DESIGN & DEVELOPMENT OF CHAIRLESS CHAIR

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❖ **Abstract :-**

Our project is to enable the worker to have the ability to move around with absolute ease, with the use of a chairless chair.

- Person with the problem of Arthiritis (bone problem) can get a little relieve with this instrument.
- Old people who have to travel in crowded places like mumbai can make good use of this 21st century instrument.
- It can also help our back remain straight and can reduce the occurrence of bad postures which can result in muscle related injuries .

❖ **Project Objectives :-**

The objective of our project is to develop affordable, wearable, light weight, user friendly chairless chair which can enable the worker, back pain, arthritis patients to have the ability to move around with absolute ease, with the use of a chairless chair.

❖ **Introduction :-**

Today the world is now going to be compact. For suitability to the world, things are also going to be made of compact and smaller in size. Now the battle is also done between machines instead of man to man. Machine, which is fighting, are operated and driven by man sitting instead the vehicle or being in touch with the machines. Also the human has to win the war against the increasing oil prizes and tremendously increasing pollution level in the air. To win this war and to thought regarding another parallel motive force to the auto-mobile, we have thought of manufacturing "(**CHAIRLESS CHAIR)**" through the mission of

project. Project is a mission of creating something new, which is innovative i.e. manufacturing of a new product. The prime requirements of an effective project organization therefore are:

1) Flexibility
2) Autonomy
3) Group functional integration
4) Small group size
5) Common work location for all project members
6) Team spirit among group members

All the foregoing requirements are mutually reinforcing, and conjoin together towards effective implementation of risky and time-bound project.

Factors in consideration of project:

1) Compactibility with the objective, plan.
2) Availability of needed scientific and engineering skills in R & D.
3) Critical technical problems likely to emerge.
4) Market prospects and potential of the proposed new product.
5) Availability of production skills needed.
6) Financial return expected.
7) Cost and availability of capital required for investment.
8) Estimate of costs of development, production and marketing.
9) Growth prospects for the future.

❖ Literature Review :-

Any Research groundwork is depending on literature investigation. Based on the studies carried out by several researchers and their contribution to research field motivates for future scopes of research. In this chapter review of several research papers by various authors and technical reports has been discussed such as about Design & Development Of Chairless Chair .

1. Cyril Varghese (2016)

Cyril Varghese and Vedaksha Joshi has worked on the Exoskeleton Based Hydraulic Support was successfully fabricated and it was found to be suitably safe [3]. Under fluctuating load during walking as well as under Dead Load when the user sits/rests on it.

2. H. Zurina ,A.fatin (2015)

H. Zurina and A. Fatinhas worked on the Design and Development of Lower Body Exoskeleton. In his paper an attempt has been made to evaluate the possibility of using the Chairless chair that will help in increasing the energy efficiency and offer weight support when the user feels tired rather than continuously taking on the weight. Other than that, in term of ergonomics, and the objectives to give comfort to user has achieved by give choices to user to choose their comfort degree level from 45° to 90°.Apart from the benefit of his experiment it can be conclude that his design still confront with some problems that need to fix in future so that the objective to give an ergonomic chair to user can be achieved. The experiment testing has been conducted for our prototype to our group member with weight of 80kg and height around 170cm. From the result of experiment testing, it can be observed that for height and weight, the Chair less chair doesn't give any effect in lack or over measure in its height dimension. It suits the user which prove that this chair can be wear by people from any height range. He tester were required to use the chair while do some work, it was observed that, he had difficulties in changing the degree level.

3. Aditya Bhalerao ,Sandesh Kambale (2016)

Aditya Bhalerao and Sandesh Kamblehave worked on Pneumatic portable chair for employees to seat while working. By referring to human seating and walking characteristic a leg mechanism has been conceived with as kinematic structure whose mechanical design can be used by employees as a wearable exoskeleton. As per the Specified Design parameters the body can suitably carry around the 100Kg of Human Body weight. In the later part to reduce the cost, Oil was also brought in the weight sustaining mechanism thus providing better results.

4. Y. Kalyan Chakravarthy, D.Tarun, A Srinath(2014)

Estimation of body segment weights for prosthetic legs suitable to Indian amputees. Approximate height & weight of Indian people 5 ft. 5inch to 6 ft. & weight 100 kg.

❖ Problem Statement :-

- In factories on production lines the workers work for about 8-10 hours daily due to this worker get tired physically as well as mentally and productivity of company gets decreased due to this.
- The workers face the problem like distress to their lower limbs and other physical problems.
- There is an insufficiency of the seat when we want to sit anywhere and anytime and It is often troublesome to provide seating equipment for all workers in every field of aspect.
- Excessive sitting is dangerous as it badly affects the body's metabolic rate, resulting in the risk of disease like high blood pressure, diabetes, cancer, depression, etc., Correspondingly, excessive standing also results in worst health outcomes.
- Despite the work environment is ergonomically designed they are not successful in soothing laborer weariness since most of the time they got to work for hours in a specific pose.

❖ Implementation Scheme, Proposed System Methodology, Block Diagram, Circuit Diagram :-

Implementation Scheme :-

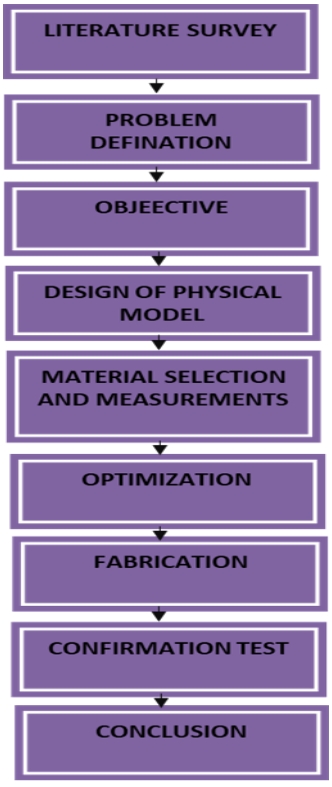


Fig :- Flow Chart of Design & Development Of Chairless Chair .

Proposed System Methodology :-

Area x Pressure = Force Output

F= P X A

Consider the weight of human sitting on chair = 100 kg. = 981 N

981 = P x π r2

P = 981/ π 102

P = 3.12 N/mm2

Material	Yield strength (MPa)	Ultimate tensile strength (MPa)
Aluminium alloy 6061-T6	241	300

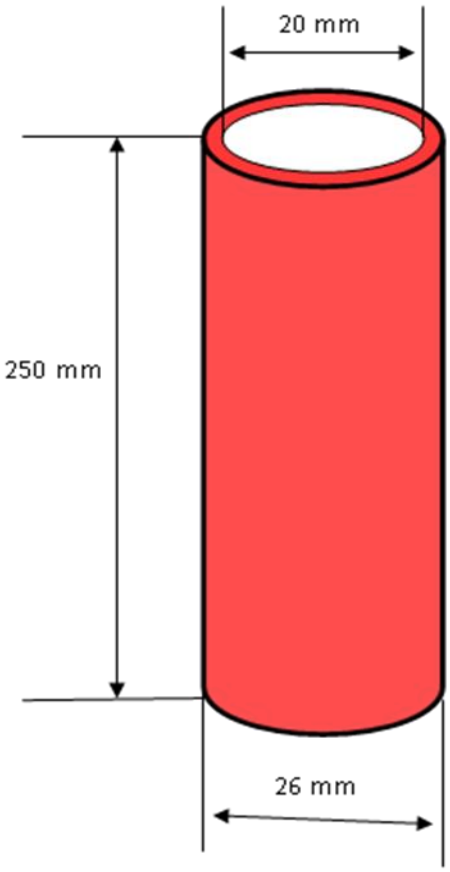
DESIGN OF CYLINDER:-

Now for thickness of wall of cylinder,

Hooks law

We have, t = pd/2 σtensile

where p = internal pressure= 3.12N/mm2 , & d = diameter of cylinder=20 mm selected, ft1 = permissible stress.



We have ultimate stress for cylinder material σultimate = 300 N/mm2 aluminium alloy

Considering factor of safety as 4.

We get permissible stress = ultimate stress/factor of safety

 σtensile =300/4

σtensile = 75 N/mm2

Inputting these value in thickness formula,

We get, t = 3.12 x 20/2 x 75

= 62.4/150= 0.416 mm.

t = 0.5 mm (say)

but standard available cylinder in the market is 3 mm thick, so our design is safe.

Outer Dia. of cylinder = 20 + (2 x 3) = 26 mm

The minimum outside dia of cylinder is 26 mm

- **Block Diagram** :-

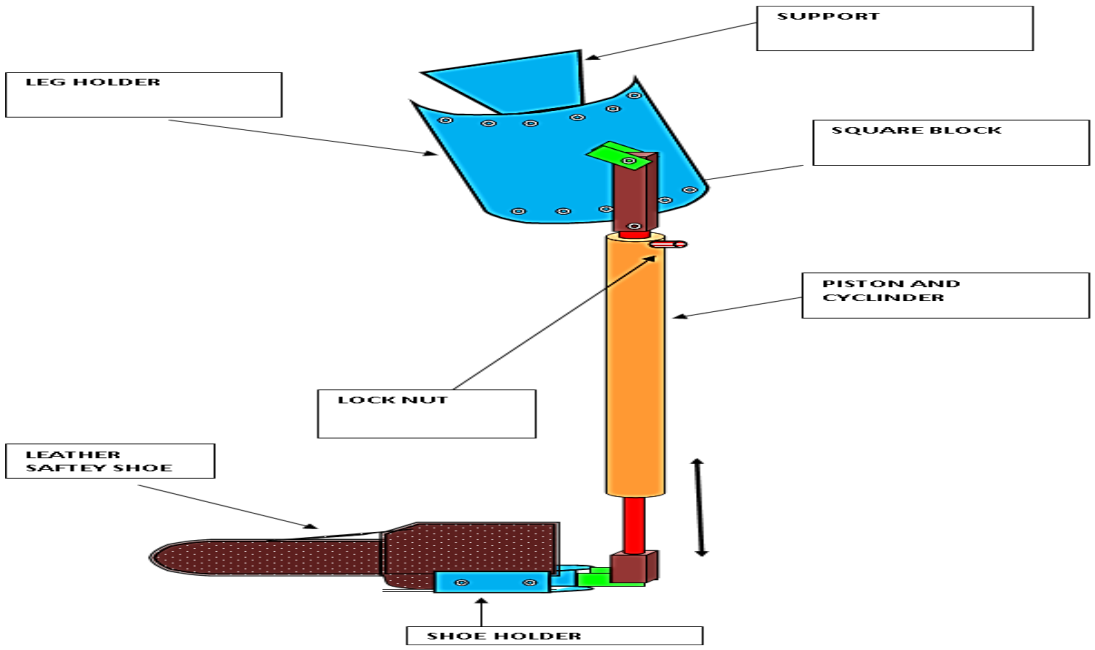


Fig:- Block Diagram of Design And Development Of Chairless Chair .

- **Circuit Diagram :-**

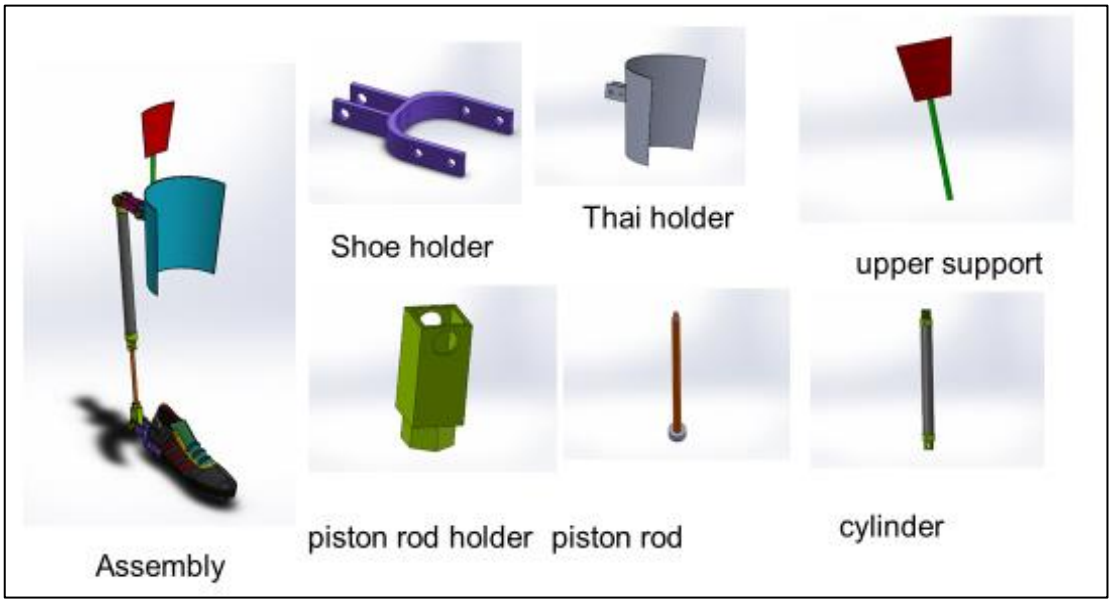


Fig :-Circuit Diagram of Design And Development Of Chairless Chair.

❖ **Outcomes** (Benefits to Societies) :-

- A variable damper engages and supports the worker bodyweight, which is directed downward to the shoes.
- Any worker can use it with any footwear and touches the ground only when in seating position.
- The user just moves into back side mechanism is converted in chair form
- Pneumatic cylinder is used for smooth working, which make easy to operate
- By using Carbon-fibre or aluminium the weight of the mechanism weight can be further minimum

❖ **List of Components with their Specifications :-**

SR NO	PART NAME	MAT	QTY	COST
1	CYLINDER 20 BORE 250 STROKE	STD	2	5000
2	PAD	MS	2	800
3	BELT	NY	4	600
4	SHOE	LE	2	1500
5	PIVOT JOINT	MS	2	700
6	SHOE HOLDER	MS	2	300
7	POP RIVIT	AL	24	50
8	NUT BOLT M-10	MS	4	199
9	ROUND PIPE	MS	5 KG	300
10	MS FLAT BARS	MS	1 KG	60
11	BLOCK NUT	SS	2	20
12	NUT BOLT M-6	MS	4	150
13	MISSILINIOUS	-	-	1000
			TOTAL	10679

Table :- List of Components with their Specifications.

❖ Advantages, Disadvantages, Applications :-

Advantage :-

- The movements of the worker are copied by the exoskeleton, i.e. the limbs of the human and the exoskeleton is aligned during motion.
- No external power source required.
- Heavy objects can be lifted for long period of time.
- Increases efficiency of operator.
- Robust in design, requires less space, can be assembled & disassembled easily.

Disadvantages :-

- Distinction of intended from unintended movements is often difficult and results in systems with many
- different kinds of sensors and complex signal processing.
- But the cooperation and function allocation, man-machine information exchange, real-time motion planning
- and safety control are the difficulties faced by building such a control strategy.
- Free body motions are restrained.
- May require costly materials like carbon-fibre, aluminium.

Applications :-

- With the growth of technology many companies like Audi have optimized factory floor plans designed to maximize efficiency, with little room, literally or figuratively, for chairs. The Chairless chair effectively lets employees carry a seat with them at all times. This enables them to take micro-breaks of 3 to 10 seconds while working thereby reducing muscle fatigue.
- This invisible chair would prove helpful to hunters, farmers, surgeons, retail workers, etc. i.e. anyone who needs to stand for long hours at stretch.
- This Chairless chair would be helpful to the elderly as they need rest a while after walking some distance.
- Chairless chair can be developed further to suit the needs of the handicap, by acting as a walking assistance.
- Once into mass production, an organisation can completely give up the usage of conventional chairs and make use of Chairless chair to save floor space and maximize efficiency.
- It can be used by commuters standing in a crowded train or metro to relax themselves without occupying much space.
- Used my military and trekkers while trekking difficult terrains.

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