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Design & Fabrication Multipurpose Wheel Chair

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Abstract: This project aims to design, integrate, interface and test a fully Manual multi-purpose wheelchair cum stretcher. A regular standard wheelchair like design was used as the main skeleton that has been on modified to meet this project's goals. In this project, the procedure of Mechanism systems design was followed to assure the quality of the final product the project has consisted of the following parts: Hardware, mechanism and testing.

I. INTRODUCTION

Older adults are the most prevalent wheelchair users in Canada. Yet, cognitive impairments may prevent an older adult from being allowed to use a powered wheelchair due to safety and usability concerns. To address this issue, an add-on Intelligent Wheelchair System (IWS) was developed to help older adults with cognitive impairments drive a powered wheelchair safely and effectively. When attached to a powered wheelchair, the IWS adds a vision-based anti-collision feature that prevents the wheelchair from hitting obstacles and a navigation assistance feature that plays audio prompts to help users man oeuvre around obstacles.

Nowadays more than 700 million persons around the world have disability or handicap. During the last decades, the elderly population in most of the European countries and across all the most civilized countries is also growing at an increasing pace. This phenomenon is receiving increasing attention from the scientific community, during the last years, and several solutions are being proposed to allow a more independent life to the people belonging to those groups. In this context, Intelligent Wheelchairs (IW) are instruments that are a natural development of the scientific work that has been conducted to improve the traditional Wheelchair characteristics using health informatics, assistive robotics and human computer interface technologies. Some of the most important features of the IW are their navigation capabilities and automatic adaptation of their interface to the user.

This paper presents the evolution and state of art concerning IWs prototypes and simulators and intelligent human-computer interfaces in the context of this devices. Our study enabled us to conclude that although several Intelligent Wheelchair prototypes are being developed in many research projects, around the world, the adaptation of their user interface to the patient is an often-neglected research topic. Thus, projects aiming at developing new concepts of Intelligent Wheelchairs are needed mainly using multimodal interfaces and wheelchair interfaces adapted to the user characteristics. Assistive Technology (AT), that refers to hardware and software solutions for persons with physical, cognitive or sensory disabilities, can help people to have a more productive and pleasant lives.

In a survey aimed to collect information from patients concerning the usefulness of new electric wheelchairs. The study concluded that 9 to 10 % of patients who use power chairs and who received appropriate training "find it extremely difficult or impossible to use the wheelchair for activities of daily living". Some of the pointed reasons are difficulty on controlling the wheelchair with a joystick, uncomfortable and inappropriate interface for the disability (because users with severe motor impairments are unable to operate the joystick smoothly). For elderly patient's arthritis is one of the major reasons for wheelchair use. The repeated usage of joysticks and continuous wrist movements can be very painful for an arthritic patient, and may result in reinforced difficulties.

II. LITERATURE SERVEY

Past, Present and Future Jesse, and Hung M. La, Senior Member:
A smart wheelchair (SW) is a power wheelchair (PW) to which computers, sensors, and assistive technology are attached. In the past decade, there has been little effort to provide a systematic review of SW research. This paper aims to provide

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a complete state-of-the-art overview of SW research trends. We expect that the information gathered in this study will enhance awareness of the status of contemporary PW as well as SW technology, and increase the functional mobility of people who use PWs. We systematically present the international SW research effort, starting with an introduction to power wheelchairs and the communities they serve. Then we discuss in detail the SW and associated technological innovations with an emphasis on the most researched areas, generating the most interest for future research and development. We conclude with our vision for the future of SW research and how to best serve people with all types of disabilities.

P EOPLE with cognitive/motor/sensory impairment, whether it is due to disability or disease, rely on power wheelchairs (PW) for their mobility needs. Since some people with disabilities cannot use a traditional joystick to navigate their PW they use alternative control systems like head joysticks, chin joysticks, sip-n-puff, and thought control. In many cases PW users have difficulties with daily maneuvering tasks and would benefit from an automated navigation system. Mobility aside, people with disabilities are heavily reliant on their caregivers for eating and drinking, handling items, and communicating with others, especially in large groups. To accommodate the population of individuals who find it difficult or impossible to operate a PW, several researchers have used technologies originally developed for mobile robots to create smart wheelchairs. A smart wheelchair (SW) typically consists of either a standard PW base to which a computer and a collection of sensors have been added, or a mobile robot base to which a seat has been attached. Pineau et al. 2011 argue that the transition to wheelchairs that cooperate with the user is at least as important as that from manual to powered wheelchairs, possibly even more important since this would mark a paradigmatic rather than merely a technological shift.

Takashi Gomi and Ann Griffith:

A brief survey of research in the development of autonomy in wheelchairs is presented and AAI's R&D to build a series of intelligent autonomous wheelchairs is discussed. A standardized autonomy management system that can be installed on readily available power chairs which have been well-engineered over the years has been developed and tested. A behaviour-based approach was used to establish sufficient on-board autonomy at minimal cost and material usage, while achieving high efficiency, sufficient safety, transparency in appearance, and extendibility. So far, the add-on system has been installed and tried on two common power wheelchair models. Initial results are highly encouraging.

In recent years, the concept of applying behaviour-based intelligent robots to service tasks [Gomi, 92} has been discussed. With the accelerated rate of aging of the population being reported in many post-industrial countries, demand for more robotic assistive systems for people with physical ailments or loss of mental control is expected to increase. This is a seemingly major application area of service robots in the near future. For the past six years, we have been developing a range of autonomous mobile robots and their software using the behaviour-based approach [Brooks,86] [Maes, 92]. In our experience the behaviour-based approach [Brooks, 86] [Brooks, 91a] [Steels, 93] [Pfeifer & Scheier, 96] [Maes, 92] allows developers to generate robot motions which are more appropriate for use in assistive technology than traditional Cartesian intelligent robotic approaches [Gomi, 96a]. In Cartesian robotics, on which most conventional approaches to intelligent robotics are based, "recognition" of the environment, followed by planning for the generation of motion sequence and calculation of kinematics and dynamics for each planned motion, occupy the center of both theoretical interest and practice. By adopting a behavior-based approach wheelchairs can be built which can operate daily in complex real-world environments with increased performance in efficiency, safety, and flexibility, and greatly reduced computational requirements. In addition, improvements in the robustness and graceful degradation characteristics are expected from this approach. In the summer of 1995, an system looks after both longitudinal (forward and backward) and angular (left and right) movements of the chair.

III. METHODOLOGY

Need of Design:

At present patients are facing problem while defecating. Patients' needs to be lifted up and helped to remove the dress and make them defecate, which is discomforting to the patients in emergency condition. The design of back rest in the existing wheel chair creates repetitive stress injury if the patient is sitting for a long time. The present design of brake needs to be improved for better impact and application of brake in slope area. Arm rest creates obstruction while shifting the patient from wheel chair to vehicles, no solution in the existing design to make ease of shifting of patient to transportation vehicle

SELECTION OF MATERIALS:

Factors determining the choice of materials

The various factors which determine the choice of material are discussed below.

Properties

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The material selected must possess the necessary properties for the proposed application. The various requirements to be satisfied can be weight, surface finish, rigidity, ability to withstand environmental attack from chemicals, service life, reliability etc. The following three types of principle properties of materials decisively affect their selection
Physical
Mechanical
From manufacturing point of view
The various physical properties concerned are melting point, thermal Conductivity, specific heat, coefficient of thermal expansion, specific gravity, electrical conductivity, magnetic purposes etc. The various Mechanical properties Concerned are strength in tensile, Compressive shear, bending, torsion and buckling load, fatigue resistance, impact resistance, elastic limit, endurance limit, and modulus of elasticity, hardness, wear resistance and sliding properties. The various properties concerned from the manufacturing point of view are,
Cast ability
Weld ability
Surface properties
Shrinkage
Deep drawing etc

IDEAS, CALCULATIONS AND SELECTION OF MATERIALS WHEEL CHAIR CUM STRETCHER

Now In hospital we see the, for various check-up's, patient transfer from one place to another place. As per the demand required for better living quality of immobilized patients, for that should be improved the hospital mattresses for patient handling. Generally immobilized patients transfer by labour or nursing staff. Patients handling in various places are a labour intensive work. It is very dangerous for patient and hospital staff, if all transfer activity not done in exact manner. Mostly hospitals use fully atomized beds &stretcher for the patient handling. These are costly and cannot be affordable to all the hospital. At the time of patient handling, the stresses generated inpatient &staffs are same for all the hospital. Our aim to provide a better solution for patient handling. According to recent survey in hospital, it found that, 38% of nursing staff and labour suffers work from back injuries, 12% of nursing staff and labour suffer from low back pain at average age 39. Any other staffs suffer from any other various injuries. The present working proposes designing of a new trolley cum stretcher along with the modified mattresses which will totally eliminate the handling of immobilized patients.

Operation
The main components involved in this project consist of DC gear motor, rack & pinion, battery, caster wheel, bicycle wheel, two-way switch, and a waste lid. In this project one rack setup with hinged joint and connected to links is used to form the stretcher and bend to wheel chair are provided. At the present position this model is a wheelchair type. Below chair a rack which is connected to lids, the links are connected to the bottom side plate and top slide plate when the pinion is rotated anti-clockwise; the movement of the link brought the bottom side plate upward and top side plate downwards to convert the wheelchair into stretcher. From stretcher when the rack is rotated clockwise, the links movement brings the top side plate upward and Bottom side plate downward to convert stretcher into wheelchair. At the middle part a removal port with lid is provided to eliminate the human waste.

DESIGN ON CAD SOFTWARE:
Computer-aided design (CAD) is the use of computer systems (or workstations) to aid in the creation, modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing. CAD output is often in the form of electronic files for print, machining, or other manufacturing operations. The term CADD (for Computer Aided Design and Drafting) is also used.

Its use in designing electronic systems is known as electronic design automation (EDA). In mechanical design it is known as mechanical design automation (MDA) or computer-aided drafting (CAD), which includes the process of creating a technical drawing with the use of computer software.
CAD software for mechanical design uses either vector-based graphics to depict the objects of traditional drafting, or may also produce raster graphics showing the overall appearance of designed objects. However, it involves more than just shapes. As in the manual drafting of technical and engineering drawings, the output of CAD must convey information, such as materials, processes, dimensions, and tolerances, according to application-specific conventions. CAD may be used to design curves and figures in two-dimensional (2D) space; or curves, surfaces, and solids in three-dimensional (3D) space.

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CAD is an important industrial art extensively used in many applications, including automotive, shipbuilding, and aerospace industries, industrial and architectural design, prosthetics, and many more. CAD is also widely used to produce computer animation for special effects in movies, advertising and technical manuals, often called DCC digital content creation. The modern ubiquity and power of computers means that even perfume bottles and shampoo dispensers are designed using techniques unheard of by engineers of the 1960s. Because of its enormous economic importance, CAD has been a major driving force for research in computational geometry, computer graphics (both hardware and software), and discrete differential geometry.

The design of geometric models for object shapes, in particular, is occasionally called computer-aided geometric design (CAGD)

DESIGN OF MULTI WHEEL CHAIR:

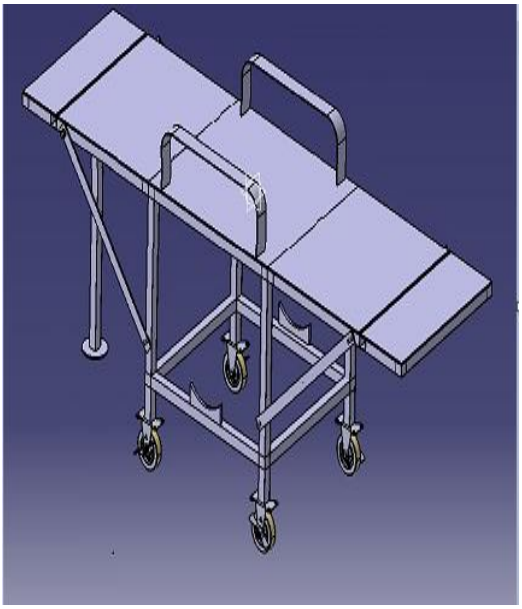

Fig. Stretcher

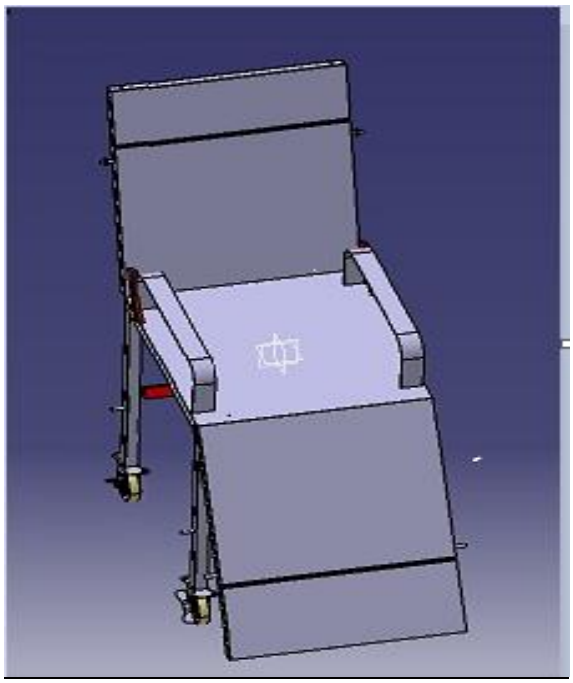

Fig. Fly Wheel

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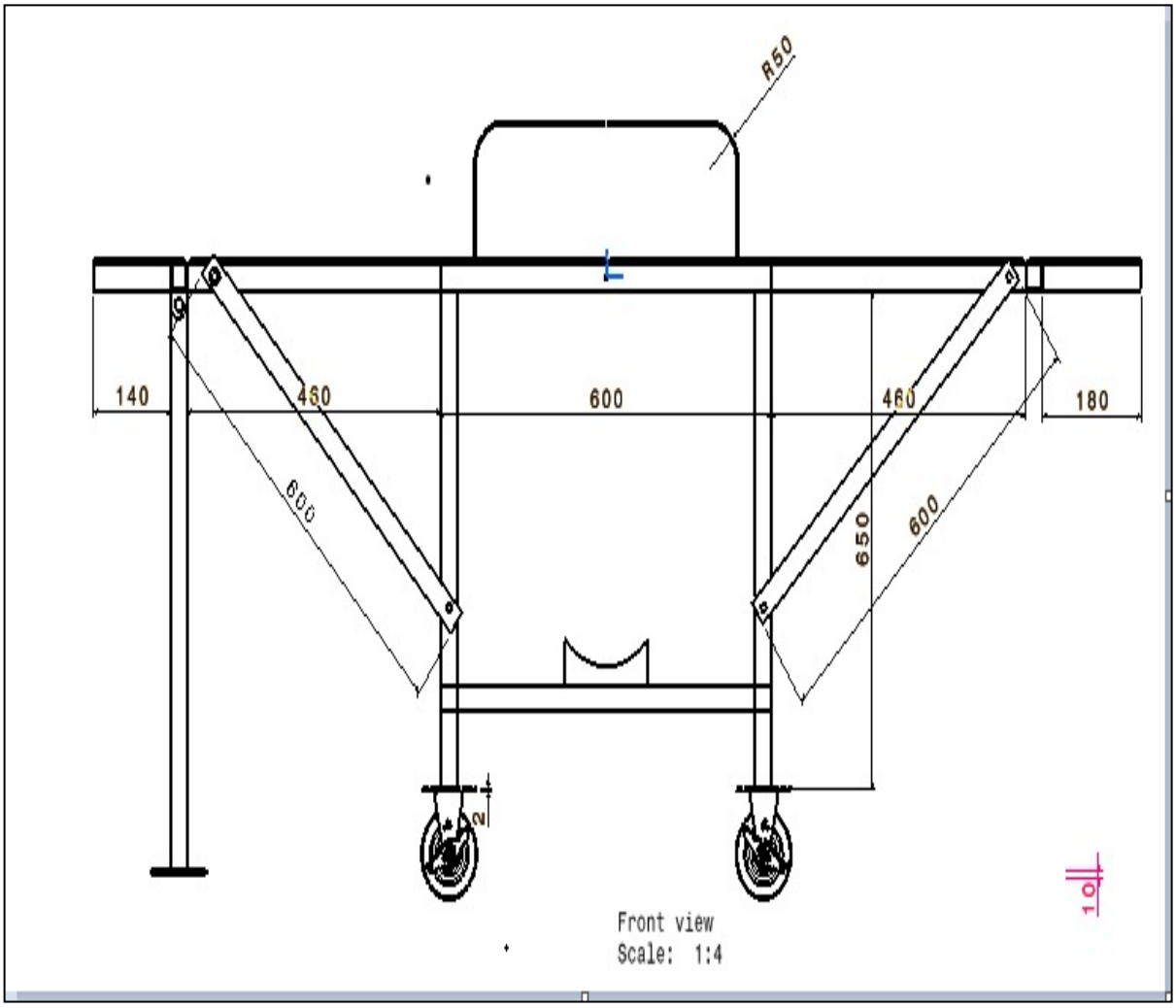

Figure front view

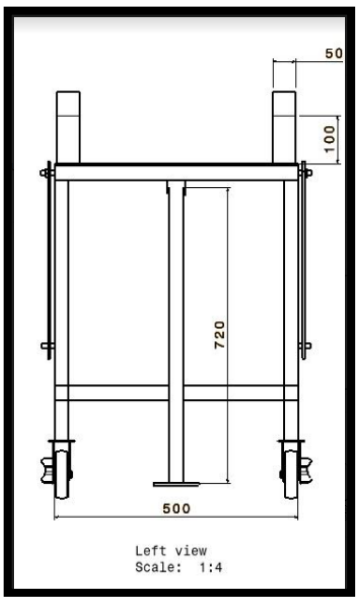

Figure Left view

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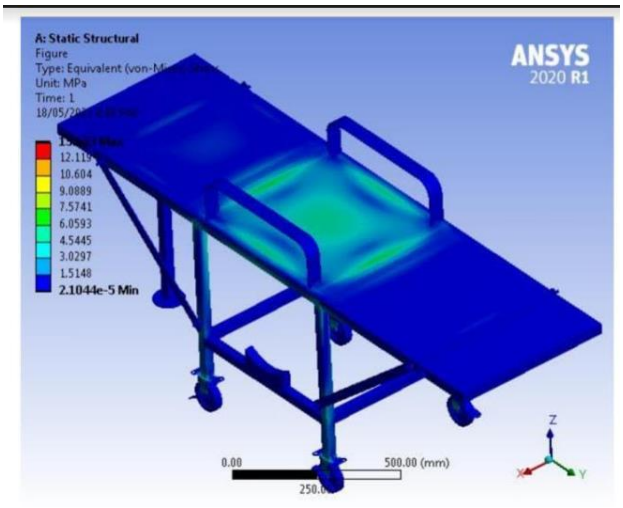
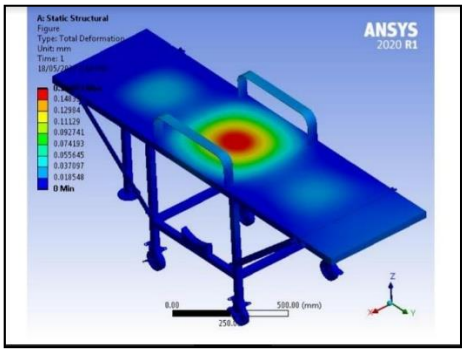
IV. RESULTS



Time [s]	Minimum [MPa]	Maximum [MPa]	Average [MPa]
1.	2.1044e-005	13.633	0.88064

Total Deformation Results:



Time [s]	Minimum [mm]	Maximum [mm]	Average [mm]
1.	0.	4.6468e-003	1.1292e-003

Table total deformation results

Time [s]	Minimum [mm/mm]	Maximum [mm/mm]	Average [mm/mm]
1.	8.911e-013	7.3798e-006	8.5771e-007

Table Von-Misses Strain

Advantages

- Increase in comfort level of the patient.
- Prevents further damage to patients and the helper while transferring him/her from chair to bed or vise-versa.
- Patients with serious injuries need not be moved to aggravate their injuries even more.
- No special training required to operate them.
- Is more efficient than other chairs.
- Less costly than electrical version of the same chair

Limitations

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- Increases weight of the chair.
- Increases the cost of the chair.

Applications

- It is used in hospitals.
- It can also be used in houses.
- Used in Emergency Cases in Hospitals
- Its is used when Unavailability of Beds in Hospitals

V. CONCLUSION

Design, analysis & development of Manual Wheel chair cum stretcher has been proposed successfully and is working as per the requirement, because of cost consideration, fabrication of product is done in small workshop so there may be a slight change in the function of accuracy and dimensions. But the wheel chair propagated was working successfully.

VI. FUTURE SCOPE

- This project has demand in the hospitals for space constraints.
- Mechanism and future electronics system has a huge demand for automation.
- This project can be implemented for sensors to observe the human health behaviors. Like heart beat sensors and pulse raise and drop detection.
- Wheel Chair has a wide range of application and scope in following areas:
- Physically Challenged People
- Physically Disabled People can use it as per their purposes. People who are able to use their hand can use this to travel around; People suffering from certain paralysis, high conditional fever can use either chair or converted bed for resting purpose as per requirement.
- Old Age Homes People at old age homes can use this chair for both purpose

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