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Prototype to Commute a Locomotive Disabled Person /Heavy Items on Stairs with Voice Control

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ABSTRACT: One of the basic problems of user on manual wheelchair is overcoming architectural barriers (kerbs, stairs etc.) on its way. Even though many research studies have been reported in different fields to increase the independence of wheelchair users, the question of overcoming obstacles by a wheelchair always remains as topic of discussion for many researchers. In our project a motor operated stair climbing wheelchair concept which can overcome the architectural barriers to a considerable extent has been developed. This project involves the design of an ergonomically designed battery powered wheelchair for multipurpose use. Stair climbing functionality is embedded in the design through its structure and mechanism. All the design parameters of wheelchair were based on the standard design of the stairs in India. Major part of the project focuses on the proposed design concept and concludes by discussing upon the physical working model developed for the proposed design solution.

KEYWORDS: Arduino uno, Battery, Drive circuit, DC Shunt Motor

I. INTRODUCTION

One-fifth of the estimated global population, i.e. between 110 million and 190 million people, experience significant disabilities. Disabilities of various parts such as eye, ear, hand, leg etc. Limb disability is one of the disabilities which are caused due to various reasons such as deformation by birth, war, disorders such as diabetes. Lower limb of sports person also suffers huge blows while playing and are always at the risk of suffering severe injuries. These injuries sometimes may be a permanent disability. Wheelchair is used by people who have difficulty in mobility. Generally people who use are,

- Lower limb disabled people.
- Patients at the hospitals.
- Elderly people.

OBJETIVES

- The system is designed for day/night operations.
- The prototype will be designed to carry weight up to 1 kgs.
- Object identification for Obstacle identification in its path.
- The system is designed for self controlled or with assistance and works in both ramp stairs and normal stairs.
- Control: Voice control for movement (Forward, Backward, Right, Left & Stop).

II. LITERATURE SURVEY

After conducting an intensive literature review, it was found that wheelchairs with stairclimbing capacities can be categorized into two types; the battery powered and the manual powered. Although there are plenty of powered wheelchairs available in the market place, there are limited scholarly reviews published on manual or battery powered

wheelchairs. Instead, patent certificates, wheelchair descriptions, and operation manuals are available. Indeed, no peer reviewed literature was found for manual wheelchairs. Some researchers have built scale models or full-size prototypes of their designs but little documentation has been published on this type of wheelchairs.

III. PROBLEM STATEMENT

The integration of voice control into a stair-climbing wheelchair presents a promising solution to enhance accessibility and mobility for individuals with physical disabilities. However, the efficacy of such a system hinges on its ability to seamlessly navigate complex environments while ensuring user safety. Additionally, the incorporation of object detection technology is crucial to identify obstacles and hazards in real-time, further enhancing the wheelchair's.

IV. METHODOLOGY

1. BLOCK DIAGRAM

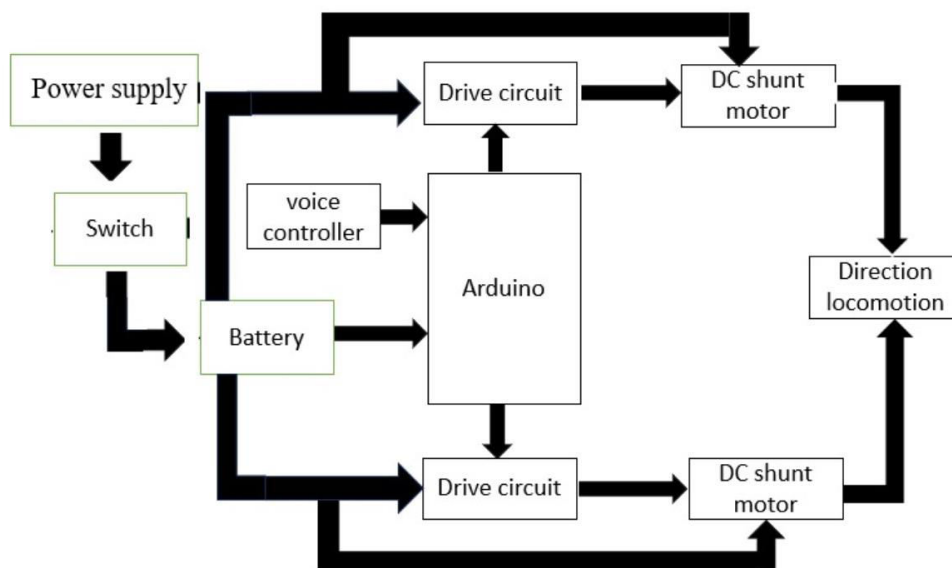


Figure 4.1 block diagram

A) ARDUINO UNO

The Arduino Uno is a popular microcontroller board based on the ATmega328P microcontroller. It's widely used for prototyping and DIY electronics projects due to its simplicity and versatility. The Uno has a variety of digital and analog input/output pins that can be used to interface with sensors, actuators, and other electronic components. It's also supported by a large community and has plenty of resources available, including tutorials, libraries, and example code. If you have any specific questions or need help with an Arduino Uno project, feel free to ask

B) DC SHUNT MOTOR

A DC shunt motor is a type of DC motor where the field winding and armature winding are connected in parallel, or "shunted" across the power supply. This configuration allows the motor to maintain a relatively constant speed over a wide range of loads.

C) DRIVE CIRCUIT

Drive circuit typically refers to a circuitry system that controls or regulates the operation of a device, often an electronic one. It's responsible for providing the necessary signals, power, or control to various components within the system. Drive circuits can be found in a wide range of applications, from simple LED drivers to complex motor control systems in industrial machinery. The specifics of a drive circuit can vary greatly depending on the application, but they often

involve transistors, amplifiers, and other electronic components to manipulate signals and power levels according to the requirements of the system.

D) DIRECTIONAL LOCOMOTIVE

A directional locomotive is a type of locomotive used in rail transport that is designed to move in a specific direction, typically forward or backward. Unlike some older locomotives that required turning around at the end of a track to change direction, directional locomotives are equipped with controls and systems that allow them to operate in either direction without the need for turning around. This capability enhances efficiency and flexibility in railway operations, allowing trains to maneuver more easily and efficiently, especially in situations such as switching yards or when operating on tracks without a turnaround loop.

E) BATTERY

Lead-acid batteries require controlled charging to prevent overcharging, which can damage the battery, and undercharging, which can lead to sulfation and reduced capacity. Charging is typically performed using a regulated charger that provides a constant voltage followed by a tapering current as the battery approaches full charge.

2. FLOW CHART

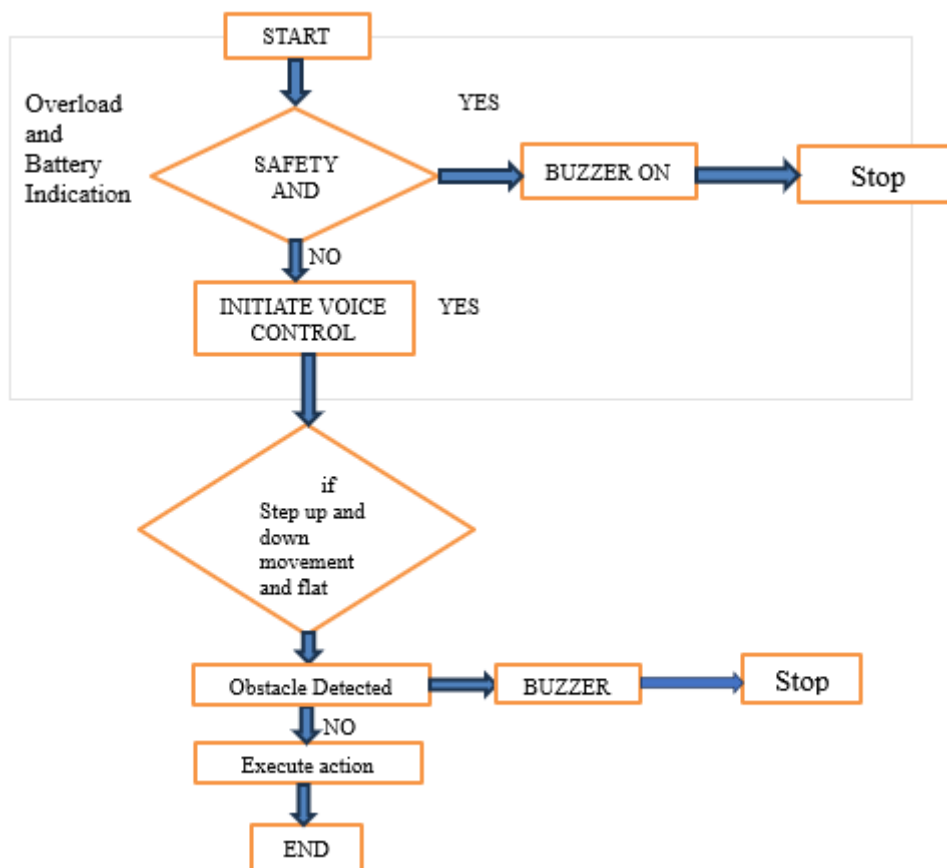


Fig 4.2 Flow Chart For Working Model

V. WORKING OF MODEL

The stair climbing wheelchair, equipped solely with voice control for directional movement (right, left, forward, backward, top, and bottom), coupled with object detection and a stop mechanism, represents a significant advancement

in assistive technology. Through this innovative design, users can navigate stairs and obstacles with ease and confidence. By seamlessly integrating voice commands for movement control, the wheelchair offers unparalleled convenience and accessibility for individuals with mobility impairments. Additionally, the incorporation of object detection technology ensures real-time detection of obstacles, allowing the wheelchair to autonomously adjust its path to avoid collisions and ensure user safety. The inclusion of a reliable stop model further enhances user control and safety, providing the ability to halt movement instantly when necessary. Overall, this integrated system revolutionizes mobility assistance, empowering users to navigate challenging environments independently and with greater confidence.

VI. CALCULATION

1) Total Bending Force = Passenger Weight + Battery Weight + Acceleration gravity

$$\text{Total Bending Force} = 1 + 1.5 + 9.81$$

$$\text{Total Bending Force} = 24.525\text{N}$$

2) Power Required

$$P = W * V$$

$$W = \text{Load}$$

$$V = \text{Velocity of motor}$$

$$= 30\text{rpm}$$

$$P = W * V$$

$$= 24.525 * 0.3$$

$$P = 7.3575 \text{ Watts}$$

3) Selection of Battery $P = V * I$

$$= 12 * 1.5\text{A}$$

$$P = 18 \text{ Watt hour}$$

VII. RESULTS

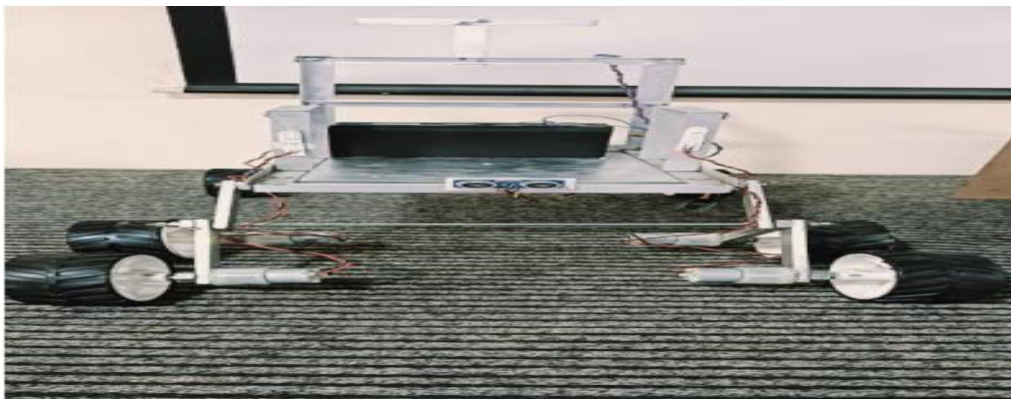


Figure 7.1 Project model



Figure 7.2 Project model with Stair

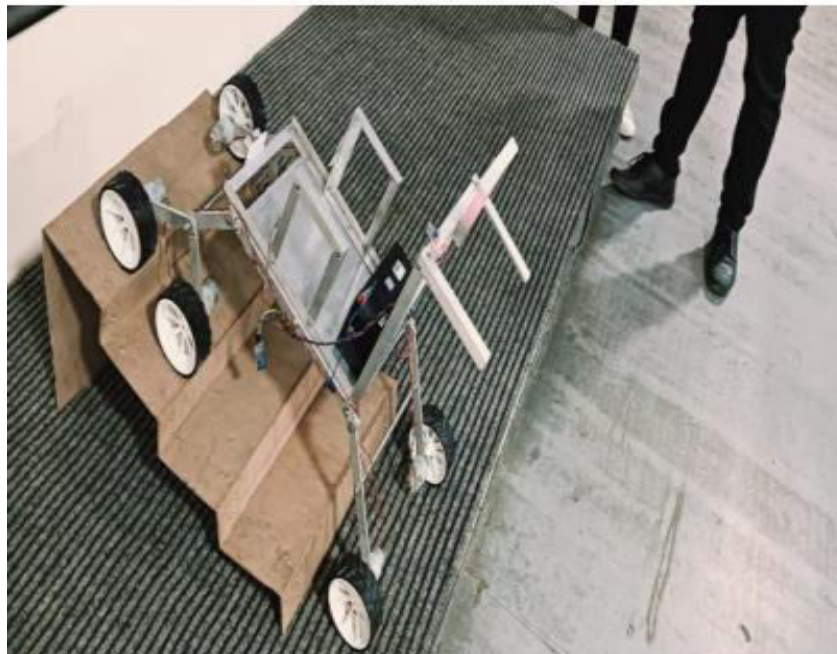


Figure 7.3 Working model on side view

VIII. FUTURE SCOPE

The frame weight can be reduced by using high strength lightweight materials such as composites, carbon fiber. The wheelchair can be automated by using electronics so that it will automatically sense and climb the stairs.

IX. CONCLUSION

Though this project had some limitations at this stage regarding the strength and built of the structure, it can be considered to be a step forward towards making life easier and convenient for people with disabilities or people lacking potential to achieve such targets; as far as Stair Climbing is concerned this chair will be efficient for user to overcome natural affliction. This product will be well acclaimed if it gets enough amount of spotlight

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