

Smart Phone Controlled Wheel Chair & Automation

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Abstract

In this paper we are proposing a semi-autonomous system. Semi-autonomous category falls in between manual and autonomous, which gives flexibility to users to move as per their choice. To avoid the risk of collision a group of monitoring sensors can be used. Ultrasonic sensors are simple, light, and inexpensive alternative to other range sensors. So here 4 Ultrasonic sensors have been used for detecting obstacle in forward, reverse, right and left direction. Android phone is used for wheelchair navigation and home automation purpose due its multiple advantages.

Keyword- Android Phone, Semi-Autonomous System, Ultrasonic Sensors, Wheelchair Navigation

I. INTRODUCTION

A physical disability is a limitation on a person's physical functioning, mobility, dexterity or stamina. Different physical disabilities can be the cause of depression, demotivation, and loss of confidence. Dependency on family members will be increased. Traditional wheel chairs have some limitations in context to flexibility, bulkiness and limited manual navigation. Here we are proposing a semi-autonomous system. Semi-autonomous category falls in between manual and autonomous, which gives flexibility to users to move as per their choice. To avoid the risk of collision a group of monitoring sensors can be used. Ultrasonic sensors are simple, light, and inexpensive alternative to other range sensors. So here 4 Ultrasonic sensors have been used for detecting obstacle in forward, reverse, right and left direction.

In the history of technology, android phone is an invention that has brought remarkable revolution in the world. The exponential increase in the user friendly features and configuration while decreasing cost of the android phones, they have made our life not only easy but filled charm in it. It has brought technology to our finger tips. It attracts many developers, as it is an open source. In addition, android allows easy access to hardware components. It is interesting for robotic use due to the numerous communication interfaces like Wi-Fi, Bluetooth, GSM, USB, and a rich variety of built-in sensors like accelerometer, gyroscope, compass, and GPS. Because of its advantages, android phone is used for wheelchair navigation and home automation purpose.

Mobility assistive device such as powered wheelchair is very useful for disabled people to gain some physical independence. The three main functions of proposed system are:

- Wheel chair navigation using multiple input.
- Obstacle detection using Ultrasonic sensors.
- Home automation for disabled persons.

II. METHODOLOGY

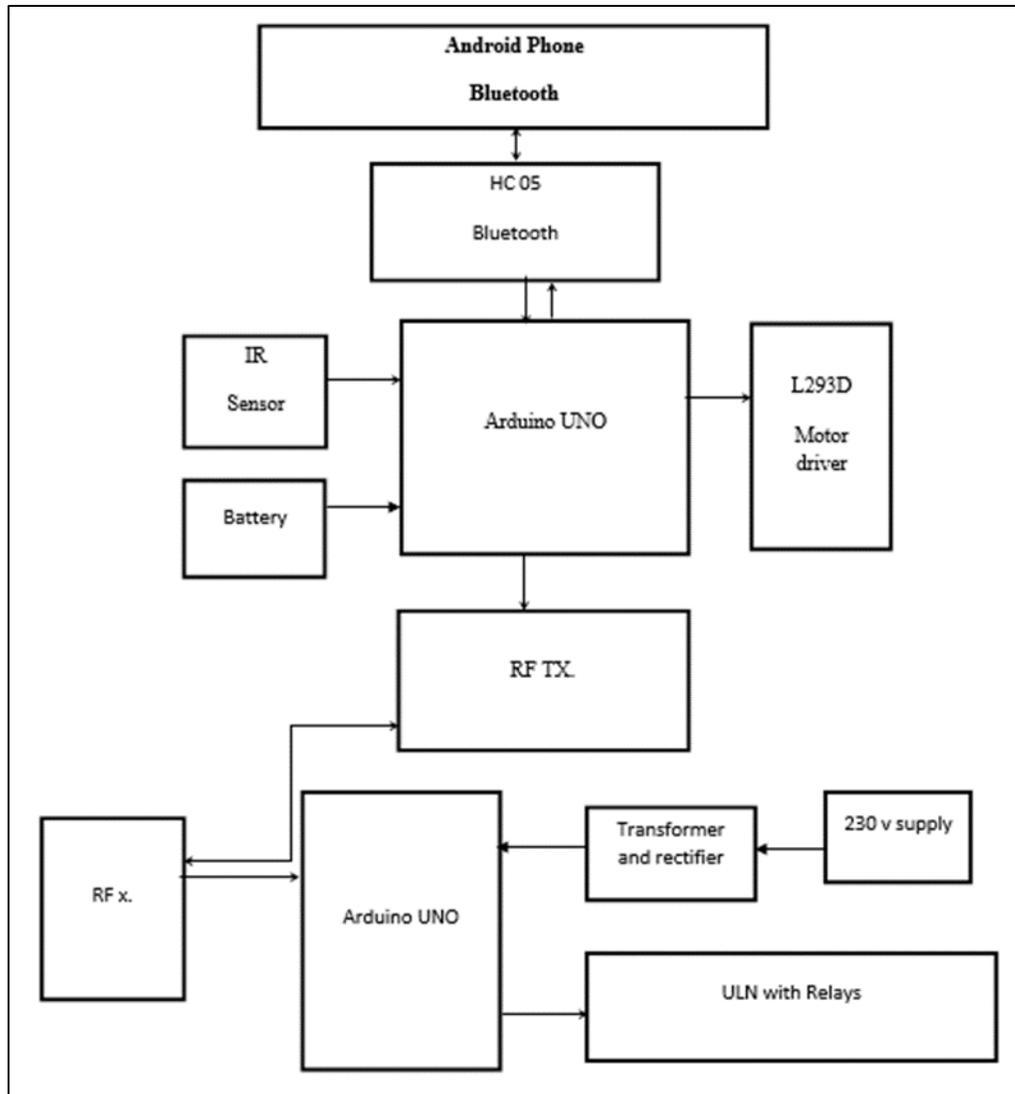


Fig. 1: Block diagram of Smart Phone Controlled Wheel Chair & Automation

In the Fig.1 the Arduino UNO is controlled by Bluetooth. The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It captures the recognized signal from Arduino328p and sends it to external device for further processing and text generation.

Relay is an electromagnetic device which is used to isolate two circuits electrically and connect them magnetically. They are very useful devices and allow one circuit to switch another one while they are completely separate. An infrared ray is an electronic device that emits in order to sense some aspects of the surroundings. It can measure the heat of an object as well as detects the motion.

A dc motor is used for the rotation of the wheel of the wheel chair. Bluetooth captures the recognized signal from Arduino328p and sends it to external device for further processing and text generation. Here HC-05 Bluetooth module is used. A motor driver is an integrated circuit chip which is usually used to control motors in autonomous robots. It act as an interface between Arduino and the motors. The motor driver circuit and relay is connected to Arduino 1.

Ultrasonic sensor that can measure distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back is used. By recording the elapsed time between the generated sound wave and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object. Using 4 Ultrasonic sensors we can avoid the risk of collision and injury and can maintain some safer distance from the objects. Disabled person cannot stand up or switch off light or fan every time. So to give them more relaxation the system offers home automation by android phone. The system can be available at very low cost so that more number of disabled persons can get benefits.

III. SIMULATION RESULTS

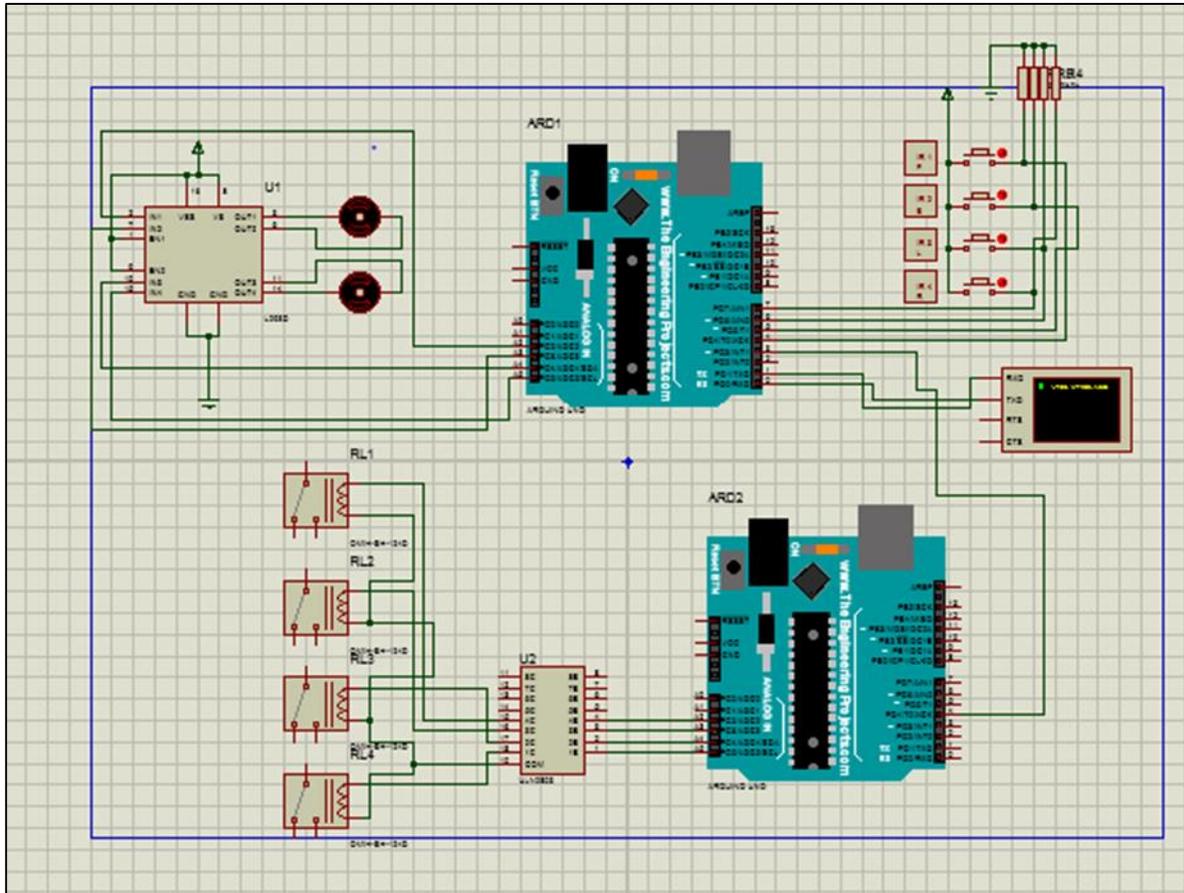


Fig. 2: Simulation Results

The Arduino IDE, which is an open- source software used to provide instructions to microcontroller. It provides an environment where you can write code and upload it to your microcontroller. The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is mainly used by electronic design engineers to create PCB design. The motor driver circuit and relay is connected to Arduino 1. Arduino 1 is programmed for transmitter section which is used to interface Bluetooth module and wheelchair section. Arduino 2 is programmed for home automation section in which relays are connected as the output.

IV. CONCLUSION

This system describes a smart wheelchair navigation system through multiple inputs. So users with different types of disabilities can also use the same system. For navigation purpose, placement of sensors like gyroscope, cameras or use of complex algorithm is not required. Now days, mostly users have android phone and this system takes the advantage of the same. Hence, no additional cost or installation is required, which makes this system affordable for more number of users. Its simple way of execution and user friendly features like home automation makes it more attractive. For future development, GPS module can be added for tracking and outdoor path navigation. On wheelchair unit, through driver circuit, torch and door lock system can be added. Android phone can support more features like sending a help message to any predefined person or raising an alert alarm in neighbour's home. These all features will be more useful to the user with minimal additional cost.

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REFERENCES

- [1] J. S. Nguyen, "A smart wheelchair system using a combination of Stereoscopic and spherical vision cameras," Ph.D. dissertation, Dept. of Eng. and Inform tech., Sydney Uni., Sydney, 2012.
- [2] Q. Mourcou, A. Fleury, P. Dupuy, B. Diot, C. Franco, N. Vuilleme, "Wegoto: a smart phone based approach to assess and improve accessibility for wheelchair users," 35th IEEE Annual International Conference of Engineering in Medicine and Biology Society (EMBC), Osaka, 2013, pp. 1194-1197.
- [3] R. Zhang, Y. Li, Y. Yan, H. Zhang and S. Wu, "An intelligent Wheelchair based on automated navigation and BCI techniques," 36th Annual IEEE International conference of the Engineering in Medicine and Biology society (EMBC), Chicago, IL, 2014, pp.1302-1305.
- [4] R. Zhang, Y. Li, Y. Yan, H. Zhang, S. Wu, T. Yu, and Z. Gu, "Control of a wheelchair in an indoor environment based on a brain-computer Interface and automated navigation," IEEE Transaction on Neural Systems and Rehabilitation Engineering, vol. PP, issue: 99, ISSN:1534-4320, pp. 1534-4320, 2015.