

COMPUTER WORKSTATION DESIGN FOR CEREBRAL PALSY CHILDREN

Product design Project II

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Submitted in partial fulfillment of the requirements of the degree of Master Of
Design In Industrial Design

Industrial Design Centre
Indian Institute of Technology, Bombay.

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APPROVAL SHEET

Industrial Design Project II titled

COMPUTER WORKSTATION DESIGN FOR CEREBRAL PALSY CHILDREN

By

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is approved for the partial fulfillment of the requirements for the postgraduate degree of

Master of Design in Industrial Design

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1. ABSTRACT

This project basically deals with the Problems of Cerebral Palsy people while using the existing computer workstation. This project includes designing of an ergonomic workstation, which will help the Cerebral Palsy people to work on computer workstation efficiently. A proper design approach was followed which included determining different ergonomics related issues like body dimensions, biomechanics, behavior, safety etc. of the users with reference to the neuro-muscular difficulties and applying those observations in designing a computer workstation for the CP. The later part of the project also describes different concepts that were evolved for these individuals along with the final concept.

2. INTRODUCTION

2.1 Why this project?

This project was brought up by NJDC team (National Job Development Center,Chembur) because it was felt that there is a need to solve a lot of issues concerned with their spastic students working on the computer workstation.

2. INTRODUCTION

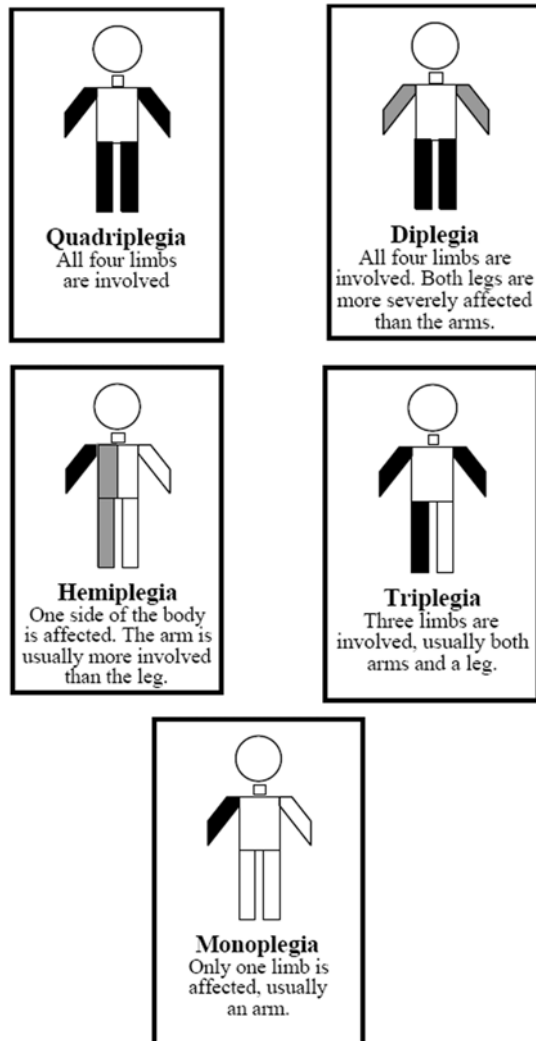


FIG. 2.2.1

2.2 What is CEREBRAL PALSY?

CEREBRAL PALSY (CP) is a term used to describe a group of chronic conditions affecting body movements and muscle co-ordination. ^{(1)*}

It is caused by damage to one or more specific areas of the brain, usually occurring during fetal development or during infancy.

The four main categories include:

1. *Spastic CP*
2. *Athetoid or Dyskinetic CP*
3. *Ataxic CP and,*
4. *Mixed CP.*

Spastic CP further includes:

1. *Quadriplegia:* All four limbs are involved.
2. *Diplegia:* All four limbs are involved. Both legs are more severely affected than the arms.
3. *Hemiplegia:* One side of the body is affected. The arm is usually more involved than the leg.
4. *Triplegia:* Three limbs are involved. Usually both arms and a leg.
5. *Monoplegia:* Only one limb is affected usually an arm.

All the above types are shown in Fig. 2.2.1.

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*Parenthetical references placed superior to the line of text

2. INTRODUCTION

2.3 Problem Definition:

The spastic subjects working on the computer can not sit in the prescribed postures as followed by the normal people based on ergonomics principle. This unintentional awkward posture in turn can cause a lot of other musculo-skeletal problems to them, which may further attenuate their muscle tone.

2. INTRODUCTION



FIG. 2.4.1

2.4 Present scenario:

Although the monitor table and the keyboard table are being provided with adjustments they are placed in such remote locations that it becomes extremely difficult for the spastic person to access it as well as use it.

The chair that is provided is an ordinary tubular structure chair, which does not have any scope for adjustments. Also the chair itself is so heavy that it becomes really cumbersome for the ingress and egress of the subject as shown in Fig.2.4.1.

2. INTRODUCTION

2.5 Type of users:

The type of subjects considered here are the persons who are in the age group of 18 to 25 years. They are not that severe in their particular kind of spasticity and can work on the computer satisfactorily.

2.6 Beneficiaries:

The benefits in this case are not only physical but also psychological. The effects of CP are lessened considerably by an environment, which enables people with disabilities to play a full part in their communities. The main outcome of this would be '**Independent Living**'

2.7 Volume of spastics:

According to the Census, 2001, there are 2.19 crore persons with disabilities in India which constitute 2.13 percent of the total population. Generally 10 out of every 100 adults are affected with Cerebral Palsy. This data varies according to different regions of the country.

3. PROJECT AIM

To design an ergonomically efficient workstation, which the spastic person can adjust by himself to sit comfortably while working on computer.

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4. DESIGN APPROACH

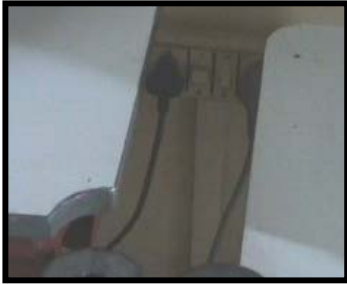


FIG. 4.1.1



FIG. 4.1.2



FIG. 4.1.3



FIG. 4.1.4

Few methods that were followed to know the probable causes and the related problems for those CP individuals.

A user study was conducted and analyzed based on the following methods:

1. *Video documentation*
2. *Time motion analysis*
3. *Questionnaire and experimentation*

4.1 Video documentation:

This method involved a continuous video documentation of the subject while working on the computer workstation right from the entry in the room to the exit from the room.

Conclusions:

1. Switches are placed at the extreme position, which makes it difficult for the subject to operate as shown in Fig.4.1.1.
2. The currently used chairs are quite heavy with no adjustability making it difficult for ingress and egress as shown in Fig 4.1.2. This also leads to inappropriate table height and dangling legs.
3. Possibility of the subject getting his legs entangled in the wires hanging from the table as shown in Fig.4.1.3.
4. During work, the person is not able to locate the sentence on the document after a visual switchover from the document to the screen.
5. Hand arresting mechanisms should be incorporated as shown in Fig.4.1.4.

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4. DESIGN APPROACH

4.2 Time motion analysis:

Time motion study was done basically to find out the part of the work activity that takes a longer time and which is the most problematic one. An entire study of about 50 minutes was done wherein time for each activity right from the entry to the exit was noted down in terms of a percentage time-scale as shown in Fig.4.2.1.

Conclusions:

Most of the time is taken by the subject to type down the sentence from the document to the monitor screen.

TIME-SCALE DIAGRAM:

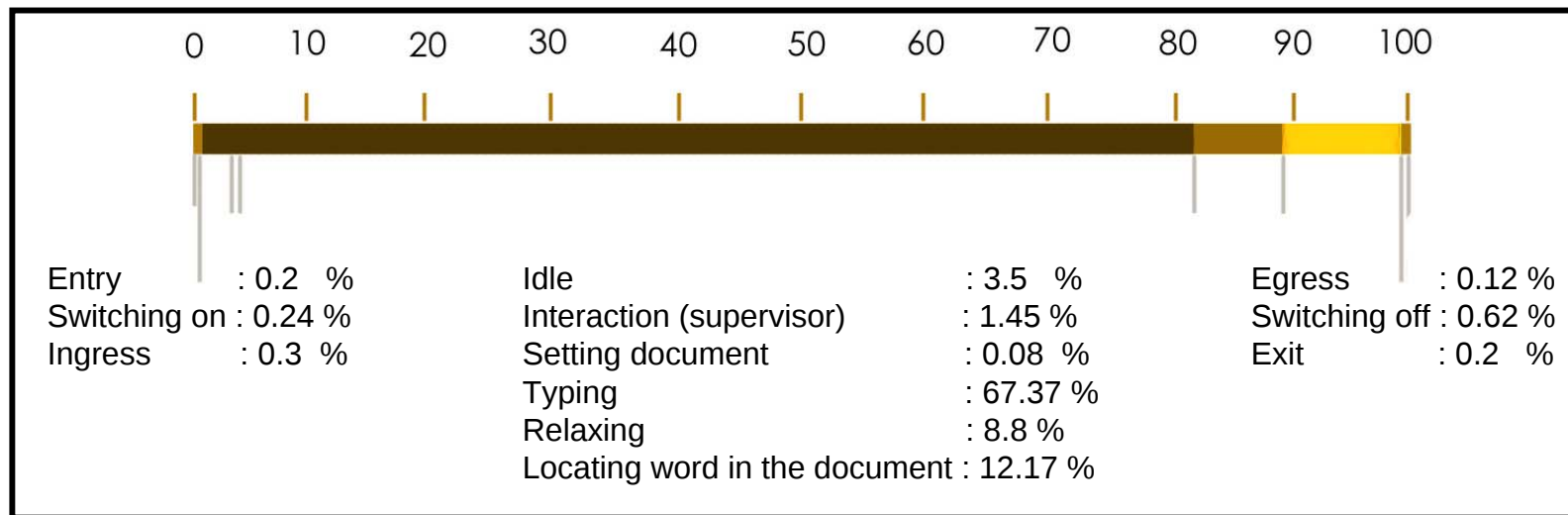


FIG. 4.2.1

we can and we will...

4. DESIGN APPROACH

4.3 Questionnaire:

The subjects were asked some general questions such as:

1. Pain in the body part before and after the job.
2. Height of the table and chair respectively.
3. Scope for height adjustment.

Also table height adjustments were done and castor chairs were used so that the subjects could realize where they face the problems.

Conclusions:

The subjects never do any adjustments on their own because of the difficulty in operating the mechanisms. Also a need for the armrest was insisted, as it would be easier for them to type the things.

5. PRODUCT BRIEF

1. Table design in detail with customized options for CP subjects.
2. Chair design along with the necessary accessories used by the CP subjects.
3. Methods of arresting their different body parts.
4. Concern for storage space.
5. Concern for wire harnessing along with proper location of the mains.
6. Design of monitor, keyboard and mouse and document holder adjusting mechanisms.
7. Special keyboard and mouse design.
8. Design of the dust covers for the monitor, CPU and the keyboard.

But considering the time limitations for the project, only the first six points will be dealt with in detail.

5. PRODUCT BRIEF

5.1 Assumptions:

1. The spastic subjects considered here are only five in number but the concept can always be extended to a larger group of people.
2. The spastic subjects using the computer are not that severely affected. Hence it can be assumed that adjustments such as chair height, table height, monitor level, keyboard and mouse table and document holder can be performed by them.
3. If the person has to be strapped then there can be an assistant who can do these things for the subjects as it becomes difficult for the subject himself to do so.
4. Awareness has to be created for the first time so that the subject can use the equipment easily and effectively.

6. CONCEPT GENERATION AND SKETCHES

1

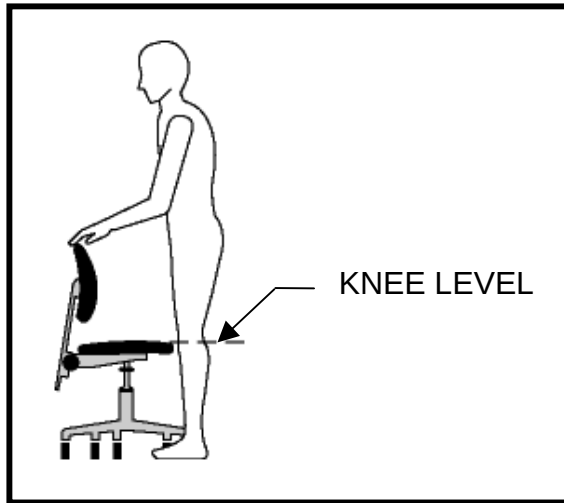


FIG. 6.1.1

2

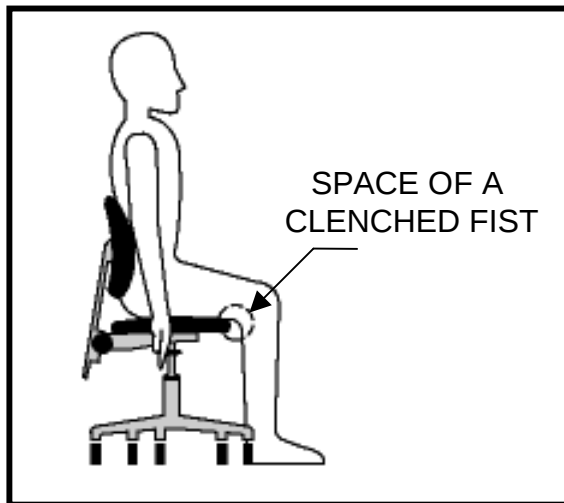


FIG. 6.1.2

Two main concepts were generated based on the product brief and the anthropometrics data recorded for each of the five subjects. Each concept was dealt with in detail including the type of material used and the mechanisms incorporated in these concepts.

Each problem such as the monitor, keyboard, document holder and wire harnessing were studied separately and the apt concepts of each were put together to generate two holistic concepts.

Before going into the details of these concepts a sequential step for the proper seating is explained ⁴. This will actually help to understand the two concepts explained later. The steps to be followed are:

6.1 General Awareness:

1. Stand in front of the chair. Adjust the height of the chair so that the seat is approximately at knee level as shown in Fig.6.1.1
2. Sit so that the space between the front edge of the chair and the lower part of the legs just fits a clenched fist as shown in Fig.6.1.2

we can and we will...

6. CONCEPT GENERATION AND SKETCHES

3

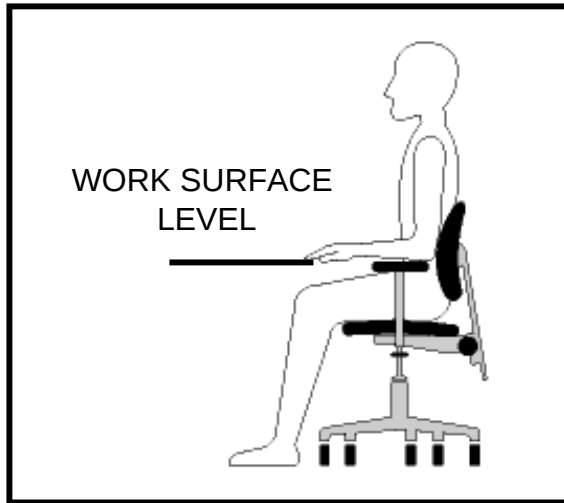


FIG. 6.1.3

3. The height of the work surface should be adjusted to the level of the elbow joint as shown in Fig.6.1.3.
4. For correct monitor location,
 - Body centerline and monitor centerline should coincide
 - The center of the screen should be at 15 degrees with respect to the horizontal eyelevel.
 - The distance can be approximately taken as one arm length.

The detail is as shown in Fig.6.1.4.

4

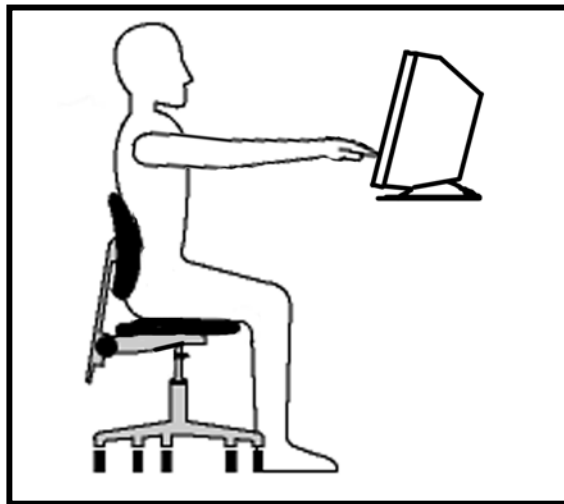


FIG. 6.1.4

we can and we will...

6. CONCEPT GENERATION AND SKETCHES

The concept sketches were made taking into consideration each problem separately.

6.2 Defining the fundamental zones:

The zones were identified on the basis of the anthropometrics data of the five subjects². Then a common range of zone was identified as shown in Fig.6.2.1.

ZONES OF REACH

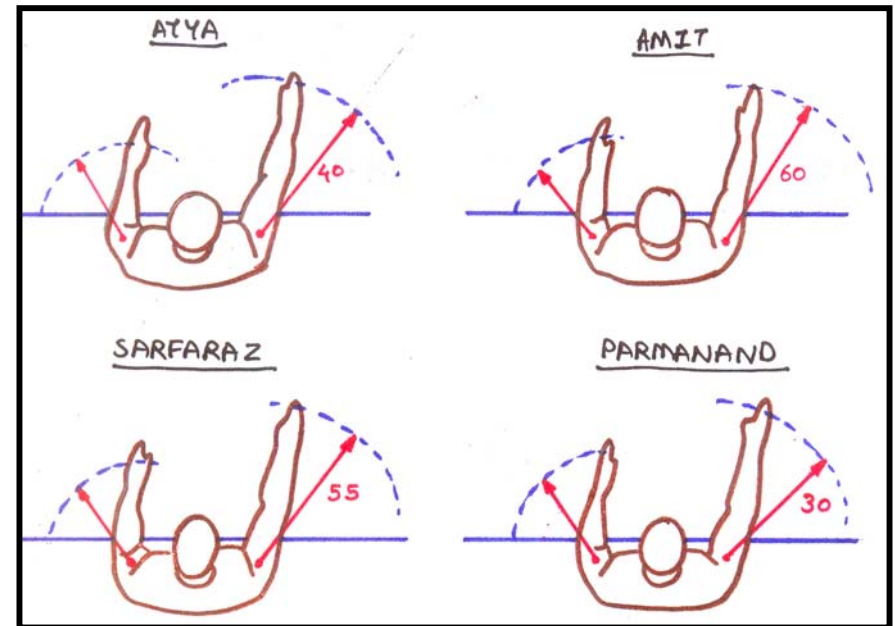
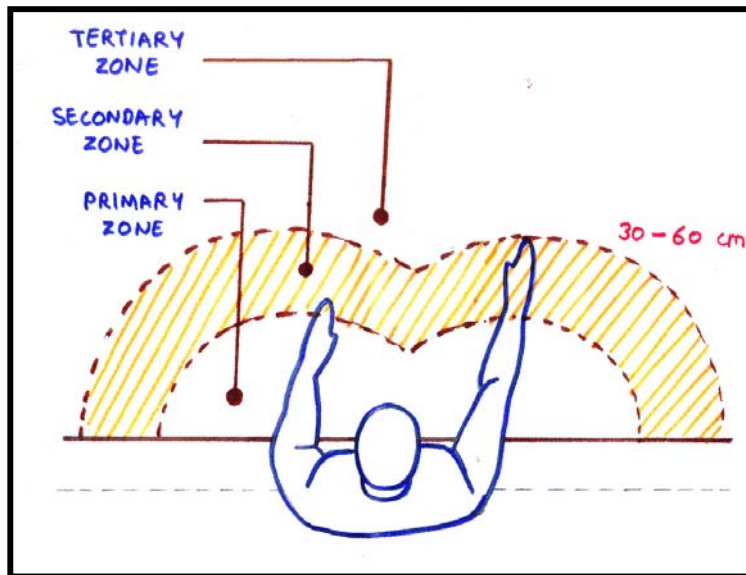


FIG. 6.2.1

we can and we will...

6. CONCEPT GENERATION AND SKETCHES

6.3 Defining the dimensions governing the adjustments:

The anthropometric data acquired from these five subjects were analyzed for the chair, table and keyboard table height adjustments.

It was observed that a body angle of 100 degrees was obtained while sitting is considered as the normal relaxed posture. Also at this posture the keyboard inclination was around 5 degrees.

Also for a specific kind of disability, i.e. left or right side affected, the keyboard and the mouse have to be shifted to the respective side, which is unaffected.

The data is specified in Table.6.3:

All dimensions are in cm

	POPLITEAL HEIGHT	ELBOW HEIGHT	EYE LEVEL HEIGHT	FOREARM LENGTH
SUBJECT				
ATYA	46	55	108	41
AMIT	45	61	115	46
SARFARAZ	45	56.5	108	40
PARMANAND	45.5	55.5	118	43
GARGI	36.8	47.3	92.3	38

TABLE. 6.3

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6. CONCEPT GENERATION AND SKETCHES

6.4 Design of the monitor stand:

The design of the monitor stand takes into consideration two issues, whether the stand is to be mounted on the wall or on the table itself. The design shown in Fig.6.4 is an existing design which is commonly available in the market.

This design consists of two arms which has a spring inside to counteract the weight of the computer screen which will be fixed to it. Also it has three degrees of freedom which makes it easier to get adjusted.

The best part of this stand is that it requires only the touch of the fingertip to adjust the screen in the vertical as well as in the horizontal direction.

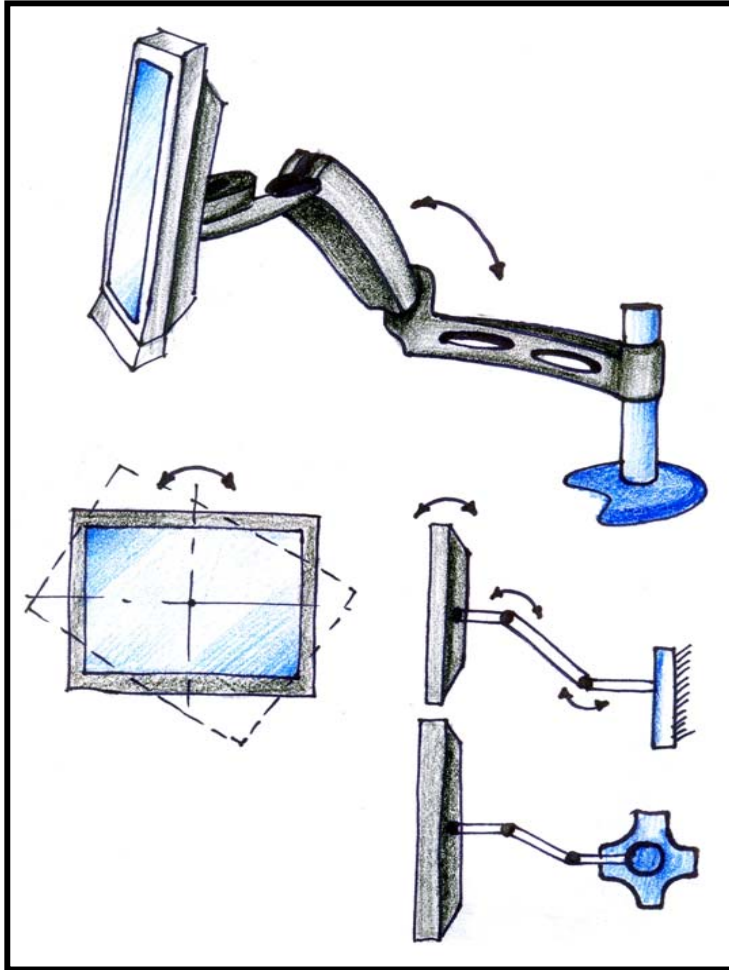


FIG. 6.4

6. CONCEPT GENERATION AND SKETCHES

6.5 Design of the document holder:

Since there is an issue with the document placement, a document holder has to be designed in such a way that it can be easily used by the subject.

There were actually three concepts which were put forward.

CONCEPT 1:

This concept shown in Fig.6.5.1 involves the use of a typewriter like mechanism which uses a rubber roller to scroll the paper up and down just as it is done in a typewriter. For loading the document in the holder the roller opens from one end, the other end being hinged. The paper is then loaded in that holder and the roller is then closed.

The advantage of this mechanism is that the roller itself acts as a guide to locate the sentence.

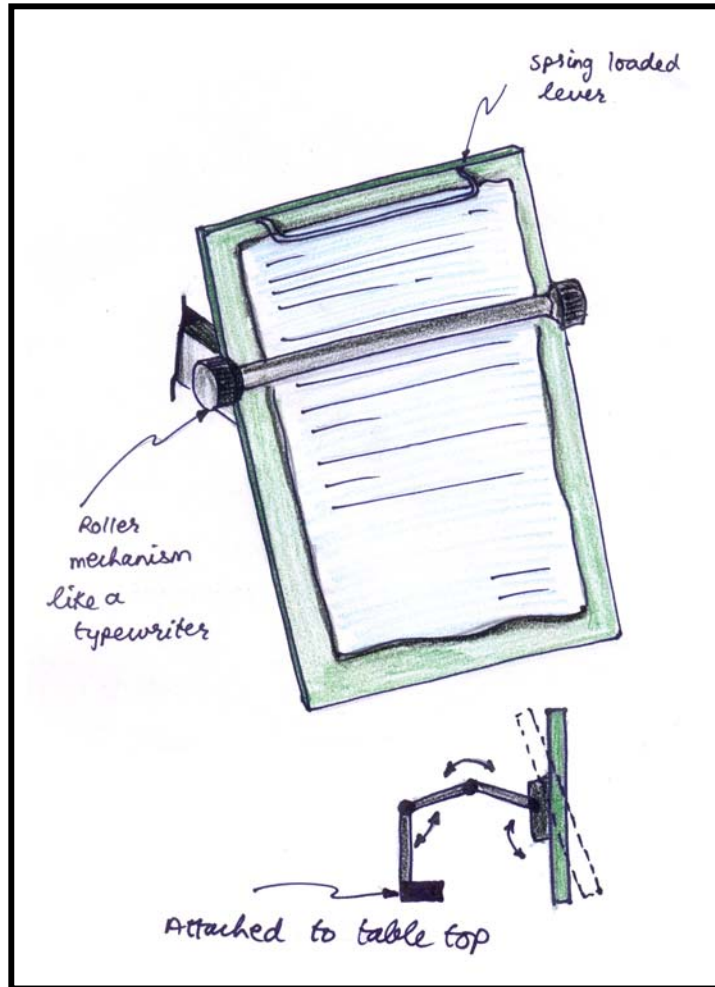


FIG. 6.5.1

6. CONCEPT GENERATION AND SKETCHES

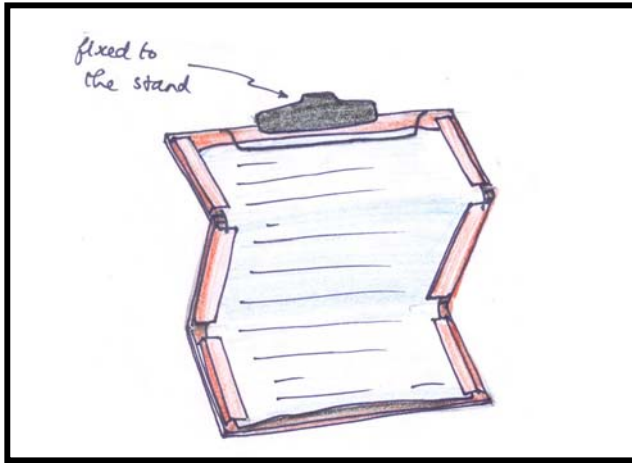


FIG. 6.5.2

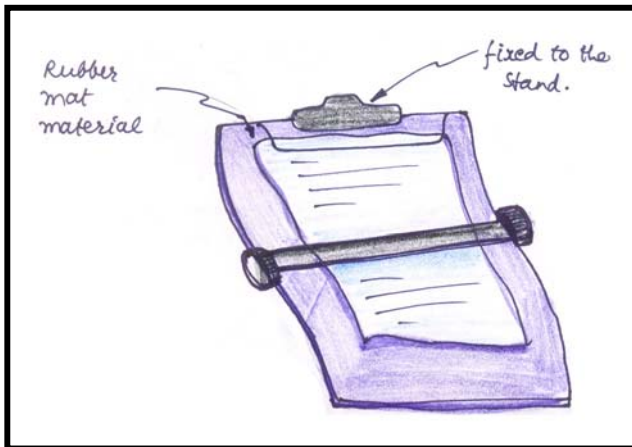


FIG. 6.5.3

CONCEPT 2:

This concept shown in Fig.6.5.2 uses the collapsible technique so that the same document holder can be used when placed at the side or at the center in front of the monitor.

The main disadvantage with this mechanism is that the thing when kept at the center collapses making an angle which is not good enough to read the matter.

CONCEPT 3:

In the concept shown in Fig.6.5.3 the document holder was made of a flex type material, which can be very well placed at the sides as well as in the center in front of the screen.

But this concept also had the same problem that this when placed at the center flexes in such a manner that it becomes difficult to read the matter.

6. CONCEPT GENERATION AND SKETCHES

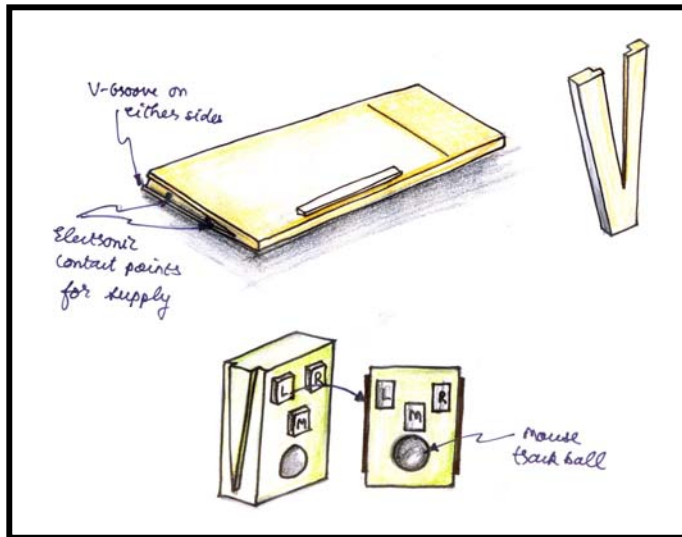


FIG. 6.6.1

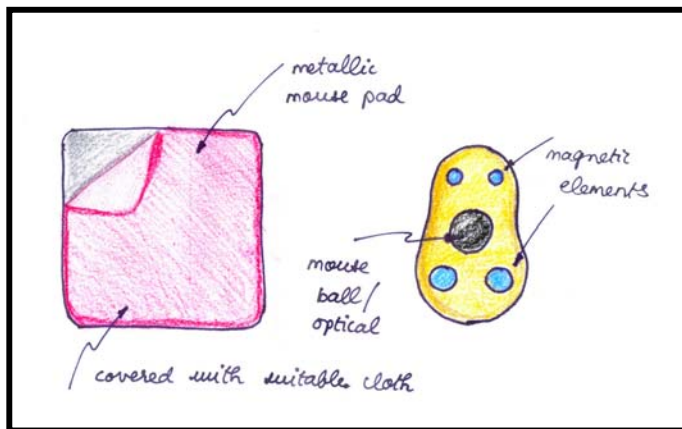


FIG. 6.6.2

6.6 Design of keyboard and mouse:

Since the spastic subjects had problems operating the mouse, there were a few concepts which were generated that may prove out to be beneficial for the subjects to use.

CONCEPT 1: Keyboard integrated mouse:

This concept shown in Fig.6.6.1 involves the use of a special mouse which can be slid on either sides of the keyboard. These are wireless and the common batteries are there in the keyboard itself. The mouse have electrical contact points on either sides from where it gets the supply.

CONCEPT 2: Magnetic mouse:

The concept shown in Fig.6.6.2 is a slight modification in the existing design of the mouse. Instead of a normal mouse pad it has a steel plate inside the mouse pad with an optical mouse incorporated with small magnets. The magnetic force will be just sufficient enough for the mouse to stay onto the table, and will not affect the muscle force of the CP person.

The main advantage of using this kind of a mechanism is that the mouse will not fall even if the keyboard table is inclined at a certain position.

we can and we will...

6. CONCEPT GENERATION AND SKETCHES

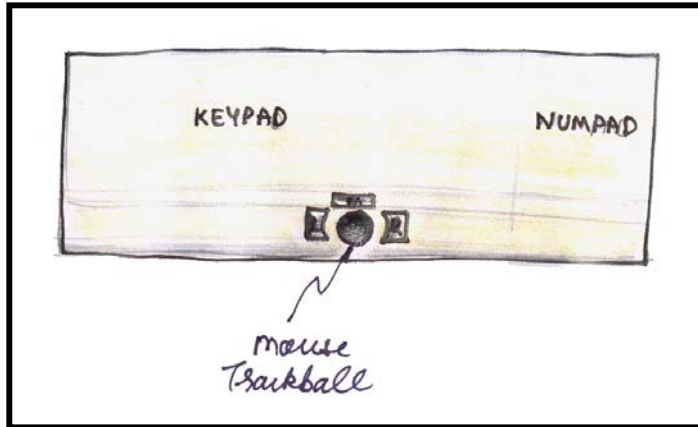


FIG. 6.6.3

CONCEPT 3: Keyboard with mouse at the center:

This concept has a mouse ball or a track ball at the lower central portion of the keyboard as shown in Fig.6.6.3.

The main disadvantage in this concept was the accidental motion of the trackball while typing hence making it very difficult to operate.

6. CONCEPT GENERATION AND SKETCHES

6.7 Arresting body parts of the subjects:

There are some kind of muscle tones which can be reduced with proper arresting of the related body parts. Some of these are shown in Fig.6.7.1.³

Even though one of the hands is affected this hand can be used sometimes for some dual operations such as SHIFT, CTRL and ALT keys in combination with some other keys. So the hands cannot be strapped completely but they can be arrested by making the subjects to grip their hand somewhere so that when they feel the need of using it they can use it.

To make the arresting easier there were two options wherein he can hold his hand somewhere on the table in a groove with a grip inside it or to hold it at the edge of the table.

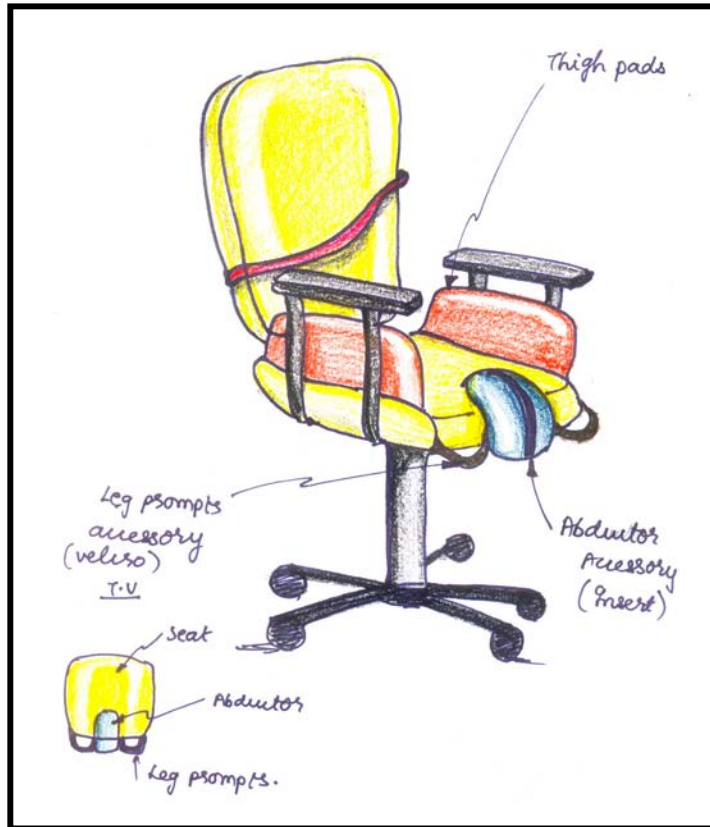


FIG. 6.7.1

Headrest Accessory 	Flat or contoured head support that adjusts vertically	Provides high level of support for client with poor head control.
--	--	---

6. CONCEPT GENERATION AND SKETCHES

Headrest Accessory 	Flat or contoured head support that adjusts vertically	Provides high level of support for client with poor head control.
Trunk Support Accessory 	Safety attachment for trunk	Provides added trunk support for clients who do not have upper torso control. Assists with good body alignment. Important for proper alignment of the spine, which helps prevent scoliosis.
Abductor Accessory 	Insert that separates knees, is adjustable forward and backward, and is removable	Helps to control spastic muscles that cause legs to scissor. Necessary for good body alignment and tone control. Important for proper joint alignment, which helps prevent deformities.
Leg Prompts Accessory 	Straps that pass around the front of each leg	Necessary to maintain body alignment in sitting by supporting each leg individually. For clients with limited muscle control. Important for proper joint alignment, which helps prevent deformities.

we can and we will...

6. CONCEPT GENERATION AND SKETCHES

Tray Accessory 	Tray that attaches to the seating system for work surface with raised edges	Necessary for placement of learning tools for communication/academic learning, hand positioning and motivational materials to promote interest for longer periods of time in safe sitting position. Can help with body alignment.
Handhold Bar(s) Accessory 	Attaches to tray for hand positioning	Necessary for clients with spastic muscle tone. Controls spasticity of arms/hands by allowing proper positioning. Important for proper joint alignment, which helps prevent deformities.

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6. CONCEPT GENERATION AND SKETCHES

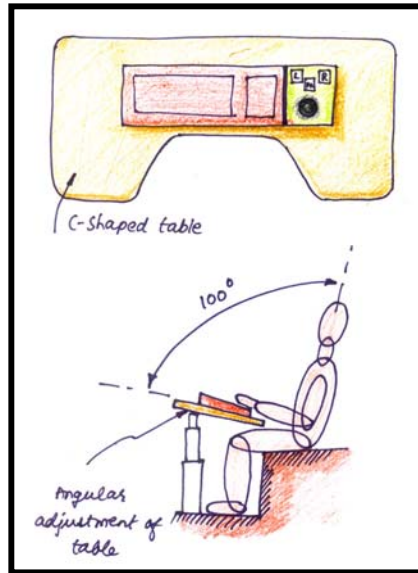


FIG. 6.8.1

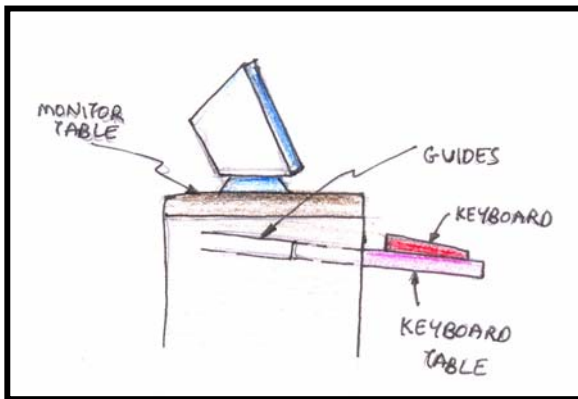


FIG. 6.8.2

6.8 Design of table:

The table design involved different considerations such as whether the peripherals are to be placed on the top of the table or below the table.

CONCEPT 1:

This design involved a 'C' type contour which helped the subject to automatically sit in a proper way. Also a provision should be made for the subject to arrest their hands if they require to. The concept is as shown in Fig. 6.8.1.

CONCEPT 2:

The design shown in Fig. 6.8.2 involves a split kind of concept with a monitor table and a keyboard table that can be easily slid inside and outside with the help of the guides located on the inside surface of the monitor table.

6. CONCEPT GENERATION AND SKETCHES

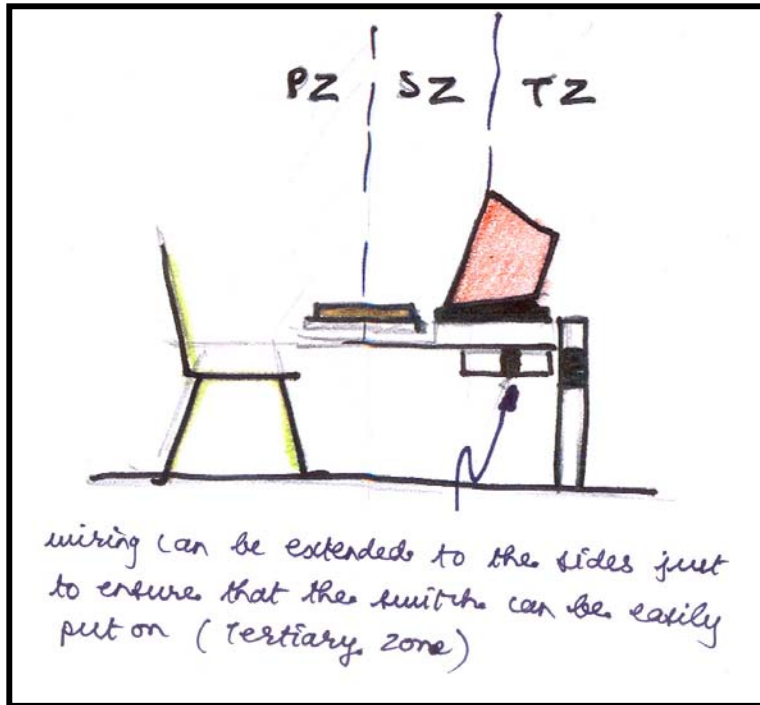


FIG. 6.9

6.9 Wire harnessing:

Wire harnessing is also taken into consideration wherein the individual sockets for CPU and monitor are being replaced by a single spike guard. This spike guard is placed at the left side rear end of the table that is in the tertiary zone as shown in Fig.6.9.

It is placed in the tertiary zone mainly because it is least used and also to avoid the accidental switching OFF of the computer workstation.

6. CONCEPT GENERATION AND SKETCHES

6.10 Design of chair:

The design of chair basically involves customizing the chair to the needs of the subjects there. It basically involves the use of a mechanism that deals with the height adjustment and the locking mechanism of the chair.

Height adjustment:

The mechanism used for height adjustment is a simple gas assisted caliper type mechanism. When the knob under the armrest is pressed the caliper is released and the height can be adjusted as shown in Fig.6.10. As soon as the knob is released the caliper locks the chair at a particular height.

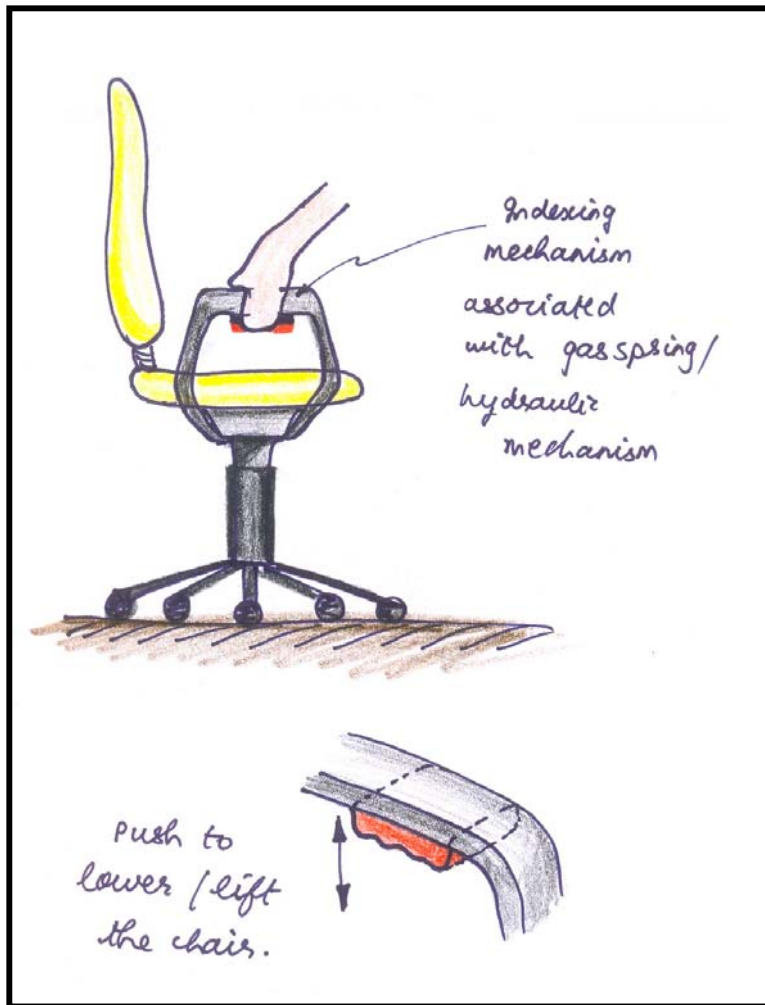


FIG. 6.10.

6. CONCEPT GENERATION AND SKETCHES

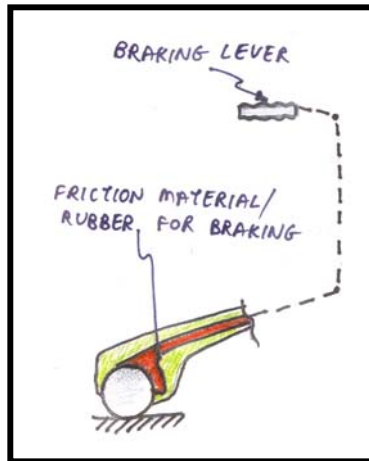


FIG. 6.11.1

6.11 Chair locking mechanisms:

CONCEPT 1:

When the braking lever is pressed the brakes on the castor wheels get actuated and the chair remains in that particular position until it is released. The concept is as shown in Fig.6.11..

CONCEPT 2:

This concept uses a foot operated cam mechanism which can be actuated by sliding the foot over the castor wheel arms. The forward sliding of the knob will lock the wheels whereas the reverse will unlock the same. The concept is as shown in Fig.6.11.2.



FIG. 6.11.2

CONCEPT 3:

This uses the 'press and lock' kind of a mechanism operated by foot in which the press of the button placed over the castor arms locks the castor wheels to lock the motion and pressing it again will release the locks and the chair can move again. The concept is as shown in Fig.6.11.3.

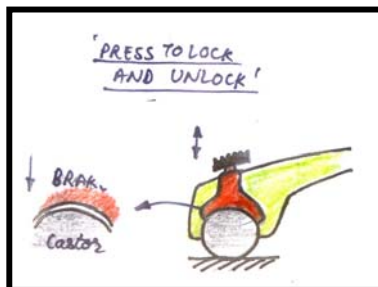
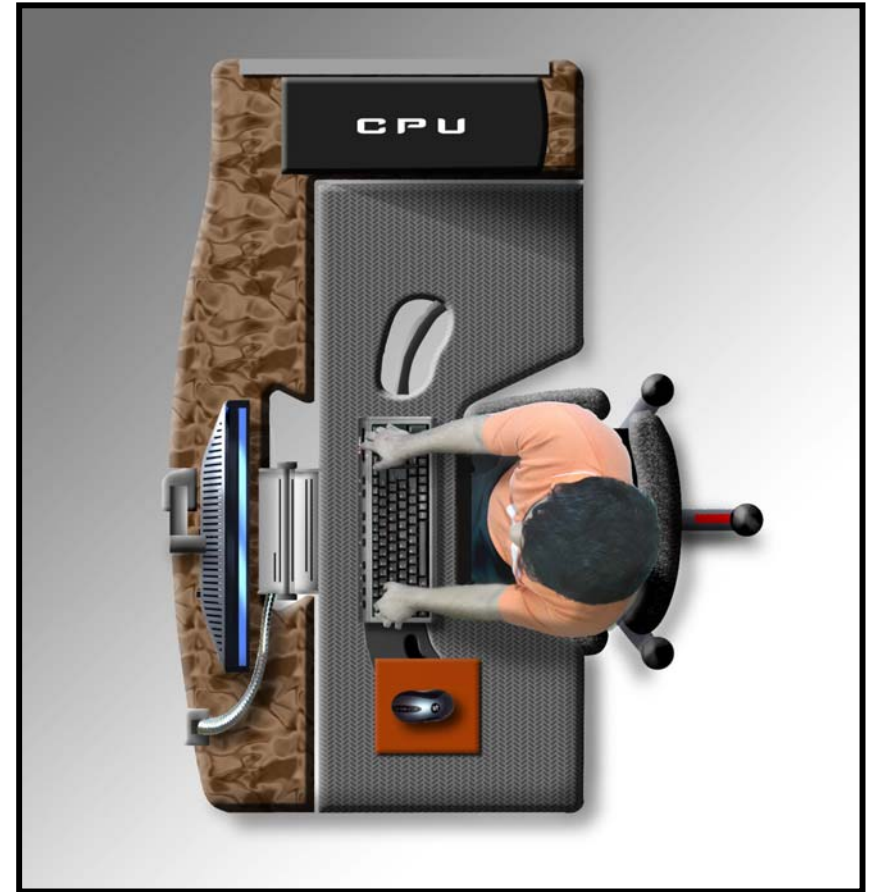


FIG. 6.11.3

we can and we will...

7. CONCEPT LAYOUT SKETCHES

7.1 CONCEPT 1: 'C' SHAPED TABLE:



we can and we will...

7. CONCEPT LAYOUT SKETCHES



FIG. 7.1.1

7.1 CONCEPT 1: 'C' SHAPED TABLE:

The first concept is basically the integration of different concepts such as the 'C' concept table, the monitor adjusting mechanism, the keyboard adjusting mechanism, the document holder concept and the chair concept.

The concept details are as follows:

Table:

The table shown in fig 7.1.1 has a 'C' shaped contour and is asymmetrical with the right side of the table being specifically used for placing the CPU on top of the table. The table is basically divided into two, the monitor half and the keyboard and mouse half. The monitor stand is fixed on the extreme edge of the table. The table height can be adjusted with an automated telescopic mechanism. The wire harnessing is also taken care by concealing the wire at the rear of the table and connected to a spike guard.

7. CONCEPT LAYOUT SKETCHES



FIG. 7.1.2

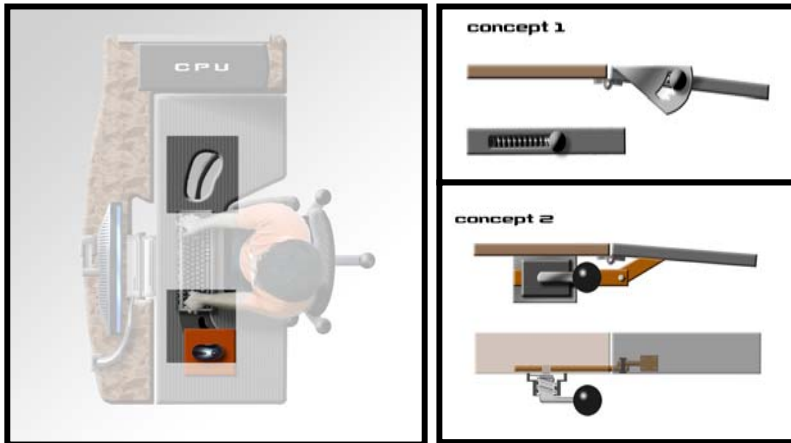


FIG. 7.1.3

FIG. 7.1.4

Keyboard table:

The keyboard part of the table shown in Fig.7.1.2 has a provision for adjusting it to a particular angle with the help of a mechanism that can be easily operated by the subjects themselves. The keyboard table also has a provision for arresting the affected arm of the subject which if not in use can be covered with a sliding cover as shown in Fig.7.1.3.

MECHANISM DETAILS:

CONCEPT 1:

The Concept 1 shown in Fig.7.1.4 involves an indexing type of mechanism. Grooves are cut on the arc in which fits a knob. This knob is operated by a compression spring. The forward motion of the knob releases it from the groove whereas the reverse motion locks a particular position.

CONCEPT 2:

This mechanism involves the concept of a multi start thread which in turn advances a pin attached to this screw. The keyboard table linkages are provided with holes into which the pin fits and the locking is done as shown in Concept 2 in Fig.7.1.4.

7. CONCEPT LAYOUT SKETCHES



FIG. 7.1.5

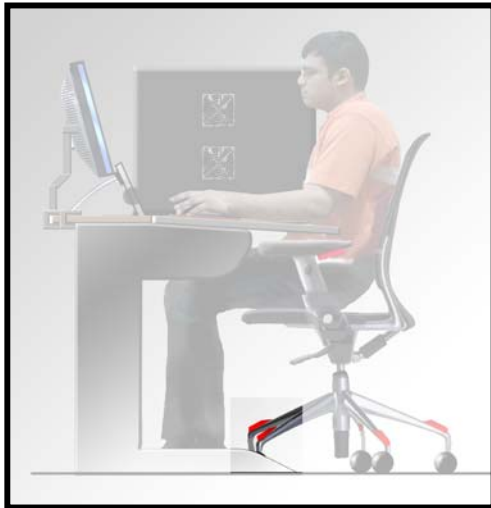


FIG. 7.1.6

Document holder:

The document holder as shown in Fig.7.1.5 can be fixed at a particular position on the monitor table with the help of a gooseneck and then it can be adjusted accordingly to place it besides the monitor or in front of the monitor. To accommodate the document holder the table center has a slot through which it passes and only the part of the document required to be read is kept visible. The document holder uses the typewriter concept for scrolling through the lines.

Chair:

The chair used has a height adjusting mechanism, which is placed right below the armrest. Locking the front two castors operated by leg can lock the chair in a particular position. The Concept is as shown in Fig.7.1.6.

MERITS:

1. Due to the 'C' shaped table the subject is always compelled to sit in the right way.
2. The table is designed in a way that when he sits in the relaxed posture he can adjust the keyboard and the mouse angle accordingly.

7. CONCEPT LAYOUT SKETCHES

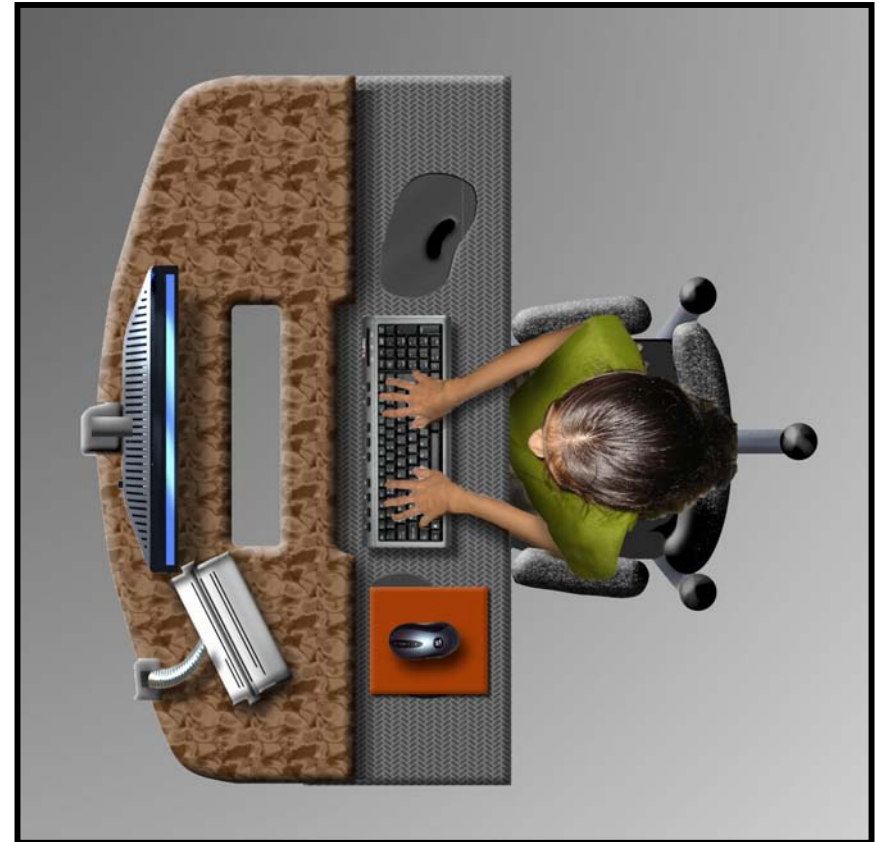
3. The keyboard and mouse are placed in the primary zone whereas the document holder is placed in the secondary zone.
4. The armrest of the chair is collapsible which helps the subject to slide the chair easily under the table.
5. The height adjustment in chair is provided on both sides.
6. The mains are located on one side of the table and placed in the tertiary zone which avoids accidental switching 'OFF' of the computer workstation.
7. The automated mechanism is easy to operate.
8. The monitor adjustment can be done very easily with just a touch of the fingertip.

DEMERITS:

1. Although the castor wheel chair can be pulled into the cavity easily, there is a possibility that the subject might get hurt due to involuntary motion of his hand making the chair to hit the C-edge.
2. The main disadvantage with the chair is that the locking has to be provided on all the five castors, so it becomes difficult for the person to judge which castor wheel was locked.
3. The mechanism involved here for keyboard adjustment is located at one of the sides, so becomes difficult for different kind of spastic subject to use it.

7. CONCEPT LAYOUT SKETCHES

7.2 CONCEPT 2: SPLIT TABLE TYPE CONCEPT:



we can and we will...

7. CONCEPT LAYOUT SKETCHES



FIG. 7.2.1

7.2 CONCEPT 2: SPLIT TABLE TYPE CONCEPT:

The second concept basically is a split type concept that has a monitor table and a keyboard table which slides into the monitor table.

The concept details are as follows:

Table:

The table is divided into two parts mainly the monitor table and the keyboard table. The monitor is fixed at the extreme edge of the table. The table has a slot in the center to accommodate the document holder when it is to be placed at the center. The table can be operated automatically with a rack and pinion mechanism. The monitor table is as shown in Fig.7.2.1.

7. CONCEPT LAYOUT SKETCHES



FIG. 7.2.2

Keyboard table:

The keyboard table shown in Fig.7.2.2 is at a fixed angle of 5 degrees which can be moved in or out with the help of a self-locking mechanism. It is also customized for arresting the affected arms of the subject which if not required can be closed.

MECHANISM DETAILS:

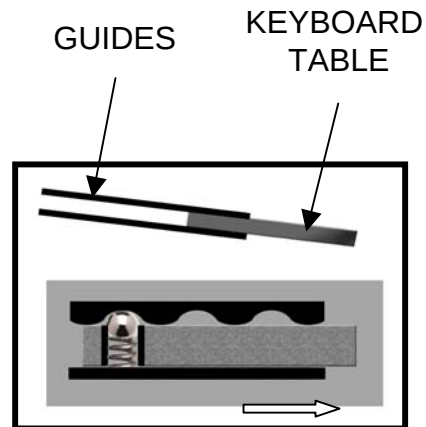


FIG. 7.2.3

The mechanism shown in Fig.7.2.3 involves the use of a metal ball placed on a compression spring. When the keyboard table is pulled out the spring compresses and the ball moves into the next groove giving in turn a positive locking.

we can and we will...

7. CONCEPT LAYOUT SKETCHES



FIG. 7.2.4

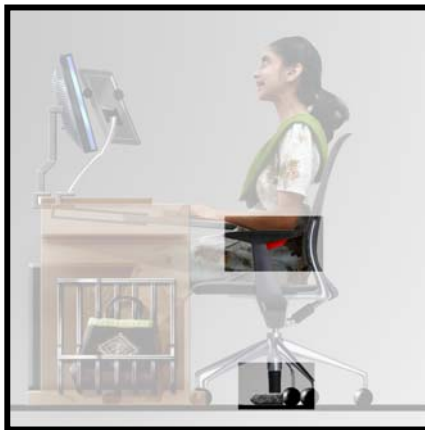


FIG. 7.2.5

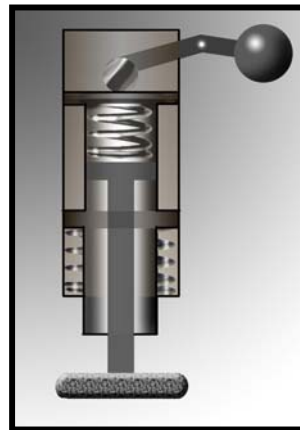


FIG. 7.2.6

Document holder:

The document holder shown in Fig.7.2.4 can be fixed at a particular position on the monitor table with the help of a gooseneck and then it can be adjusted accordingly to place it besides the monitor or in front of the monitor. To accommodate the document holder the table center has a slot through which it passes and only the part of the document required to be read is kept visible. The document holder uses the typewriter concept for scrolling through the lines.

Chair:

The chair has the height adjusting mechanism shown in Fig.7.2.5 placed below the armrest. It can also be locked at a particular position with the help of a rubber pad mechanism operated by hand as shown in Fig.7.2.6. The rubber pad exerts sufficient pressure on the floor so that the chair becomes stationary.

MERITS:

1. There is nothing like 'C' shape here so the subject will not get hurt if he pulls the castor chair towards his table.
2. The table is more or less symmetrical with the spaces used on either sides for storage and CPU respectively.

7. CONCEPT LAYOUT SKETCHES

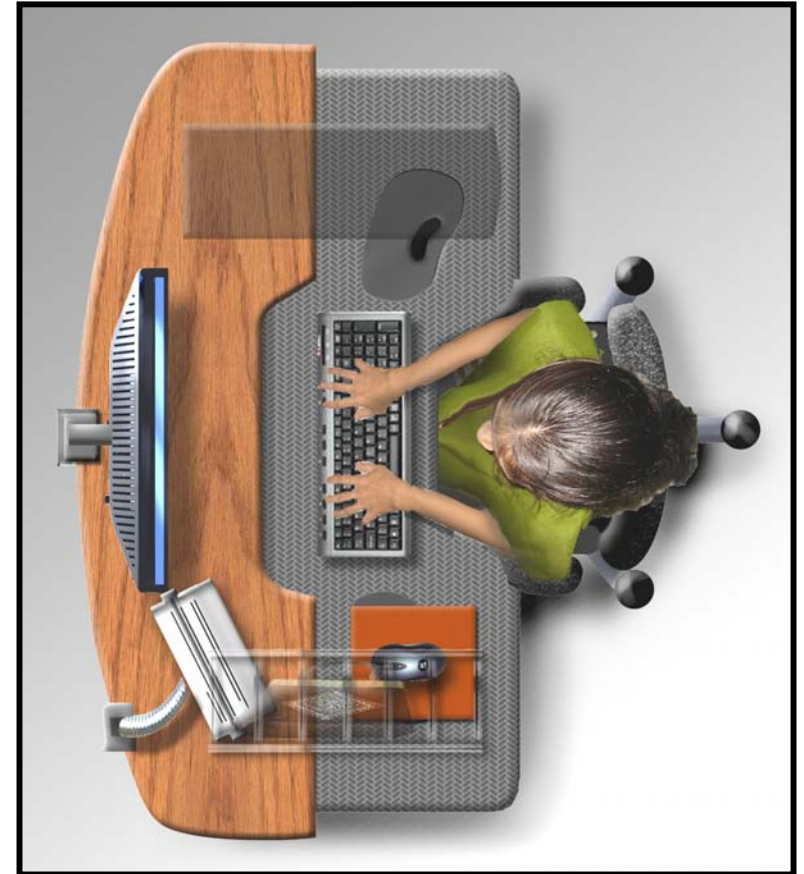
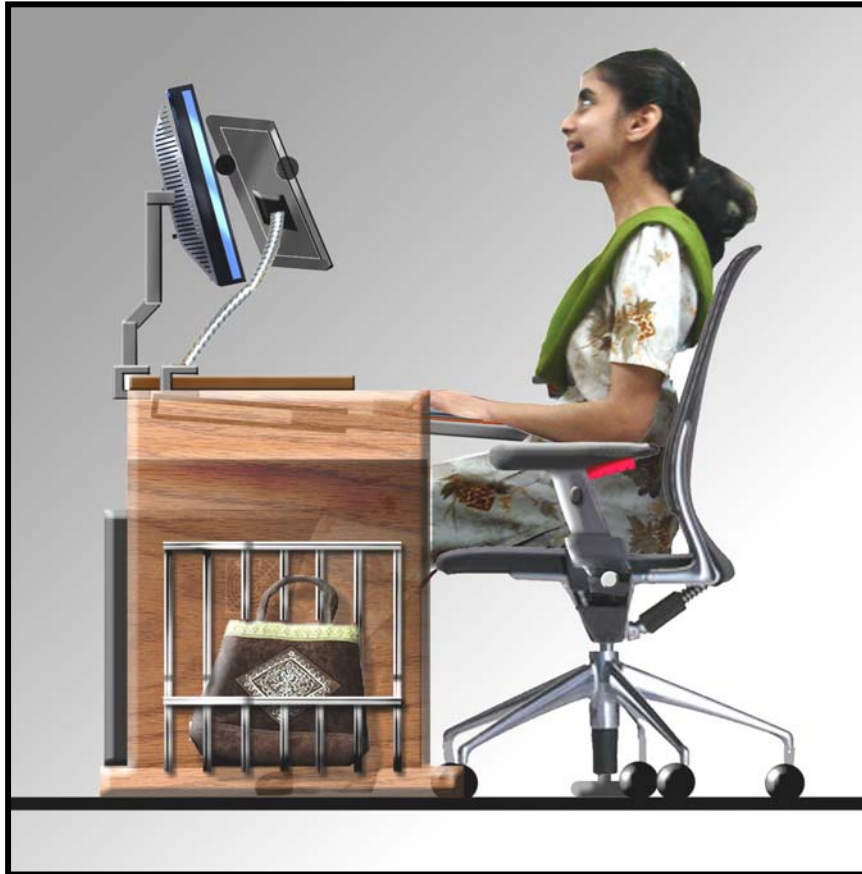
3. Monitor and document holder can be adjusted effectively.
4. Uses an automatic telescopic mechanism for table height.

DEMERITS:

1. No automatic correct positioning of the subject.
2. The keyboard angle here is kept as 5 degrees by default.
3. The chair locking is done by a central vertical arm with a pad at the base. This may cause the chair to pivot and overturn if the subject gives a sudden jerk to the chair.
4. CPU is placed at the bottom so the person has to bend to switch it 'ON'.
5. The chair armrest may prove out to be spaced apart than their normal armrest position, so the subject arms might be floating in air for the time they are typing.

8. FINAL CONCEPT LAYOUT

FINAL CONCEPT: 'C' TYPE TABLE WITH SLIDING MECHANISM



we can and we will...

8. FINAL CONCEPT LAYOUT



FIG. 8.1

'C' TYPE TABLE WITH SLIDING MECHANISM:

The final concept was made based on the advantages of both the previous concepts that is the 'C' type and the split type concepts.

The concept details are as follows:

Table:

The table is divided into two parts mainly the monitor table and the keyboard table. The monitor is fixed at the extreme edge of the table. The table has a 'C' contour in the center to accommodate the document holder when it is to be placed at the center. The table can be operated automatically with a rack and pinion mechanism. The monitor table is as shown in Fig.8.1.

8. FINAL CONCEPT LAYOUT

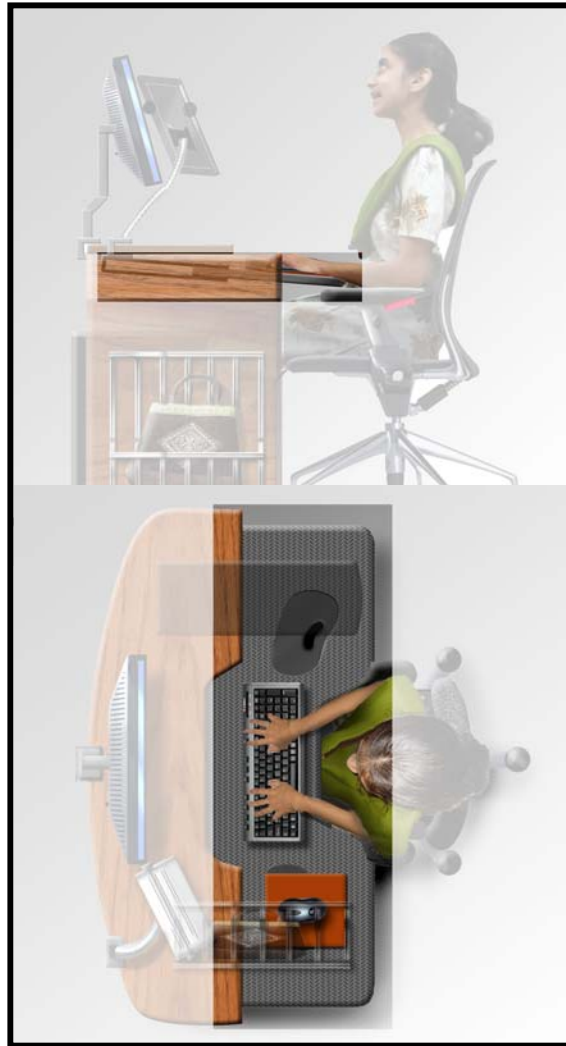


FIG. 8.2

Keyboard table:

The keyboard table shown in Fig.8.2 has a 'C' contour which helps the subject to sit in a correct posture. It is at a fixed angle of 5 degrees which can be slid in or out with the help of a self-locking mechanism. It is also customized for arresting the affected arms of the subject which if not required can be covered with a lid.

MECHANISM DETAILS:

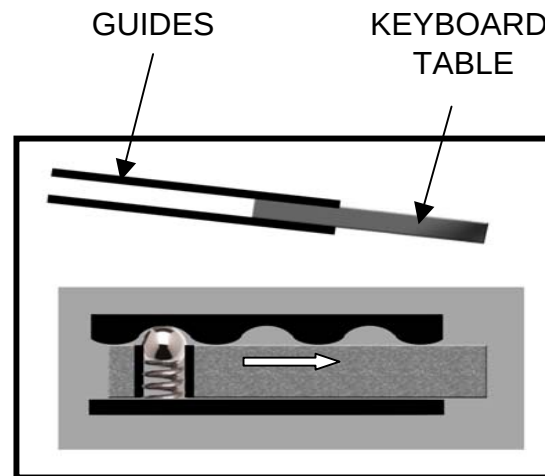


FIG. 8.3

The mechanism shown in Fig.8.3 is the same as explained in Concept 2 which uses a ball locking mechanism for the sliding keyboard table to remain in position.

we can and we will...

8. FINAL CONCEPT LAYOUT



FIG. 8.4

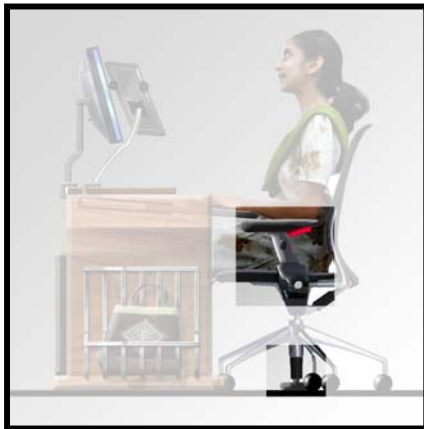


FIG. 8.5

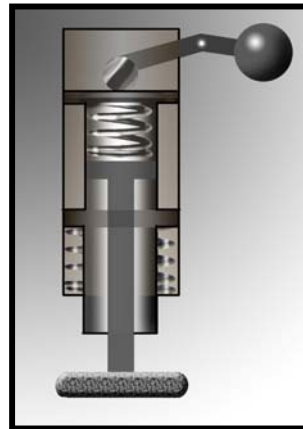


FIG. 8.6

Document holder:

The document holder shown in Fig.8.4 can be fixed at a particular position on the monitor table with the help of a gooseneck and then it can be adjusted accordingly to place it besides the monitor or in front of the monitor. To accommodate the document holder the table center has a 'C' shaped contour. The document holder concept used here is the typewriter concept which is efficient for easy scrolling through the lines.

Chair:

The chair concept for height adjustment and locking mechanism used is the same as Concept 2 and are shown in Fig.8.5 and Fig.8.6 respectively.

MERITS:

1. Due to the 'C' shaped table the subject is always compelled to sit in the right way.
2. The keyboard and mouse are placed in the primary zone whereas the document holder is placed in the secondary zone.
3. The armrest of the chair is collapsible which helps the subject to slide the chair easily under the table.
4. The height adjustment in chair is provided on both sides.

we can and we will...

8. FINAL CONCEPT LAYOUT

MERITS:

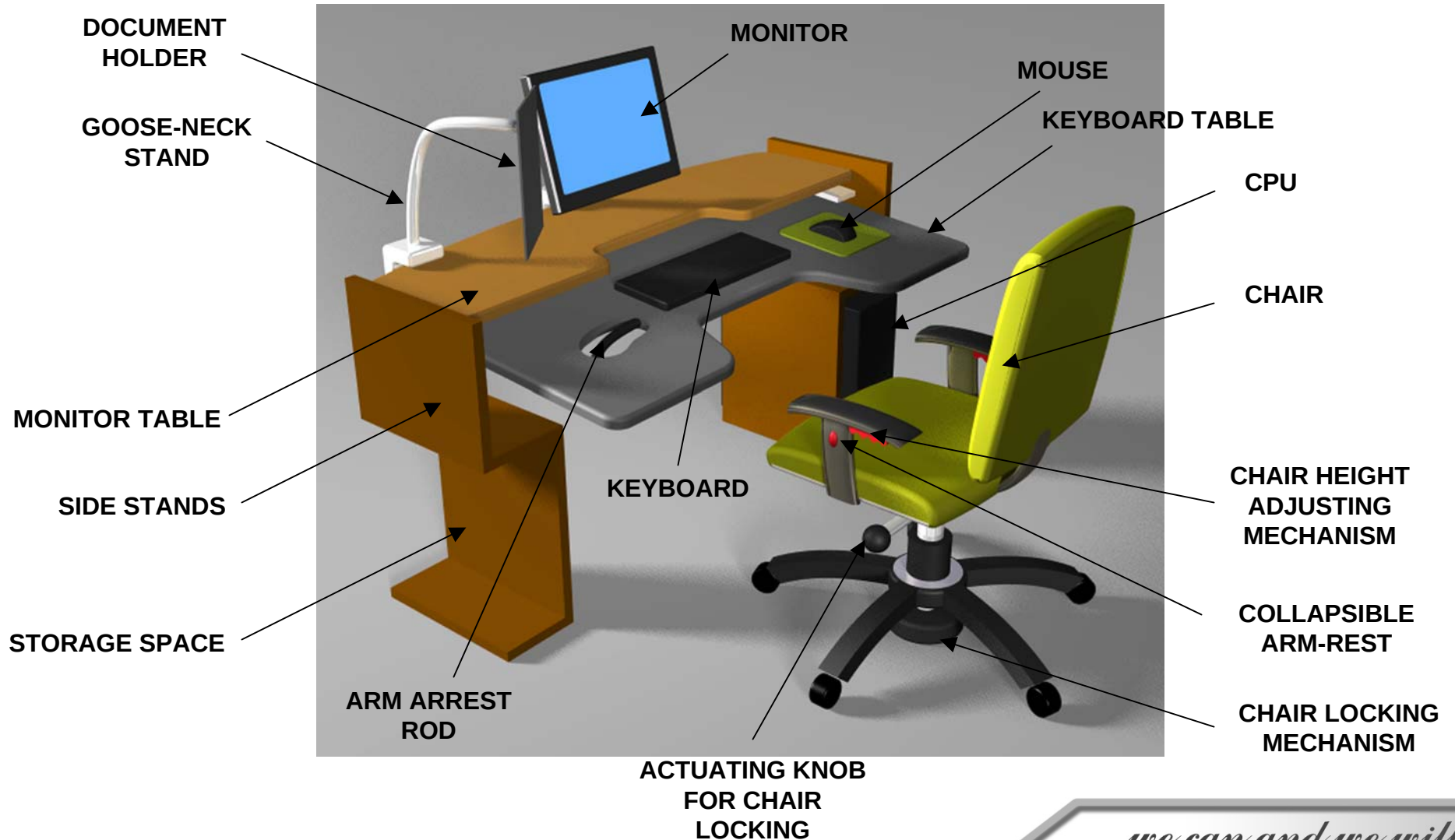
5. The mains are located on one side of the table and placed in the tertiary zone which avoids accidental switching 'OFF' of the computer workstation.
6. The automated mechanism is easy to operate.
7. The monitor adjustment can be done very easily with just a touch of the fingertip.
8. The entire unit is rigid and does not involve the use of mechanisms that are difficult to operate, hence making it simple and better for use by the CP persons.
9. The table is more or less symmetrical with the spaces used on either sides for storage and CPU respectively.

DEMERITS:

1. The main disadvantage of this concept is that the keyboard angle is kept constant as 5 degrees by taking the consideration of their seating posture.
2. The chair locking is done by a central vertical arm with a pad at the base. This may cause the chair to pivot and overturn if the subject gives a sudden jerk to the chair.

we can and we will...

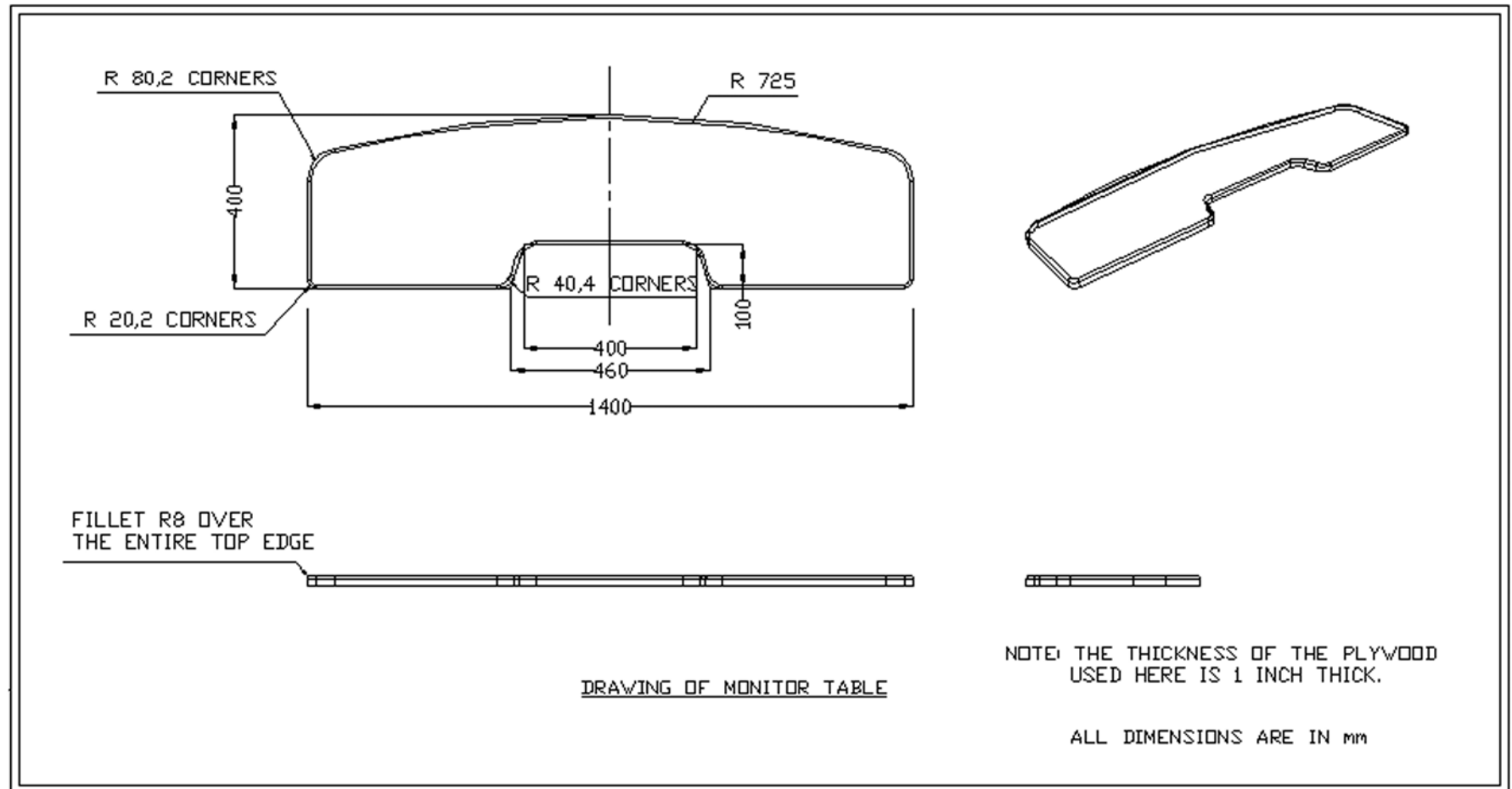
9. FINAL CONCEPT LAYOUT RENDERING



we can and we will...

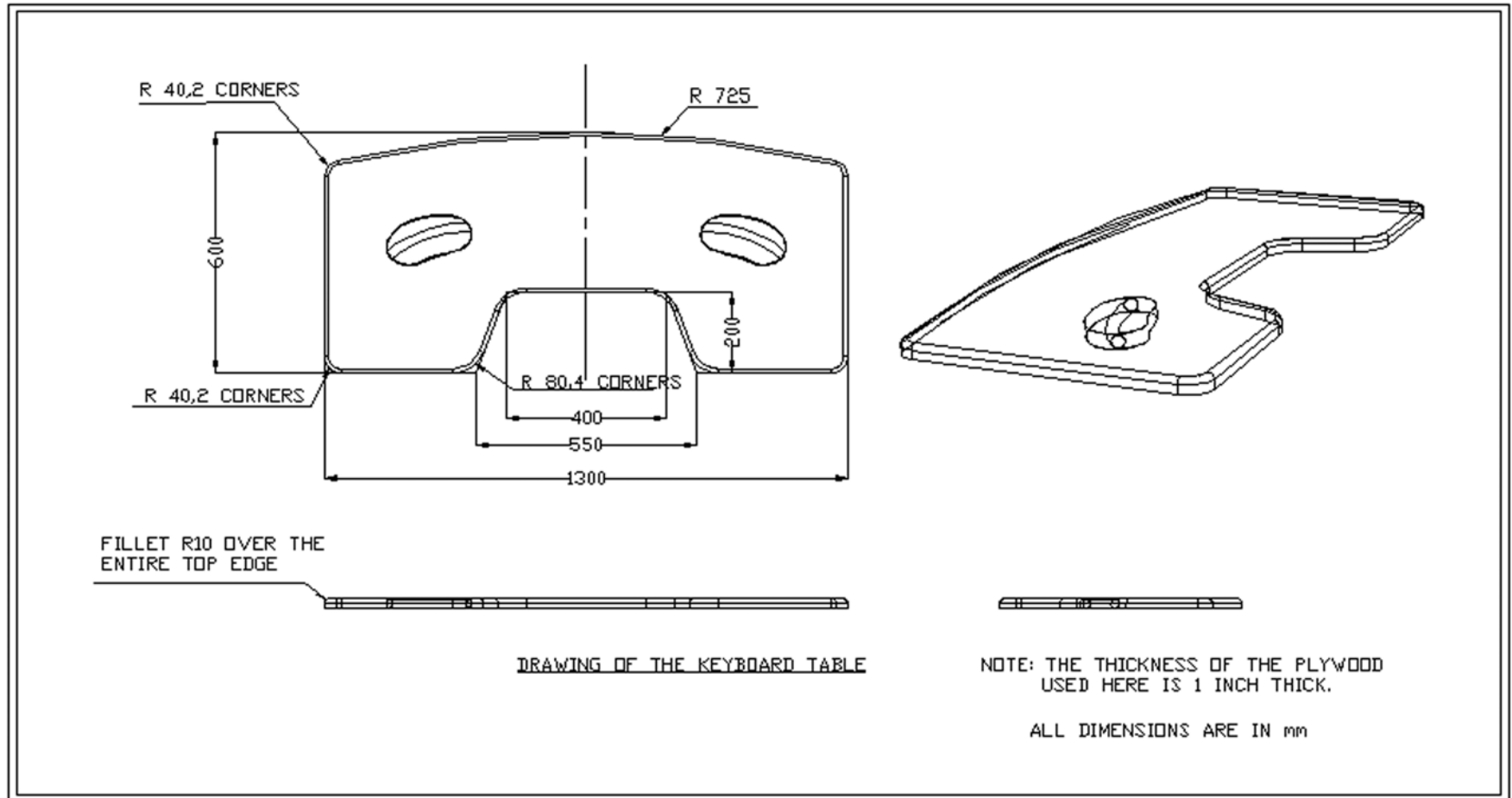
10. FINAL CONCEPT DRAWINGS

MONITOR TABLE:



10. FINAL CONCEPT DRAWINGS

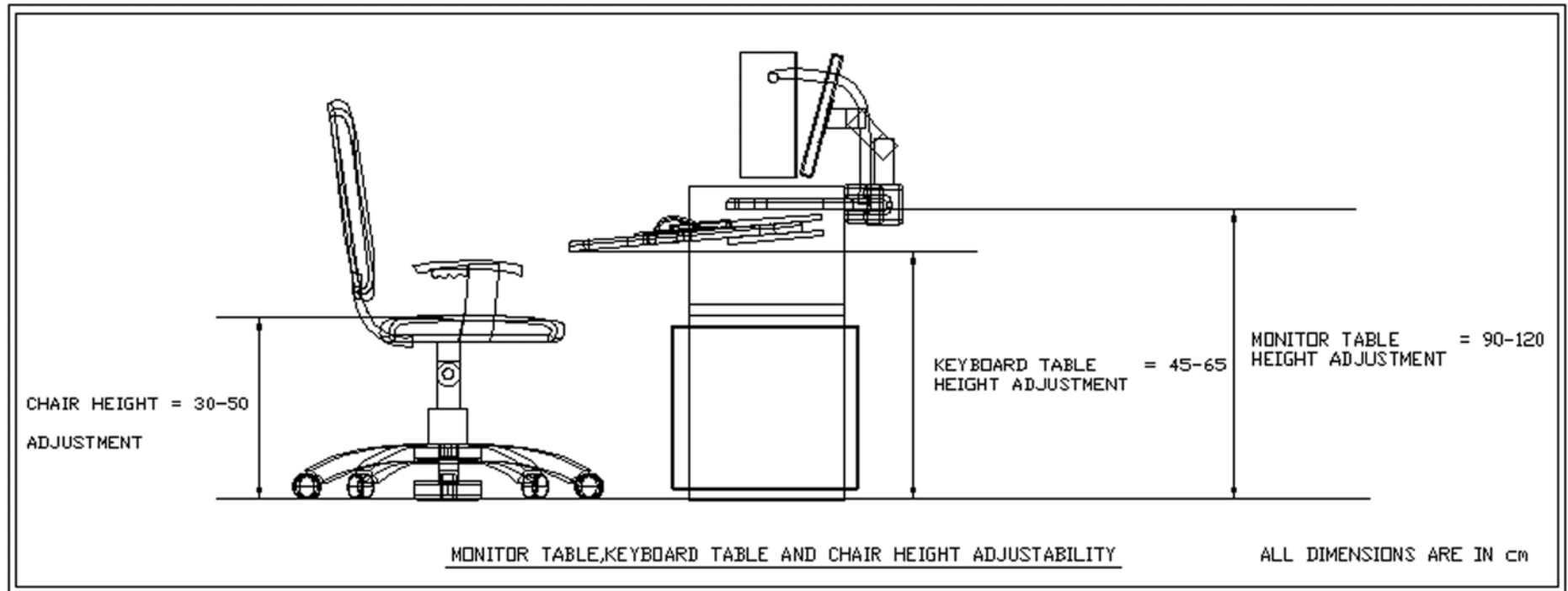
KEYBOARD TABLE:



we can and we will...

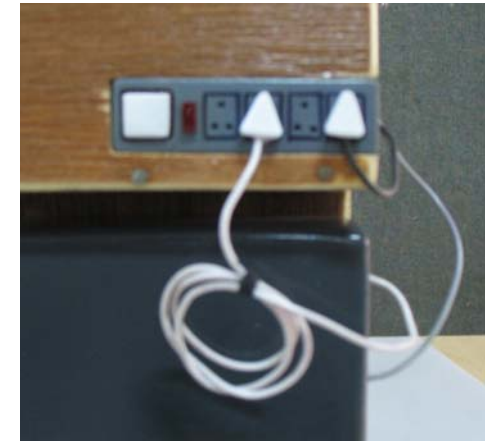
10. FINAL CONCEPT DRAWINGS

MONITOR TABLE, KEYBOARD TABLE AND CHAIR HEIGHT ADJUSTABILITY:



we can and we will...

11. FINAL MODEL: (1:5 SCALE)



we can and we will...

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