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Design and development of device to facilitate differently abled persons to get into bus independently

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Abstract - *This Assistive Technology plays an important role for independent living of people with special needs. Therefore it is a key issue to identify the problems that come up in the everyday use of assistive technology. The analysis of user requirements is one of the most important factors for effective special needs developments. The user involvement in every step of the development procedure is meaningful. Especially the experiences of long-term users are very helpful. In case of new technology prototype testing by users during the development can correct the aims by giving unexpected inputs. Although some research activities with user involvement are going on, it still needs more concern in industry and appropriate methodologies have to be established. As an example of emerging technologies the use of a robotic aid is investigated. In this case the analysis of user requirements is based on tests of available prototypes with users. As an example of already existing technical aids an investigation of practical user experiences with wheelchairs is described. In both cases the experiences of the users are fed back to the development to achieve real improvement. Our experiences may stimulate researchers and industrialists to initiate user involvement within their activities.*

Key Words: **Assistive Technology, differently abled, design**

1. INTRODUCTION

Cummins Power Generation India has taken voices of various institutes. During this activity we visited The Society for the Welfare of The Differently Abled Persons (Physically Handicapped), Education and Research Centre, SWPH. This institution is, with an aim to rehabilitate the orthopedically handicapped children within the age group of 6 to 18 years. "The Society for the Welfare of the Differently Abled Persons (Physically Handicapped) education and research centre" has a problem that the students of this organization need help in getting into the bus which is provided by the institute. Today, with its credentials, the institute strives to become a centre of excellence and base for orthopedically handicapped children in the age group of 6 to 18 years. A separate building for pre-vocational program, library, Small clinic as well as an auditorium was built. The Dy. Prime Minister Shri. Lal Krishna Advani inaugurated the building in the year 2000.Today as many as 128 boys & 108 girls from all over India are availing the educational and vocational facilities provided by the Institute.

India has made impressive economic gains in the last few decades and currently has the 4th largest economy in terms of purchasing power parity. Despite this improvement, more than 260 million people in India live in poverty. The reciprocity of poverty producing disability, and disability resulting in poverty creates unique challenges for the inclusive education movement in India. This paper begins with a brief history of special education in India, including changes to government legislation and policy in the move towards more integrated educational provision. In India 1.67% of the 0-19 population has a disability. 35.29% of all people living with disabilities are children. Other estimates say that India has 12 million children living with disabilities. Only 1% of children with disabilities have access to school and one third of most disabilities are preventable.

2. PROBLEM STATEMENT

"The Society for the Welfare of the Differently Abled Persons (Physically Handicapped) education and research center" has a problem that the students of this organization need help in getting into the bus which is provided by the institute as shown in the Fig. 1.

Fig. 1. Problem during boarding in to the bus

3. LITERATURE REVIEW

[1]. Christian Biihler, (Approach to the analysis of user requirements in assistive technology.)
Christian concluded to achieve real progress in the field of assistive technology, a precise interweave of development and application is required. This enables system optimization in the sense of a control loop with respect to the most important output value the availability of effective technical aids and their real use. This includes several repetitions of periods of development and tests. In any case, the problems of acceptance by the users.

[2]. P. Nisbet (Integrating assistive technologies: current practices and future possibilities)
People with impaired mobility, speech and motor functions can benefit greatly from an integrated approach to the provision of assistive technology. For some individuals, this is best achieved by integrating control of a mobility aid, computer, voice output communication device and environmental control system into a single, multi-function unit. However, driving a powered wheelchair effectively requires quite different skills and controls compared with accessing a computer or communication aid. Integrated systems must be designed to take account of these differences to avoid compromising safety and efficacy. For this and other reasons, many people Faith 'disabilities are best served with an integrated package of several devices rather than a single integrated structure

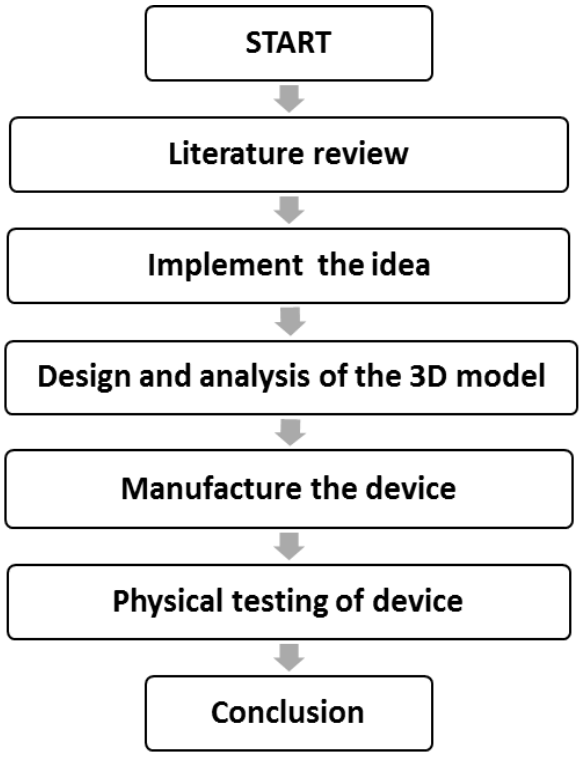
[3]. Yu-Tien Cheng (Risk management of developing assistive devices for elderly)
This study uses the Delphi method in interviewing experts to identify critical risks in the development of assistive devices. Critical risks included product planning, technology development, production, performance, schedule management, and cost management, comprising 26 risk factors in 6 constructs. Organizational risk strategies could be developed to reduce risk and maintain stability while achieving the objective of developing new products.

[4]. Ornella Plos, (Claude Dumas, A Universalist strategy for the design of Assistive Technology)
Assistive Technologies are specialized products aiming to partly compensate for the loss of autonomy experienced by disabled people. Because they address special needs in a highly-segmented market, they are often considered as niche products. To improve their design and make them tend to Universality, we propose the EMFASIS framework (Extended Modularity, Functional Accessibility, and Social Integration Strategy). We then present three examples illustrating its application for designing Assistive Technologies: the design of an over bed table, an upper-limb powered or those and a powered wheelchair. We conclude on the expected outcomes of our strategy for the social integration and participation of disabled people. Relevance to industry. Our design framework is expected to stimulate innovation in the field of Assistive Technology.

4. OBJECTIVE

A. *Deliver to Assistive technology commitments initiative by developing an optimized design to help People with disabilities without compromising to Health, Safety, and the Environment (HSE) requirements.*
B. *To prepare a CAD model and mechanism design using PTC Creo 2.0 CAD software.*
C. *To make structural analysis by using any ANSYS software based on FEA process.*
D. *Assemble the device in the school bus.*

5. METHODOLOGY



6. MECHANISM DESIGN IN CREO 2.0

Mechanism Design carried out to see how mechanism of device is working. In Fig. 2, 3, 4 and 5 different position of the device is shown.

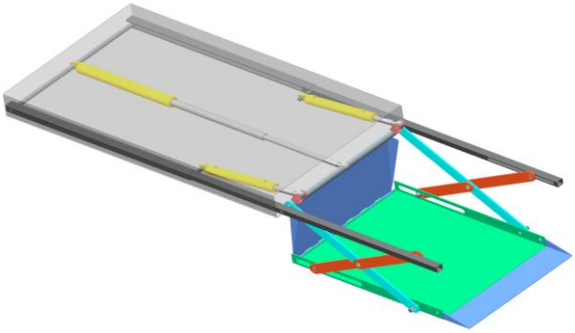


Fig. 2. Ground position

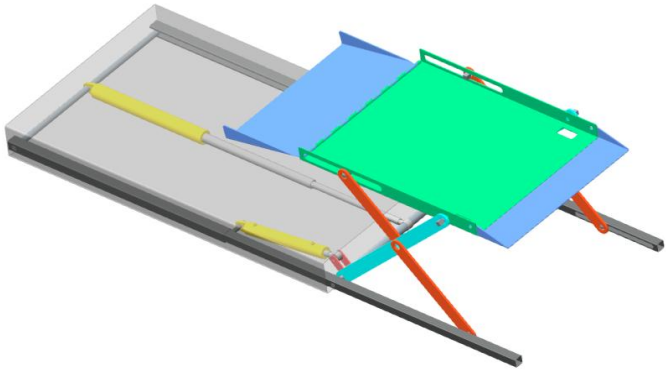


Fig. 3. Boarding position

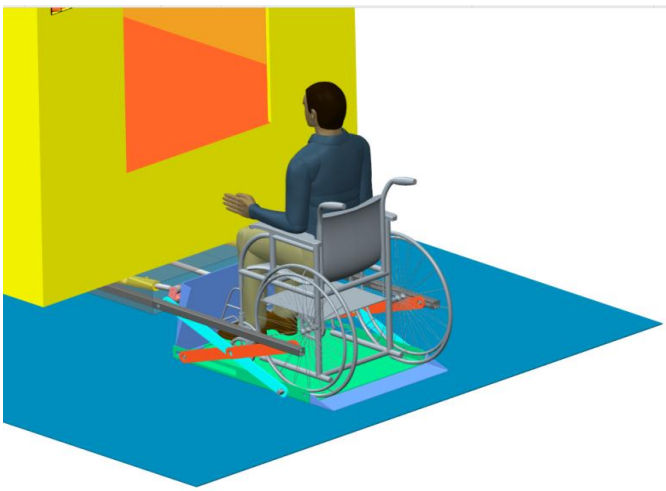


Fig. 4. Manikin with wheelchair ground position

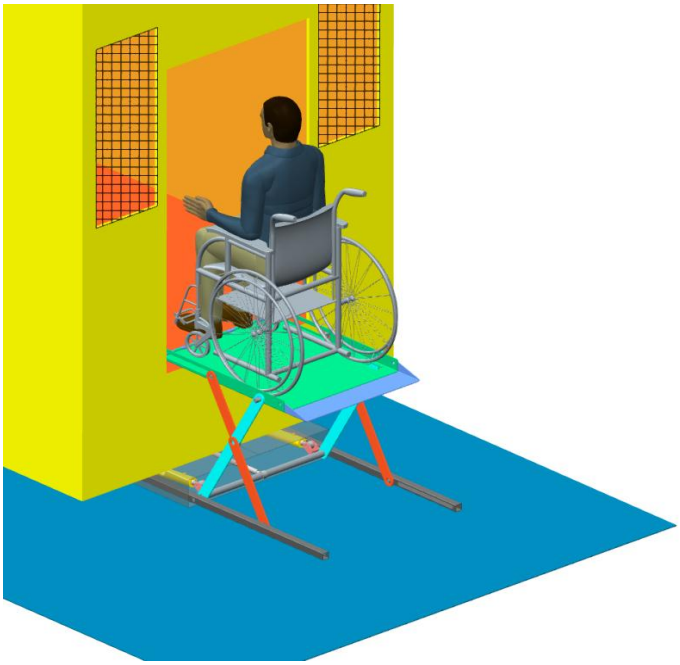


Fig. 5. Manikin with wheelchair boarding position

7. STRUCTURAL ANALYSIS OF THE BUS BOARDING DEVICE

A. Analysis Objective

1. To analyze the arrangement of Bus Boarding device for the static structural integrity.
2. Perform the analysis for the boarding base at top level and assembly in locked condition supported by fixed channels welded to chassis connection.

B. Analysis Approach

1. Weld lines along fixed channels on either side are fixed in all directions.
2. Total Mass of 400 kg is simulated as point mass and connected to wheel locking locations on the base plate.
3. All the components of the assembly are considered are generic steel material.
4. All three hydraulic cylinders are not considered and assumed that they are not adding considerable stiffness against loading during locked condition.
5. All joints & link connection are simulated as bonded contacts (rigid connections).
6. Boundary conditions are applied on 3D model in ANSYS software as shown Fig. 6.

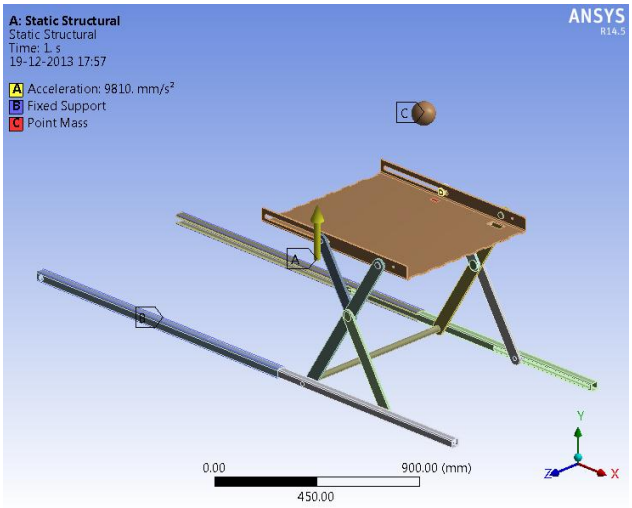


Fig. 6. Boundary Conditions

C. FEA Results

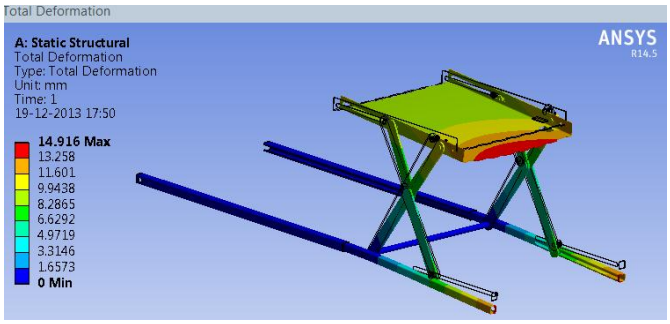


Fig. 7. Total Deformation

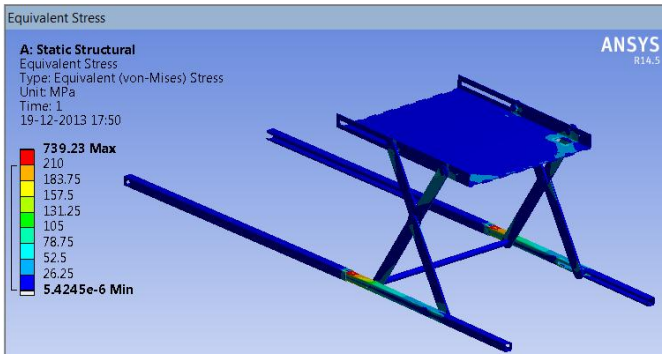


Fig. 8. Equivalent Stress

Maximum displacement of around 15 mm is observed in the Fig. 7.
Stresses are exceeding the yield value of 210 MPa on sliding channel members and observed to be around 280 MPa in the Fig. 8.

8. CONCLUSION

The persons with physically challenged continue to struggle to gain education in contemporary areas relevant to the market place and their disability. Educational institutions have been slow to ensure accessibility of learning materials and environments for these people. Studies show that assistive technologies significantly help disabled students in general to excel in inclusive teaching and learning. The educational institutions (school, colleges or universities) must provide facilities to all students based on the individual needs in support of their willingness to learn. Inadequate teacher training, lack of awareness, infrastructural deficiency and high cost are some of the major problems in the use of technology. But with willingness, appropriate effort and positive outlook these shortcomings can be overcome.

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