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## Mechanical Design and Development of Tridevice for Children with Cerebral Palsy

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**ABSTRACT:** A tridevice is a mechatronic (new) equipment, that has been developed to providefacilities like Standing-Sitting-Commodeto children suffering from cerebral palsy and other multiple disabilities due to lack of complete brain development or brain damage during the process of development, by improving their quality of life and making them partially independent on long term usage of the tridevice, and thereby allowing them to perform activities of daily life (ADL).

**KEYWORDS:** Cerebral Palsy, Tridevice

#### I. INTRODUCTION

Cerebral Palsy (CP) is a non-progressive disorder or a neurological disorder caused by the improper development of the brain before/during/after the birth of the child, basically known as a Central Nervous System defect. Cerebral Palsy affects the posture of a child, muscular movements of the body, vision impairment, speech problems, developmental disorders, etc by the degree of brain damage that occurred. The goal of the research is to reduce the continuous assistance required either from family or caregivers. The introduction of a commode into the device makes it more comfortable for the patients to use the toilet when required and needed without taking them to the restroom. The addition of height adjustment allows the child to use the device for a long period, as the child's height increases the device height can also be adjusted accordingly which cuts the replacement of the device.

#### **II. PROJECT OBJECTIVES**

- 1) The objective of the project is to develop a device that should allow CP children to Stand-Sit-Toilet when necessary.
- 2) The main objective of this project is to allow children to attain proper posture and correct position who has multiple disabilities.
- 3) One of the objectives is to provide a commode along with a seat for the easy usage of the toilet by the children.
- 4) The further objective is to allow the increase of device height by adjustable up and down motion and thus allowing the usage of the device for a long period.
- 5) The placement of straps around the pelvic region of the children sitting in the tridevice prevents them from falling.
- 6) The tridevice should be comfortable for the children and allow peer-to-peer interaction with others which can be attained by using a versatile table (attachable and detachable).



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#### **III. MATERIAL**

• Waterproof Plywood (12 mm thick, 8X4 ft)

#### TABLE1: PARTS AND DIMENSIONS OF THE TRIDEVICE

Parts	Dimensions
Lockable Caster Wheels	4"
Nuts and bolts	20 mm X 20 mm
L clamps	2" X 2"
Beadings	2" X 10mm
Hinges	2"

#### **IV. METHODS**

#### i. **PREPARATION OF DESIGN**

Creating a design in 'Fusion 360' Design Software.









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Fig.1 Final Structure of the Tridevice (a) Front view (b) Side view (c) Back view (d) Down view

#### ii. FABRICATION STEPS USED IN THE MANUFACTURE OF TRIDEVICE ARE AS FOLLOWS

- A. **CUTTING:**It is a process for getting the required geometry by the removal of the undesired material by using different kinds of tools.
- B. **GRINDING:** It is a process employed for attaining a proper and smooth finish to the final parts of the device.
- C. DRILLING: This process is used to make holes into the wooden material by using various machines.
- D. FINISHING: This has been achieved by fixing the parts of the device using various tools of machinery.

#### TABLE 2: SPECIFICATIONS AND DIMENSIONS OF THE TRIDEVICE

Specifications	Dimensions
Height	90 – 110 cm
Child's weight	50 – 70 kg
Cushion	29*26 cm
Backrest height	97 cm
Headrest	20*20 cm
Sidewall's height	78 cm
Footrest	33*19 cm
Base	56*53 cm
Base supports	42*30 cm
Lapboard	42*46 cm
Handle	30 cm

#### **V. PURPOSE OF THE DEVICE**

- Improves well-being and alertness
- Aids digestion and proper bowel function
- Facilitates hip joint and development
- Provides a stable support
- Controls abnormal movement patterns

#### VI. RESULTS

The adjustable tridevice is fabricated using wooden material. It has adjustments like width and height. Width adjustment can be achieved by moving the side walls inwards and outwards with the help of nuts and bolts provided. Height adjustment can be achieved by placing the footrest in the required groove attached below the device. The addition of a commode makes it beneficiary to the patient which is attachable and detachable.

#### VII. CONCLUSION

The tridevice manufactured benefits, Cerebral Palsy patients, by allowing them to stand and sit in the correct position or posture which plays a major role in the improvement of the patient's health and physical condition.

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