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Design, Synthesis and Development of Adaptable Multi-postured Chair for ATM Security Personnel

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Abstract: ***Chair is a basic necessity in every household and organization across the world. The ATM Security Personal spend majority of their working hours in a day by sitting on a plastic or steel chair provided by the Bank, but most of the chairs are not ergonomically designed and hence does not have multi-posture feature. Thus sitting on these chairs for prolonged periods can take toll on their body by leading to impaired blood circulation, to sore and weakened muscles, back pain and other ailments. Hence it is highly recommended for them to use an ergonomically designed chair. Thus, the project study was focused on designing an ergonomically multi - postured adaptable chair for the ATM Security Personnel with equipment handling facility.***

Keywords: ATM security; chair; foldable chair; multi-posture; soft armrests.

1. Introduction

A chair is a piece of furniture for a person to sit, typically having four legs, two arms and a back for support. Every one of us spend most of our time by sitting on the chair to relax ourselves after a busy day schedule or to accomplish any task even including the ATM Security guard. Though sitting on chair for prolonged periods is inevitable for the ATM Security personnel, it can take toll on their body by leading to impaired blood circulation, to sore and weakened muscles and other ailments. Hence it is very important for them to use an ergonomically designed chair.

1.2 Features of a good chair

The following are some of the features, which a chair must have in order to provide comfort and relaxation to the user.

- *Adjustability* - Check to see that seat height is adjustable.
- *Seat height range* - Check whether the seat height can be adjusted to the height recommended for the worker(s) who will use it. Other chairs may have to be selected for very short or tall workers.
- *Backrest* - Check to see that the backrest is adjustable both vertically and in the frontward and backward direction and has a firm lumbar support.
- *Seat depth* - Select the seats that suit the tallest and the shortest users.
- *Stability* - Check for the stability of the chair; a five-point base is recommended.

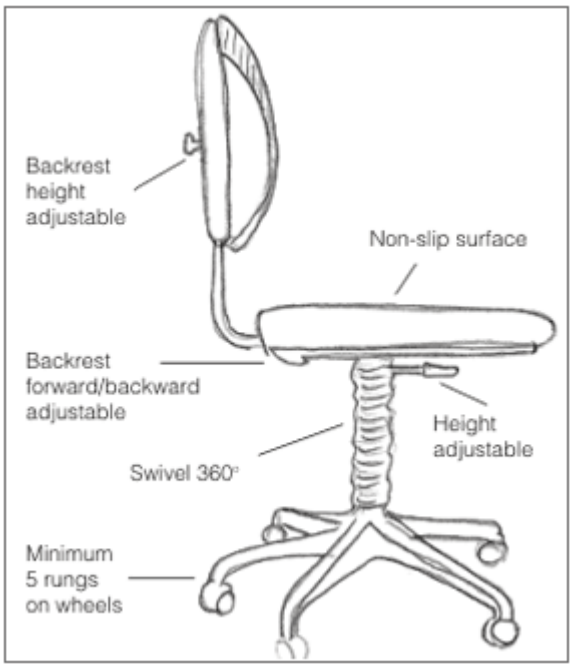


Figure 1

2. Problem Definition

The ATM security personal spend most of their working hours by one any plastic or steel chair provided by the Bank, but most of these chairs are not ergonomically designed and lack multi-posture facility. Thus sitting on these chairs for prolonged periods can take toll on their body by leading to impaired blood circulation, to sore and weakened muscles and other ailments. Hence it is very important for them to use an ergonomically designed chair.

2.1 Statement of the Problem

To design, synthesize and develop a multi - postured adaptable chair for the ATM Security Personnel considering ergonomic and functional requirement.

2.2 Objective of the study

Based on the research problem, the following objectives are formulated for the study.

- To arrive at the design specifications based on utilities and ergonomics.
- To identify issues and problems associated with the usage of the existing chair and find the possible solutions.
- To generate concepts through sketches, CAD modeling and rendering based on QFD and PDS.
- To generate three concepts as alternative solutions and
- Evaluate all the concepts and identify the right concept model on the basis of model which fulfills the highest no of product specification/requirement.

3. Customer Needs

The ATM Security personnel has been identified as the primary customer/consumer for the study. Questionnaire and Interview method were used to collect the customers inputs and based on the discussion with them, the following requirement/ specification were derived which needed to be incorporated while designing the product:

- Foldable/Adaptable
- Less weight and Easy to carry
- Multi postured
- Back rest movable
- Equipment keeping rack(lathe)
- Soft Armrest
- Water bottle holder
- The chair should not produce more heat
- Torch holder
- Compartment to keep Uniform and attendance sheet.
- Relieve from Back pain and other ailments.

3.1 Overview of existing products

The Banks provides a variety of chairs to the ATM Security personnel which are shown below:

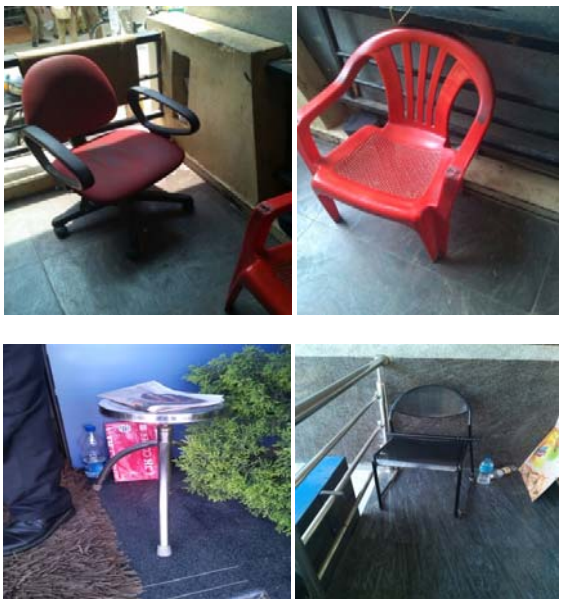


Figure 2

3.2 QFD Matrix

QFD matrix, customer voices and importance are used to create features for the new product and these input increases the chances of innovation

SL NO	Technical Voice / Customer's Voice	Relative importance rating	Material	Shape(Volume)	Function	Weight(Kgs)	Size	Colour	Ergonomics	Manufacturing	Maintainence	Life Time	Importance Weight Total
1	Foldability	5	3	5	3	5	5			1			110
2	Multi postured & Backrest movabl	5	3	5	5	1	3		5			1	115
3	Equipment keeping rack	3		5		3				1			27
4	Soft Armrest	3	3		3				5			1	36
5	Water Bottle holder	3		5						3			24
6	Chair should not produce more heat	3	3					1					18
7	Security Alarm button	1					3					3	6
8	Tourch holder	1		5			3					1	9
9	Compartment to keep Uniform & Attendance sheet	1		3			1			3	3		10
10	Less Weight & Easy to Carry	5	3	5			3			1			60
11	Extensive seating space	3	3	5			3						33
12	Asthetic look	1	1	3		1	3	5			3		16
	Importance Weight Total		73	131	49	40	74	8	40	25	6	12	

Strong Relation 5
Medium Relation 3
Weak Relation 1

Figure 3

3.3 Idea Generation

Figure 4

4. Concept Generation and Selection

The concepts were derived from the analyzed data. Based on the PDS, all the engineering parts were designed and then the external shape has been derived. The concept includes the ergonomic considerations, aesthetics, utility and the external shape of the product.

The complete requirement has been converted into product design specification. These requirements, specifications or technical characteristics are then used as the basis for developing various product concepts. First the concepts were derived through the sketches and then the concepts were made in CAD modelling using CATIA. The data collected from the costumers and the technical requirements were used to generate concepts.

4.1 Concept Model – 1

The Chair is designed by considering all the customer voices. The designed Chair is entirely different from the existing Chair which ATM security personnel's are currently using with additional features such as good aesthetic look, handle at the bottom of the chair to provide comfort and rest their foot, a compartment at the back of the chair to keep their uniform, water bottle, etc.

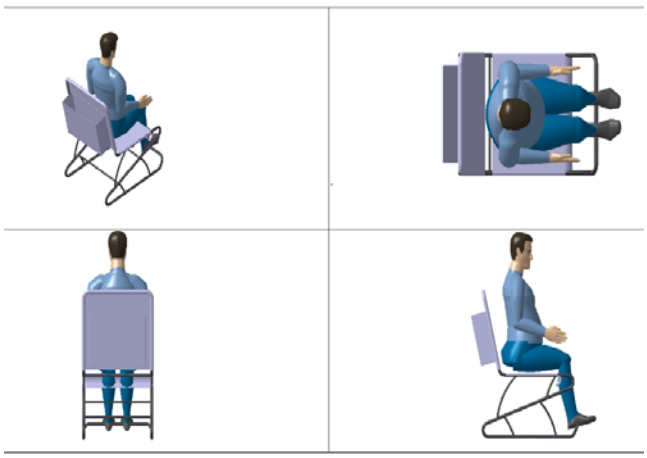


Figure 5

4.2 Concept Model – 2

This concepts design has considered incorporating soft arm rest to the chair, as armrest is one of the key feature to a chair. Many of the ATM security personnel get back pain and other ailments mainly due to inconvenient seating space and improper armrest. So the design catered to their need along with additional features such as good aesthetic look, a compartment at the back of the chair to keep their uniform, attendance document and lunch box.

Figure 6

4.3 Concept Model - 3

Many of the ATM security personnel carry a lathe/stick as a weapon to protect themselves and the customers during unforeseen circumstances like theft, so this model has considered their requirement by designing a small round shaped rack below the right arm rest to keep their lathe. Another concern of the security personnel is that their existing chairs are heavy, immovable and occupies lot of space. The model also addressed their need by designing the chair with easy movement, foldable/adaptable and light weight so that the ATM security guard can carry it wherever they want. Some of the other additional features of the chair are good aesthetic look, a compartment at the back of the chair to keep their uniform, attendance document and lunch box.

Figure 7

4.4 Concept Selection

The final concept has been identified by using weighted ranking method. The below mentioned table depicts the features and the weight-age assigned to each feature of the concepts. The concept which has got highest weight-age has been selected as the final concept.

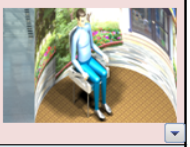
Sl No	Features	Data	Concept 1	Concept 2	Concept 3
					
1	Foldability		−	−	+
2	Multi postured & Backrest movable		−	−	+
3	Equipment keeping rack		−	−	+
4	Soft Armrest		−	+	+
5	Compartment to keep Uniform & other stuffs		+	−	+
6	Less Weight & Easy to Carry		−	+	+
7	Extensive seating space		+	−	−
8	Asthetic look		−	+	+
	Total	+	2	3	7
		−	6	5	1

Figure 8

4.5 Detailed drawing of Concept model – 3

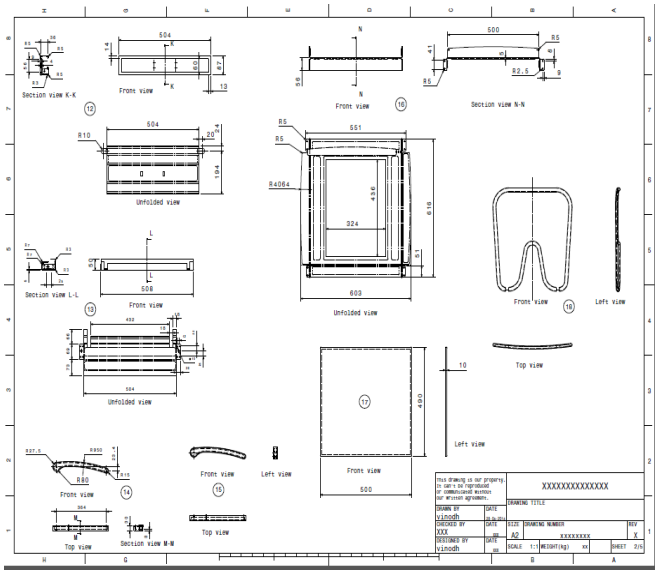


Figure 9

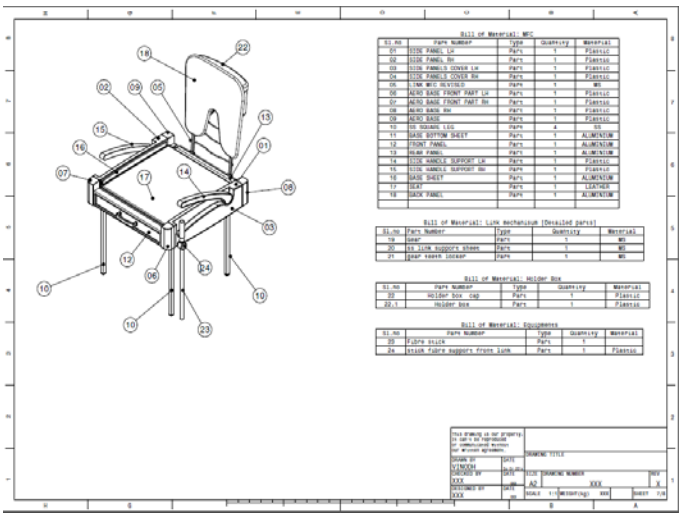


Figure 10

5. Validation and Interpretation of Analysis

5.1 Validation – 1

The normal chairs which are used by the ATM Security personnel do not have multi – posture facility. Due to the lack of this feature it causes back pain to the security guard. Hence the new design provides multi – posture and movable backrest facilities to relieve them from back pain and other ailments.

Figure 11

5.2 Validation – 2

The Security personnel usually carry a lathe/stick as a weapon to protect weapon to protect themselves and the customers during unforeseen circumstances like murder, theft, or to waive off street dogs entering the ATM Center. But their existing chairs do not have the facility to keep the lathe. Hence the new chair has a round rack below the left armrest to keep the lathe/stick.

Figure 12

5.3 Validation – 3

The existing chairs do not have the provision to keep water bottle, lunch box, attendance sheet and other necessary things which the ATM security guard usually carry with themselves. Thus they need to keep beneath their chair or else in the ATM room. In order address this need the design provides have a compartment/rack behind the back rest wherein they can keep all their necessary stuffs.

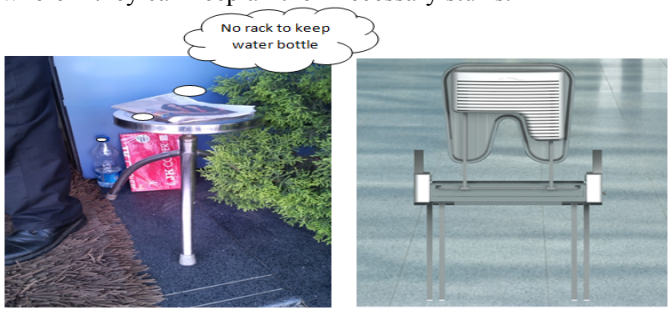


Figure 13

5.4 Validation 4

The existing chair's armrests are not ergonomically designed and immovable, thus it leads to weakness of hand, causes shoulder and hand pain to the security guard. Hence the new design provides soft and movable armrest facility.

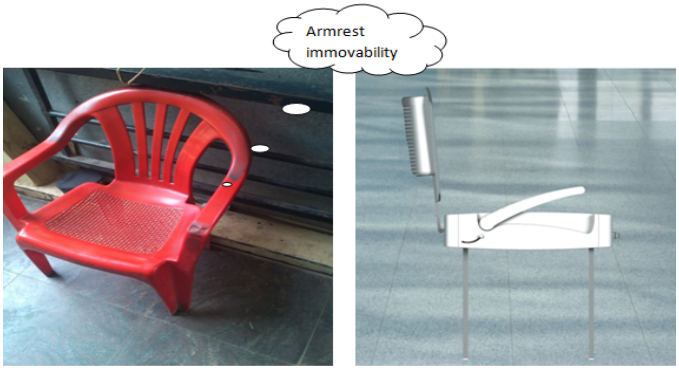


Figure 14

5.5 Validation - 5

Most of the chairs provided to the ATM security personnel are either plastic or steel chair which are unfoldable and requires both seating and storing space either inside or outside the ATM machine room. Whereas the new chair design is foldable, light weight and the ATM Security personnel can carry like a suitcase to wherever they go.

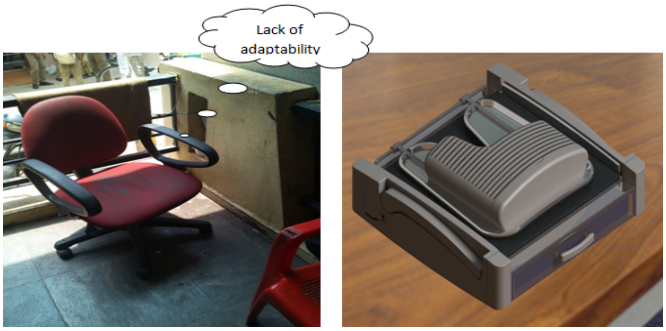


Figure 15

6. Conclusion

We can conclude that the chair has been designed by considering the ergonomic factors and also the requirements of the ATM Security personnel. The essence of the study is extracted directly from the customer by way of interviewing them with the help of questionnaire and also by review of related literature. Thus the final product captures all the specifications such as adaptability, aesthetic look, multi-posture facility, soft armrest, equipment handling facility, rack to keep water bottle and other necessary stuffs.

7. Recommendations for Future Research Work

Some of the recommendations derived from this study are as follows:

- This product is designed by considering ergonomic guidelines, hence it can be useful for not only for ATM Security personnel, can be used in normal household and any organization.
- The manufacturing will be high to produce a single chair. But the cost can drastically come down the production is high due to economies of scale.
- The chair provides sufficient seating facility to average weight security personnel. So there is scope to customize the seating space for obese security personnel.
- This product will be beneficial to even other Security personnel's who work in Banks, Apartments, and other organizations and
- The Government of India and the private enterprises can take up in Public Private Partnership to design and distribute these chairs to all the Security personnel across India at free of cost as part of their corporate social responsibility.

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