# Automatic Wheelchair with Object Detection and Avoidance Using IR Sensor

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Abstract— The Automated Wheelchair assists the physically disabled person to operate the wheelchair automatically via joystick. The aim of this proposed system is to operate and drive the wheelchair using joystick and to avoid the obstacles automatically coming in its path. It allows the user to move and travel independently, with the help of joystick from where the motors are driven. The micro-controller is basically used in the proposed system due to its high efficiency features & synchronizing the data with different types of devices. The whole apparatus is carried out in an economical way and is cost effective such that it can overcome financial barriers and can be afforded by all. The design consists of following components Motor drivers, BLDC motors, Arduino uno, battery, battery charger, Joystick, Wheelchair, Jumper wires, IR Sensors, etc. Basically, we are using IR Sensor in order to avoid obstacles and accidents and a joystick in order to operate the wheelchair automatically and to reduce the daily labour work and dependency on others and to be independent.

Keywords- Arduino; BLDC Motors; Joystick; IR Sensor.

#### **I.INTRODUCTION**

Wheelchair is a vital vehicle for handicapped and physically disabled person to move from one place to another [1]. The wheelchair is classified into the following types: the self-controlled wheelchair and helper-controlled type wheelchair [5]. The user drives the self-controlled wheelchair by using their physical force imparted by their upper limbs using a wheel setup equipped at the rear wheel [3]. Whereas the helper-controlled type is a supporting as well as automated controlled device where the user can operate the wheelchair independently, for instance, we have developed the product where the user is using a joystick in order to move from one place to other or around [7].

Disability is the deterioration or the damage caused which substantially affects a person's life activities [6]. A person who is physically disabled or too old needs a wheelchair to perform various functions. The user can move the wheelchair manually by setting up the wheelchair in motion by using hands [2]. However, it is a difficult task to move the wheelchair manually. Hence there is a need of automated wheelchair which can be controlled by using joystick [4]. Thus, we aim to design and implement a smart wheelchair which will assist the movement of the user so as to help them live a life independently [8]. This proposed system is a simple implementation of the discussed approach. Commands are taken from joystick, processed and driven to the wheelchair and the wheelchair acts accordingly [9]. We have implemented an IR sensor on the wheelchair for the detection of obstacles coming in its path and in order to avoid accidents.

The proposed system aims at controlling a wheelchair with the help of joystick. It allows a disabled person to move around freely and independently, by using a joystick which is interfaced with motors on the wheelchair [9]. The wheelchair is built by using a micro-controller which is selected due to its low cost, versatility, high performance and efficiency [5]. The system has been designed and implemented in a cost-effective and economical way so that if our proposed system is commercialized and materialized in bulk amount, then majority of the people from different parts of the world would be benefited from it [2].

The main objectives of Proposed system are to provide assists to physically disabled and elderly people who can't move properly are dependent on others; to develop a joystickcontrolled automatic wheelchair in order to help the disabled people to be independent in life [4] and to avoid any kind of obstacles coming in the path of the wheelchair [6].

# **II.RELATED WORKS**

We know that the population in the world is growing at a rapid rate and is multiplying at an exponential rate. In India, according to recent survey we found out that about 120.5 million people are disabled in which 41.325% are physically disabled [2]. Unfortunately, due to various medical conditions and accidents or due to old age, people are not able to walk and are thus dependent on others. Thus in order to solve this problem, we have developed this automatic wheelchair product in order to help them and make them completely independent [16]. The graphical representation of various types of disability in India is represented in the given figure:[9]



Figure 1: Disability Specific Data

The figure shows the graph for all types of disability like Physically Disability, Visual Impairment, Hearing Impairment. Speech Disability, Locomotors. Disability and overlapping. Among all these disabilities, the rate of Physically Disabled patient is high as compared to other disability. Most of the physically disabled patients make use of wheelchair as their only medium to travel around, but they are dependent on others as the wheelchair needs to be moved by another person[1]. Wheelchair Automation will help overcome this problem by making the disable patient independent of other's help and can move freely with the help of a simple joystick control[4].

#### **III.PROPOSED METHOD**

Wheelchair are categorized in three sections namely selfcontrolled wheelchair, helper-controlled wheelchair and the last is automatic-wheelchair. As our country is a developing nation so everything is becoming automated. But along with development in automation the cost of automation products is touching the sky. We thought of working on wheelchair that can be controlled with the help of Joystick[5].

The automatic wheelchair available in the market are way too expensive. Not everyone can afford a costly automatic

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Wheelchair. So, we came up with an idea of a low cost selfassistive Wheelchair[4].

Hence we came to know about BLDC Motors through research and surveys. It is basically an electric motor that is incorporated into the hub of a wheel and drives it directly. It simplifies the work and is easy to interface. Hence the idea of developing this proposed system was proposed.



Figure 2: Block Diagram

Automated Wheelchair is cost effective and economical joystick assistive wheelchair which is operated by joystick commands. The input to the system is given through a joystick by the user, which is transmitted to the micro-controller. The micro-controller process and detects the input command signal and then takes the required decision to move the wheel-chair in the required direction that is left, backwards, front and in the right direction. This data signal is based on a Data to Analog converter also known as DAC which is a system that converts the digital signal to the analog signal. Motors are used to rotate the wheels appropriately in the required direction as per given or defined by the user.



Figure 3: Flowchart

The DAC later passes the signals to motor drivers and the IR sensor is used in order to avoid obstacles in the path and if any

object is detected in the path then it automatically stops.

## **IV. HARDWARE MODULES**

#### 1. Arduino uno

Arduino is an open-source development board which consists of an inbuilt microcontroller. It is generally used for interfacing different types of sensors and actuators [4]. The microcontrollers can be programmed using C and C++ programming languages [7].

Specification: Microcontroller used: ATMEGA 328p Operating voltage: 5V Analog pins: 6 Digital pins: 14 Frequency clock: 16 MHz

### 2. BLDC Motors:

They are the type of motors which primarily runs on DC supply provided either by an inverter or by a power supply [7]. The BLDC motor is used to generate an AC current to run each phase of the motor via closed loop controller. The controller is used to provide input to the motor windings which ultimately controls the speed and torque of the motor [3]. Features are as follows:

- 1. Operating Voltage: 24-36V
- Operating Voltage: 24-50V
  Operating Power: 250-500W
- Motor type used: Brushless gearless hub motor
- 4. Operating speed: 200 550 rpm
- 3. Motor Driver

A motor driver is nothing but a current amplifier which works on the principle of current amplification where it coverts a lowcurrent input signal into high-current output signal which is required for the operation of the motor [5].

Specifications:

- 1. Operating Voltage: 24V DC power supply
- 2. Operating Power: 250W
- 3. It has Anti-coaster features with over current protection
- 4. Automatic identification of the Hall sensor
- 4. Battery

The battery used in our proposed system is a lithium-ion or Liion battery which is a type of rechargeable battery [8]. When the battery is charging, the Li ions moves from the negative part of electrode to the positive. It generally uses a type of lithium compound as one of the electrode materials as compared to the metallic lithium which is basically used in a non-rechargeable lithium battery [9]. The electrolyte which is used to allow ionic movement, and the two electrodes present are the main components of a lithium-ion battery cell [5]. Specification of the battery used is

1. Operating voltage: 36V

2. Operating Power: 4.8Ah/172.8WH.

5. Battery Charger

A battery charger is a device which transmits energy in a secondary cell or rechargeable battery as soon as electric current passes through it, sometimes the input supply is set according to the desired rating which is suitable for the battery [2].

Specifications: Input operating Voltage: 100-240V Operating frequency: 50/60HZ Output operating Voltage: 42V Output operating current: 5A Operating Power: 273W Efficiency: 80%

#### 6. Joystick

A joystick is a device used as a input for the desired command. It consists of a stick which rotates on a base and is used to report the angle or the direction to the device which is controlling it. A joystick which is also known as the control column, is one of the most important and key control devices available [7].

#### 7. IR sensor

An IR sensor is one of the most commonly used electronic device which is used to measure and detect the infrared radiation in any kind of surrounding environment [9]. It is generally used to detect any type of obstacle coming in its path or the direction in which it is transmitting the radiated waves [2]. It can be used in any sort of security applications like home security, Smart Industrial applications, etc.

## V. IMPLEMENTATION OF THE PROPOSED SYSTEM

The below given figures represents the implemented part of the proposed system which is developed and designed by us.



Figure 4: Side View







Comparison between existing systems and our proposed system is as follows:

Parameters	Existing system	Proposed system
1.Cost	Very expensive	Cost effective
2.Battery backup	Very poor	Strong battery
		have provided 1
		battery to each wheels
3.Technology	Either Bluetooth	Bluetooth and
used	or joystick	joystick
4.Maintainence	High	Low
5.Weight	100-120 kg	150-180 kg
carrying capacity		
6. Additional		Use of IR sensor
		for object
		detection and
		avoidance in the
		same system

#### VI. CONCLUSION

This proposed system contributes not only to the selfdependency but also independency of the physically challenged and old aged people. It not only reduces the manual effort but also makes the user comfortable and independent. Thus, the only thing required to ride the wheelchair is to have a command on the joystick and IR sensor for object detection. Besides that, the development of this proposed system is done in a costeffective manner and is thus affordable. The user just has to give commands by pressing the buttons present on joystick. Finally, we hope that this kind of the proposed system would contribute to the evolution of the wheelchair technology and to the welfare of the society.

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Figure 6: Front View