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Construction of Medical Bed Cum Chair

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Abstract*—Engineering simplifies the processes in life thereby improving human life standards and even more, when a person becomes physically challenged. This Project is centered on enabling a patient's (elderly person a deformed person) mobility like sitting, reclining and sleeping, when seated on the perform basic Convertible Chair Bed, without relying on another person or without giving any stress to the patient. The Convertible Chair Bed is specifically designed keeping in mind the patient who is unable to even move around, within his own residence. The product is dimensioned in such a way that he can have access to any part of his/her place of stay with the minimum help of another person. The added special feature of the Convertible Chair Bed is that it can be easily stackable one into another thereby occupying very less space when compared to any other traditional Chair Beds. Because of this facility, old age homes, hospitals and service organizations can store more Convertible Chair Beds and provide better amenities to the needy. The Convertible Chair Beds are mounted on castor wheels with braking facility keeping in mind the safety of the patient. The mobility of the Convertible Chair Bed is facilitated using electric linear actuators because of their silent and smooth movements.*
Keywords*: convertible, stackable, portable, linear actuators, cost-cutting, ergonomics*

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I. INTRODUCTION

With time comes senescence, and as more number of people go into old age, better medical facilities need to be available at regular times. A multiutility hospital bed is one of vital importance for people suffering from immobility and lack of posture. This multi-utility bed consists of multiple features, the two most essential features being the ability to adjust the backrest and the ability to inhibit mobility. Both go side-by-side, as these are common movements that old people are incapable of performing at an average age of 60.Any person with grandparents may have noticed that once they recline (or) lie down, it's a cumbersome task to get up once again. This bed is a solution to that problem. The second feature stated, is the lack of mobility (or) immobility among old people. To tend to this feature, this bed can be converted to a chair and since wheels are provided it takes up the work of a wheel chair (i.e) the person can be moved around. All these features in the present day might sound expensive. This is mainly where the multi-utility hospitality bed differs from other beds i.e. in terms of being cheap. The multi-utility bed has been fabricated from the most cheap and sustainable material as possible, such that any person whether geriatric or not can use it.

1.1 Background work

Todd RH [1]in his reference, we derived and extracted the various forms of welding techniques that were carried on our project which helped in the manufacturing process.Arc welding was greatly used for the joints of different parts in the project.

Padmanabhan M [13] in his research focuses on the ergonomics and comfort for a patient on the bed. This reference further explains the conditions and needs to be followed for a paralyzed person on a bed or a chair.

Colvin F H [2] helped in assembling the jig and fixture placement which was set as a foundation and clamp hold for the manufacturing process.

The design and development of conceptual wheelchair cum stretcher from SASTECH volume 10 written by CS Gopinath [9] made us understand and gave an impact on the need of a convertible wheelchair cum bed which would serve as a dual purpose medical chair.

In the International Journal of Engineering and Innovative Technology, Tokishiro [10] Yukawa highlights the ideas on how to reduce manual control of wheel chairs by implementing electric drives and power systems.

Various other books and journals helped in minimalizing the cost and enabled in implementing automizing techniques which would bring in lot simpler control.Also certain references helped us on implementing stackability and good portability to the chair.

II. EXISTING SYSTEM

A basic manual wheelchair incorporates a seat, foot rests and four wheels: two, caster wheels at the front and two large wheels at the back. The two larger wheels in the back usually have hand rims; two metal or plastic circles approximately 3/4" thick. The hand rims have a diameter on average slightly smaller than the wheels they are attached as shown in fig 2.1. Most wheelchairs have 15 two push handles at the top of the back to allow for manual propulsion by a second person. Other varieties of wheelchair differs only in their basic design, but can be customized for the user needs. Such customizations may encompass the seat dimensions, height, seat angle footrests, leg rests, front caster outriggers, adjustable backrests and controls. Foot propulsion of the wheelchair is common for patients having limited hand movement. Foot propulsion allows increase blood flow and limit further disability. Attendant-propelled chairs otherwise called as transport wheelchairs, are designed in such a way that it can be propelled by an attendant using the handles. These chairs are often used to move a patient possibly within a hospital, as a temporary option. patients to exercise their legs to increase blood flow and limit further disability. Attendant-propelled chairs otherwise called as transport wheelchairs, are designed in such a way that it can be propelled by an attendant using the handles. These chairs are often used to move a patient possibly within a hospital, as a temporary option.

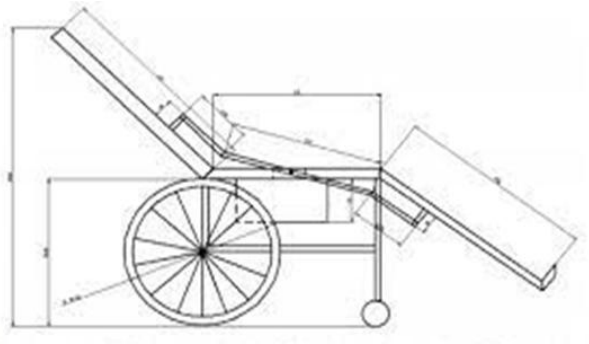

Fig 2.1: Structure of bed

III. Proposed System

The course of our work begins with the planning phase involving initial research, literature survey and background study. It is followed by concept generation phase that includes evaluating existing wheel chair, customer requirements and concept designs. Prototyping the wheelchair into complete bed using actuator system by means of 2-5 bar pressure and we progress towards testing a feasible model. Collection of all the equipment's and materials required for overall wheel chair cum bed enhancement setup.Forming of a light weight wheel chair cum bed structure which would carry up to 100- 150 kg. Successfully coding of a specific program, which would run the device directionally by using mobile control application, and head motion. Implementation and connection of all the equipments likeLinear actuators, would convert the Wheel chair into Bed and lifts the wheel chair into adjustable height.

IV. CONSTRUCTION AND TESTING OF THE BED CHAIR

4.1 Construction of Bed chair

1. Designing the skeleton of the project by implementing cost effectiveness, stackability, and portability (knock down).
2. Fabricating the designed framework in a dismantlable way using the required machinery and tools.
3. Positioning and fixing the Actuators, Microcontroller and battery to the fabricated and assembled framework.
4. Checking for project failures or further improvements needed by running test trials.
5. Spray painting for the fabricated part and any fine tuning and arrangements if required
6. Applying the furniture and final physical testing with human subject.

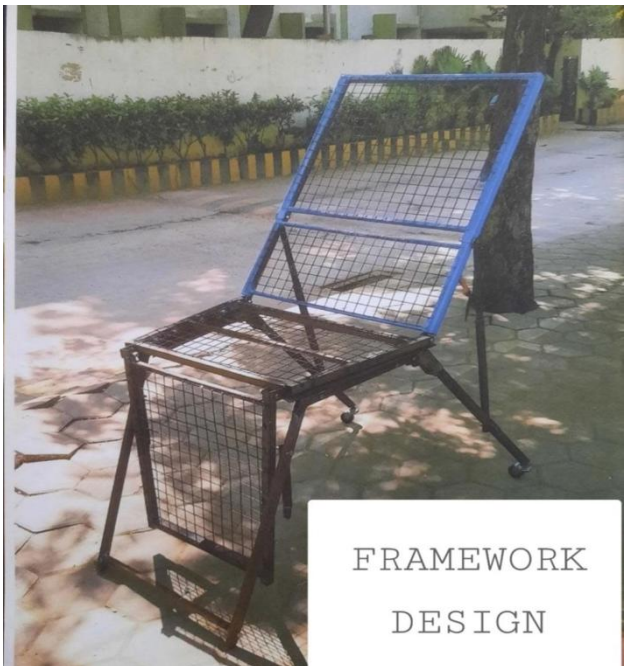

Fig 4.1: Construction

4.2 Factors to be considered for designing the Bed Chair

A. Component

The design of the component has to be studied carefully and ensure that the work is being performed in proper sequence. As far as possible, the maximum number of operation should be performed on machine in single setting.

B. Capacity of the bed

The type and capacity of the bed on which a patient is lying has to be considered.

C. Production requirement

Design of equipment should be made on basis of actual production requirement This leads to decision for use of manual or automatic arrangement.

D. Location

Location should be hardened, wear resistance and should have high degree of accuracy. Location is one that ensures that the movement of joints in the bed. Adjustable support may be placed with respect to the shape, strength and size of the bed

E. Arrangement of joints:

There should be adequate clearance for joints to move freely. The bed can be moved to different positions without any resistance only if there is clearance between the joints. The area of the joints must be hardened so that it does not shear off.

F. Body construction:

The body (bed frame) are manufactured by the following methods.
a) Machining
b) Fabrication.
c) Welding

G. Frame construction procedure

a) All the parts can be completely machined before assembly
b) Worn out parts can be easily replaced
c) Screw serve only to hold the components together.
Frames must process enough rigidity and must be equally balanced.

H. Welding construction

a. Welding construction used for attaching the frames together.
b. Arc welding is used to construct
c. Welding must be strong enough to withstand the load.

I. Safety features

The height of the bed is maintained in such a way that even if the patient falls down from the bed, patient doesn't get hurt. Side rails are provided in order to prevent the person from falling.

J. Cost

All components should be simple as possible. The initial investment required to design and built the bed should be optimum. Hence a cost-cutting design is developed.

4.3Testing of Bed chair

Different forms of testing were made with the patient on the bed chair and also certain forms of testing were made using the Ansys software with which we could find the stress test and deformation test.

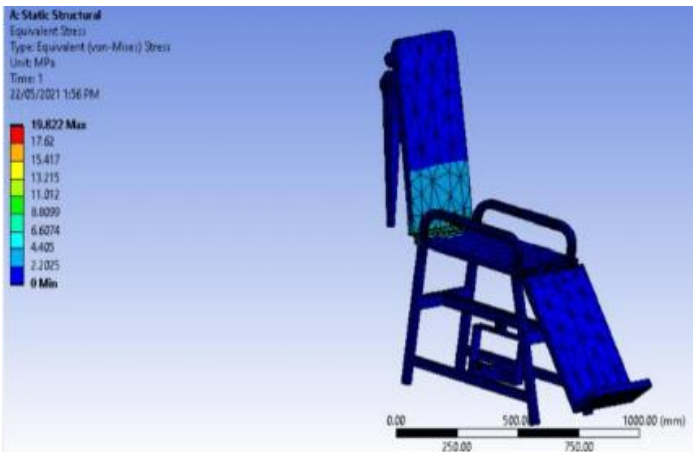

Fig 4.2: Stress Test

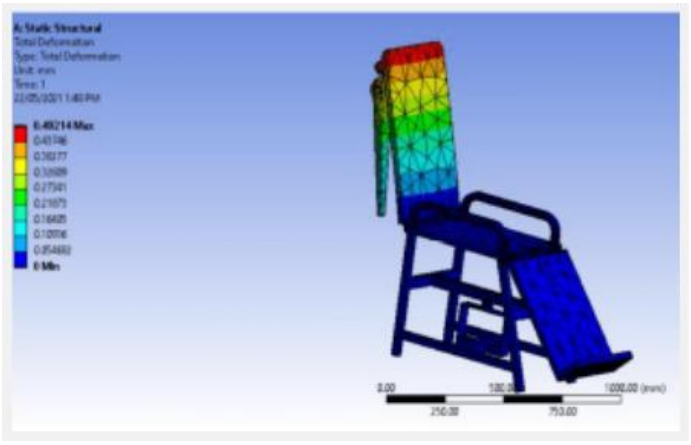

Fig 4.3: Deformation Test

V. CONCLUSION AND FUTURE SCOPE

This journal deals with the design, fabrication and automation of multiple utility hospital beds. The project is carried out by us in collaboration with a company. It is very useful in hospitals and at homes. For the further development of the project, few sensors and a hub motor connected to the wheels can be included on the project which allows to monitor the patient and also to control the movement of the bed chair around its path.

FINAL CONSTRUCTION

The Final construction of the chair after assembly looks as though in the below fig.6.1

Fig 6.1: Final Construction

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