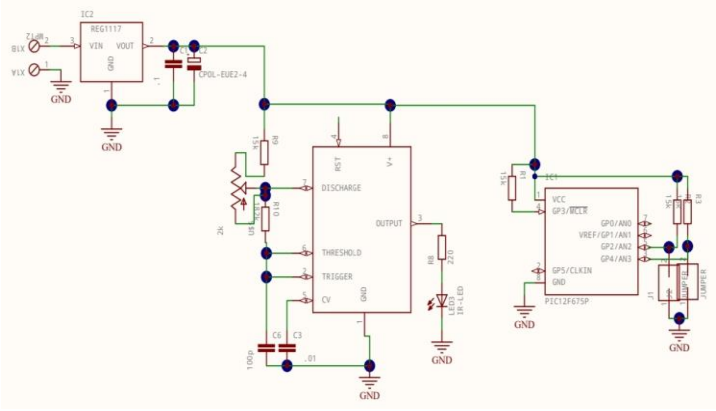

Fig-3: Circuit Diagram of an IR Transmitter Module

5. DEVELOPED SYSTEM

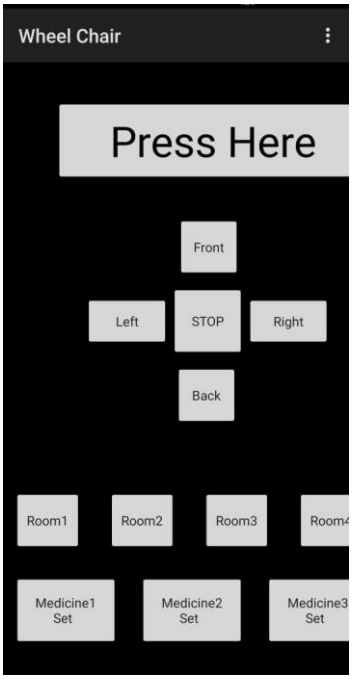

Fig-4: App Interface for Voice Recognition and Navigation

The user interface of the Android based app which is installed in Smartphone in order to control the smart wheelchair is shown in the figure [Fig-3]. Different options like forward, back, right, left and stop are the instructions available on the mobile app. Mobile app can be connected to the wheelchair through Bluetooth facility. On using the Press Here button, the voice recognition system turns on and accepts voice input from the user.

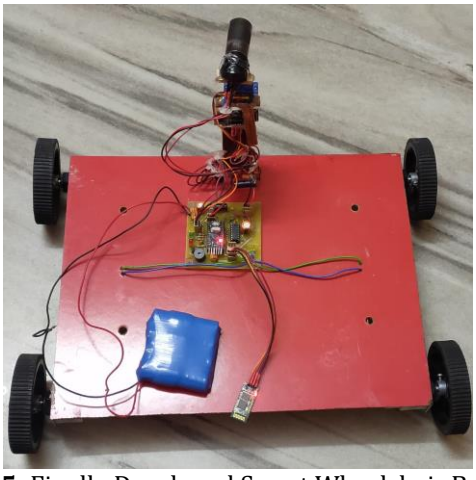

Fig-5: Finally Developed Smart Wheelchair Board

6. RESULT

We have successfully made a prototype based on the circuit. The developed system has been tested and has been found to be fully functional. The Smart Wheelchair provides response

to instructions like forward, back, left and right. It has shown precise, fast and accurate response to the given instructions. The app was installed in an Android mobile. The mobile app has undergone test run and have been found to be very user friendly. Medicine reminder system which is incorporated in the Smartphone application gives timely reminders to the user to take medicine. One observation made was that the during autopilot system, when an obstacle is encountered the wheelchair comes to a halt, which has to be rectified. By programming, the wheelchair can be made to go around the obstacle in future modes.

7. CONCLUSION AND FUTURE SCOPE

In this generation of fast technological development, it is our sole duty to make technological advancements for physically disabled people and make them able to keep pace with others in the society.

In this paper we have developed a voice controlled smart wheelchair that can be used by physically disabled people to help them in movement without any assistance. The wheelchair can also be controlled using an Android mobile app that can be installed in a Smartphone. Autopilot system incorporated in the Smart Wheelchair help the person to move from one room to another without any hindrance as well as assistance. Finally, the medicine reminder system helps the person to set timely reminders to take medicine which can be set with the help of Android mobile app.

As far as the future scope of this technology is concerned, by incorporating radar or other radio receiver / transmitter for better autopilot navigation between obstacles which will provide more accurate and precise movement. This will be of great help to patients suffering from different disabilities.

We believe that everyone in the society should have ease of movement and that even the physically disabled people should have the opportunity to move freely without any assistance like other people of the society and we aim to bring that into practice with this project.

REFERENCES

[1] C. Drane, M. Macnaughtan, and C. Scott, "Positioning gsm telephones," IEEE Communications Magazine, v 36, n 4, Apr, 2015, pp. 46-54.

[2] T. Kos, M. Grgic, and G. Sisul, "Mobile user positioning in GSM/UMTS cellular networks," Proceedings ELMAR-2006-48th International Symposium ELMAR-2006 Focused on Multimedia Signal Processing and Communications, 2006, pp. 185-188.

[3] S. T. Thong, T. H. Chua, and T. A. Rahman, "Intelligent fleet management system with concurrent GPS and GSM real-time positioning technology," ITST 2007-7th International Conference on Intelligent Transport Systems Telcommunications, Proceedings, 2007, pp. 136-141.

[4] F. Meneses and A. Moreira, "Using GSM CellID positioning for place discovering," 2006 Pervasive Health Conference and Workshops, PervasiveHealth, 2007, pp. 4205183.

[5] R. C. Simpson, "Smart wheelchairs: A literature review," J. Rehabil. Res. Dev., vol. 42, no. 4, p. 423, 2018.

[6] Lin, Chern-Sheng & Chien-Wa, Ho & Wen-Chen, Chen & ChuangChien, Chiu & Mau-Shiun, Yeh. "Powered wheelchair controlled by eye-tracking system" Optica Applicata. 2017, Vol. 36 Issue 2/3, p401- 412.

[7] Tsui, Chun Sing & Jia, Pei & Gan, John & Hu, Huosheng & Yuan, Kui. (2008). EMG-based Hands-Free Wheelchair Control with EOG Attention Shift Detection. Proceedings of IEEE International Conference on Robotics and Biomimetics, 2019. 1266 - 1271.

[8] M. Mahmud, D. Hawellek, A. Bertoldo. (2010). EEG Based BrainMachine Interface for Navigation of Robotic Device. Proc. 3rd IEEE/RAS-EMBS Intl. Conf. Biomed. Robotics & Biomechatronics (BioRob'10), Tokyo, Japan, 26-29 Sept. 2010, pp. 168-172, doi: 10.1109/BIOROB.2010.5627015.

[9] M.S. Kaiser, Z. Chowdhury, S. Al Mamun, A. Hussain, M. Mahmud. (2016). A Neuro-Fuzzy Control System Based on Feature Extraction of Surface Electromyogram Signal for Solar-Powered Wheelchair. Cogn. Comput., 8(5): 946-954. doi: 10.1007/s12559-016-9398-4.

[10] Helena Gruhn, Daniel Stohr, Mehmet Govercin and Sabine Glesner, "Design and Verification of a Health Monitoring Driver Assistance System", 2013 17th International Conference on Pervasive Computing Technologies for Healthcare and Workshops.

[11] Heung-Sub Shin, Sang-Joong Jung, Jong-Jin Kim and Wan-Young Chung," Real Time Car Driver's Condition Monitoring System", IEEE Sensors 2010 Conference, Pages 951 - 954.

[12] M.Senthil Sivakumar, Jaykishan Murji, Lightness D Jacob, Frank Nyange, M.Banupriya, "SPEECH CONTROLLED AUTOMATIC WHEELCHAIR", Pan African International Conference on Information Science, Computing and Telecommunications(2013).

[13] Megha Muralidharan, P.T.Jabir, Vinod Pottakulath, "Voice Recognition Based Intelligent Wheelchair", International Journal of Innovative Research in Science, Engineering and Technology, Volume 5, Special Issue 5, April 2016.