

[Marshall Playground – Team F4]

[Preliminary Report]

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2017-2018



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1. Background

1.1 Introduction

This project relates to the children in which children will get a source to play around with fun apparatuses and tools. Our purpose is to support the children with disabilities and varying needs that require them to be in a classroom that accommodates those specific needs. The majority of students use walkers, gait trainers, and strollers to help them get from place to place in their daily routine. Students are working on academics that are modified to their specific learning needs, as well functional skills and life skills. Some students use a communication device to say their wants and needs, others use sign language, and some have verbal communication skills. So this project will build something that will help those children for fun playing and hanging out.

1.2 Project Description

Purpose of this project is to build such a toy that will help children with disabilities to play around with, and through the toy they will be able to spend time all around. This project calls for a fun apparatus for children to play on outside. Basic need is that such a toy or a device that has to be a learning module for them and it must withstand in various weather conditions as it's going to be used in an outdoor areas. It has to be portable, easy to set up and be safe for children to use with little supervision.

1.3 Original System

This is an original system and we are not going to extend any already built system and neither are improving any old system which has already existed. The design of this project will also be the new one and didn't copied neither amended any existed design.

“This project involved the design of a completely new fun playing apparatus for children. There is no original system when this project begin.”

2 Requirements

In this section we are going to discuss about the customer requirements, engineering requirements, testing procedures and house of quality (HoQ)

2.1 Customer Requirements (CRs)

Our design requirements were generated from the given project description in Bblearn. However, all the customer requirements were taken from the meeting with our clients as shown in table 1. We have listed the most important customer requirements that we received from the client so we start building our design. All the customer requirements have helped is a lot in achieving our goals.

Table 1: Design and CRs requirements

Design Requirements	Customer Requirements
Fun apparatus for children with disabilities	Portable, Long life, less cost
Withstand various weather conditions	Safe.
Potentially portable	No sharp edges
Safe	Material needs to be rubber and soft
	Consider different sizes
	Sound motivations
	Nontoxic material

2.1 Engineering Requirements

The engineering requirements have to be generated from whatever the client gave us in terms of the customer requirements. Therefore, table 2 shows a list of our engineering requirements after evaluating the customer requirements.

Table 2: Engineering Requirements

Engineering Requirements
Device shouldn't weigh more than 30 lbs.
Rubber platform needs to be at least 6 x 6 ft.
Round all sharp edges to 1/8''.
Children ages range between 4 to 9 years
Device needs to at least last for 5 years
Size of planned device is 50 x 50 inches
Picture icons of 20 x 20 inches.
Sounds at 5 DB.

2.4 House of Quality (HoQ)

House of quality is a chart which creates the link between engineering requirements, customer requirements and targeted values. Table 3 shows the HoQ of our project. Our house of quality has not yet been confirmed %100 because the team believes that it might be changed.

Table 3: HoQ

House of Quality (HoQ)										
Customer Requirement	Customer Weight	Device shouldn't weigh more than 30 lbs	Rubber platform needs to be 6X6 ft	Round sharp edges to 1/8"	Sounds at 5 DB	Children ages range between 4 to 9 years	Device size 50X50 inches	9 inches tire radius		
1- Portable	4	5	5					3		
2- Soft Material	3			5						
3- Safety	5	3	9	9				5		
4- No sharp Edges	4	3	9	9						
5- Sound Motivations	3				9					
7- Consider different sizes	3					5				
8- Device size	3	3					3			
9- Picture icons	3									
Total	33	56	74	96	27	15	9	37		
Absolute Technical Importance (ATI)		56	74	96	27	15	9	37		
Relative Technical Importance (RTI)		3	2	1	5	6	7	4		

3 Existing Designs

In chapter 3, it has discussed about how the research has to be done and how the existing designs can find out, and doing the literature review for any project with the references.

3.1 Design Research

Design research is process of searching out the related data as the project. As our project is to build such fun apparatus which will help disable children to play around with in the outside environment. For this purpose, we have searched on internet, and tried to find out different sort of journals, articles, and different websites to see if there have been any similar projects done on the same requirements or not. And from the search, we have found out different designs available with the same requirement and those are different ideas then the one we will going to implement in this project. From those design problems we have found some issues which will be relevant to our project as well and those issues are:

1. Size of a project must be enough that children can play around easily
2. Portable with easy to set up

These two issues are the problem that we will face while building our own project. And there are few opportunities we have identified after research which are:

1. Sound motivation can easily get by putting small speakers
2. Pictures can use for toy shaped icons

So with these opportunities we will able to fulfill our engineering and customer requirements. So from searching around we have found that things can get easy and lot of help can get from internet. As the issues have mentioned now we will focus on our design and finalize such design from which issue of size will not appear. Furthermore, portability and easy to set up is our main course as well, and now we will keep focusing on our design to make such design which will not have any portability issue as well.

3.2 System level

Here are the few design ideas we have found which have been built before but these are not similar to the one we are building in this project but their requirements are the same as given to us for this project.

3.2.1 Existing Design # 1: A game to Play with the small board with holes

This is a toy formed apparatus which is portable and will not affect by the weather conditions. Also it is long lasting as all of the material used in it is plastic. There are pictures of fruits of large size made on the board and their mouths have cut. So children can play by putting things in their mouths [1].

3.2.2 Existing Design # 2: A baby's laptop

A laptop in small size with the keyboard which play around with sound and some alphabets so this design is useful for disabled children as well because they will have the capability to listen it. So they can use this apparatus for fun time [1].

3.2.3 Existing Design # 3: A small running Train

This is also a fun playing apparatus. It is a train which moves around with the battery backup and it don't need the track as well so with such design with no track this design is good for playing disable children [2].

3.3 Functional Decomposition

Functional decomposition is basically a way to describe the project in details. First of all, there is black box model which describe the top level of the system by just telling the inputs and outputs of the system. Then there is hypothesized model which is also known as hierarchy model in which the detailed functions of inside the product explain in details. Here is the black box model section. It is very significant that we do our black box and functional decomposed models because they help us in examining the design we'll consider.

3.3.1 Black Box Model

Black Box model of this system is showing below as

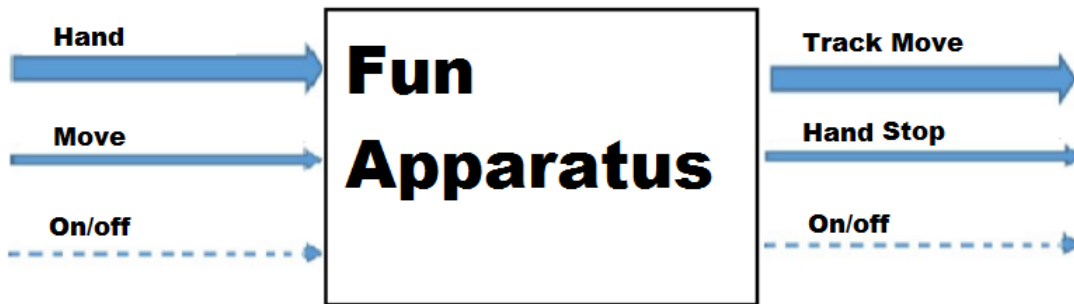


Figure 1: Black Box Model

3.3.2 Functional Model

Here is the functional model for our project.

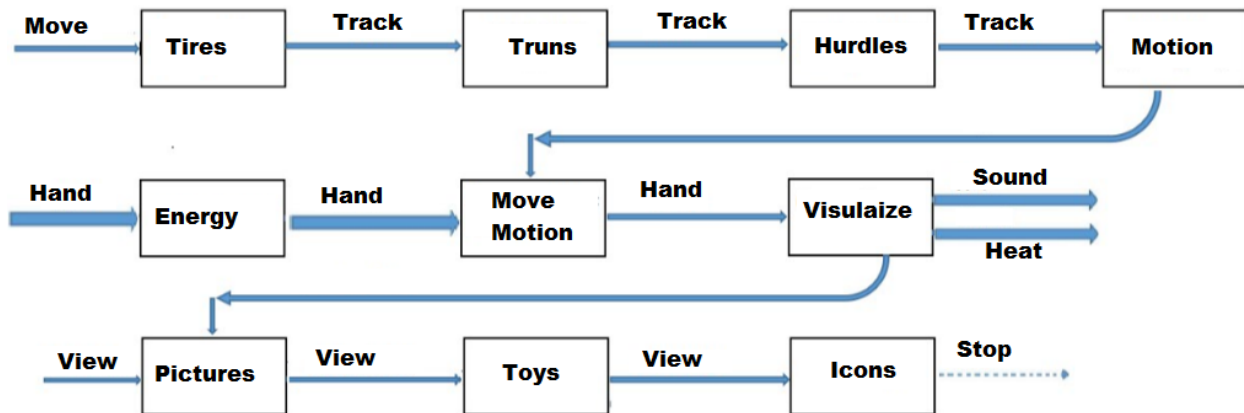


Figure 2: Functional Model

3.4 Subsystem Level

In this section we are going to discuss our three sub system for the project.

3.4.1 Subsystem # 1: Track

For our project the product will move on some sort of track that could be either ground or any track like a train system. So the apparatus will easily move over the track. This is really important for our project as it will provide a moving platform so it will be easy a good fun for the children and easy to move over the surface. Now see the existing designs for this this subsystem.

3.4.1.1 Existing Design # 1: Tracking System

Tracking system is a track similar to the train on which trains moves only in the direction where the tracks heading. Train cannot move other than the track system that's why this design could be useful for our project. For children when they want to move the apparatus, it will move only in a specific direction and it will be easy for them. And this track can place at any location and move the apparatus

3.4.1.2 Existing Design # 2: Ground level

This is an option of ground level, means the simple ground with small grass or no grass can use for the track to move the apparatus. This is very common as everything with tires can move over the ground. In the same way we can use this system in our design and use the simple ground as a track so the children will not need to put any defined track and can move towards each side.

3.4.1.3 Existing Design # 3: Carpet road

This design is basically the roads we have available in our surrounding. This is a good track as well and useful for the plan ride and movement. This track is not available then have to build such track. This option is also useful for design because we can move our apparatus over the carpeted surface.

3.4.2 Subsystem # 2: Tires

This subsystem will play an important role in our project for moving the apparatus all around. Tires is the only best way to move things around without carrying them. That's why it plays an important role children apparatus with which they are playing and can take it around without any problem.

3.4.2.1 Existing Design # 1: Plastic Tires

Plastic is good material to use and there are hundreds of tires available in plastic materials. These are smooth, don't have any hard edge, and long life as well. We can use this type of tires in our project and that's why this existing design is useful for our project.

3.4.2.2 Existing Design # 2: Iron Tires

These tires are also available in different sort of materials. Irons tires is an existing design and we can use this design for our project because for any tracking method iron tires can work and move all around.

3.4.2.3 Existing Design # 3: Rubber Tires

Rubber tires design is available and this type of tires are soft and have the capability to cover up some sort of jerks because of their elastic nature. This design is useful for our project especially if we use ground track or carpet road track.

3.4.3 Subsystem # 3: Visualizing Board

This is another important part of our project, as visual boards will use for fun and children will enjoy such boards if they want to play they can play with it and if they just want to watch they can just watch it,

3.4.3.1 Existing Design # 1: Wooden Board

Wooden board is an existing design and useful for holding knels in them and placing pictures, toys, icons etc. on the board. This is useful for our project because if we use wooden board we can place any sort of item over it and it can hold easily because it is strong.

3.4.3.2 Existing Design # 2: Iron Board

Iron boards are not very common but it is an existing design. It is useful for our project in a way that we can put the icons over the board and put the displaying pictures.

3.4.3.3 Existing Design # 2: Plastic Board

Plastic boards is another existing design useful for displaying the things. Over the plastic board different sort of things can write as well. So this is a good option to use for our project as children can write over it as well.

4 Designs Considered

As the purpose of this project is to build fun apparatus for disabled children and therefore multiple designs have considered for it and these designs have presented below as well.

4.1 Design # 1: Cart moving on rail track with display board

This is the design in which a there is cart with 4 tires and that cart moves over the rail track. Cart has a holding board which uses for display items, holding pictures, icons and placing toys. Design is showing below

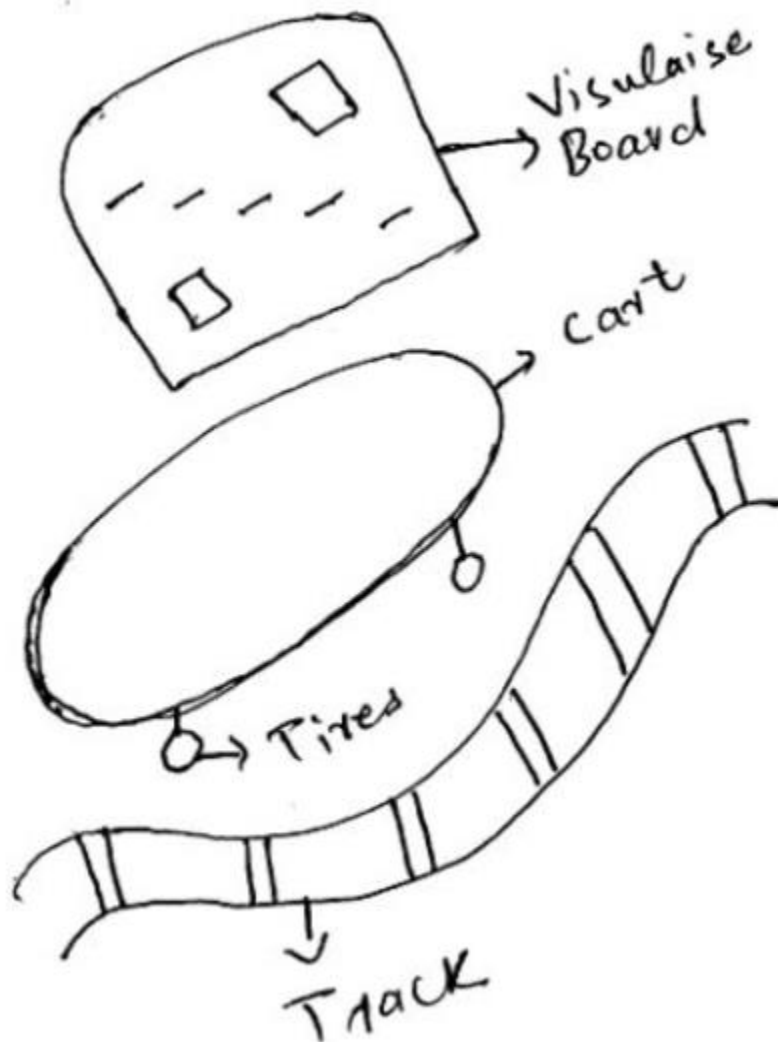


Figure 1: Rail track cart system

Advantages

- No sharp edges of cart and board
- Sound Motivations
- Picture Icons
- Safe
- No toxic Material
- Portable
- Easy to Set Up

Disadvantages

- May be little longer in size
- Track could be difficult to manage

4.2 Design # 2: Moveable and portable Wall

This is a portable wall with the tires and holding platform which is safe as well. Wall is useful for displaying items like pictures, icons and toys and there are speakers over the wall which produce sound for enjoyment for children. Wall is portable as it can fold around and easily carry to some other place. There are tires which moves the wall and there is black slit showing on the right side of design which is holding the wall straight and the wall can easily detach from the slit. Following figure is showing the design idea.

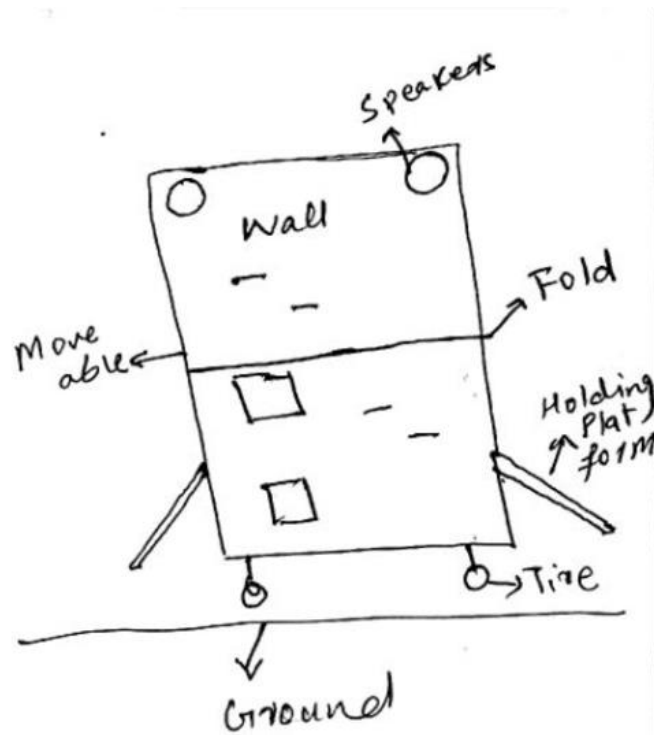


Figure 2: Moveable Wall

Advantages

- Safe
- No sharp cuts

- Sound
- Moveable
- Portable
- Easy to set up

Disadvantages

- Big in size
- Difficult to stand up the big wall with tires and slit

4.3 Design # 3: Moving Stairs

This is a design of moving stairs. A stairs made up of wood with the tires under them. These stair can move around and two children can play with it. One children can sit over the stairs and second children will push the stairs. Other than this, it has a displaying part on which pictures and icons can use for display. Another option is that a child can put the ball over the top and it will flow down towards the end where the ball catcher will catch it. Following figure is showing the design.

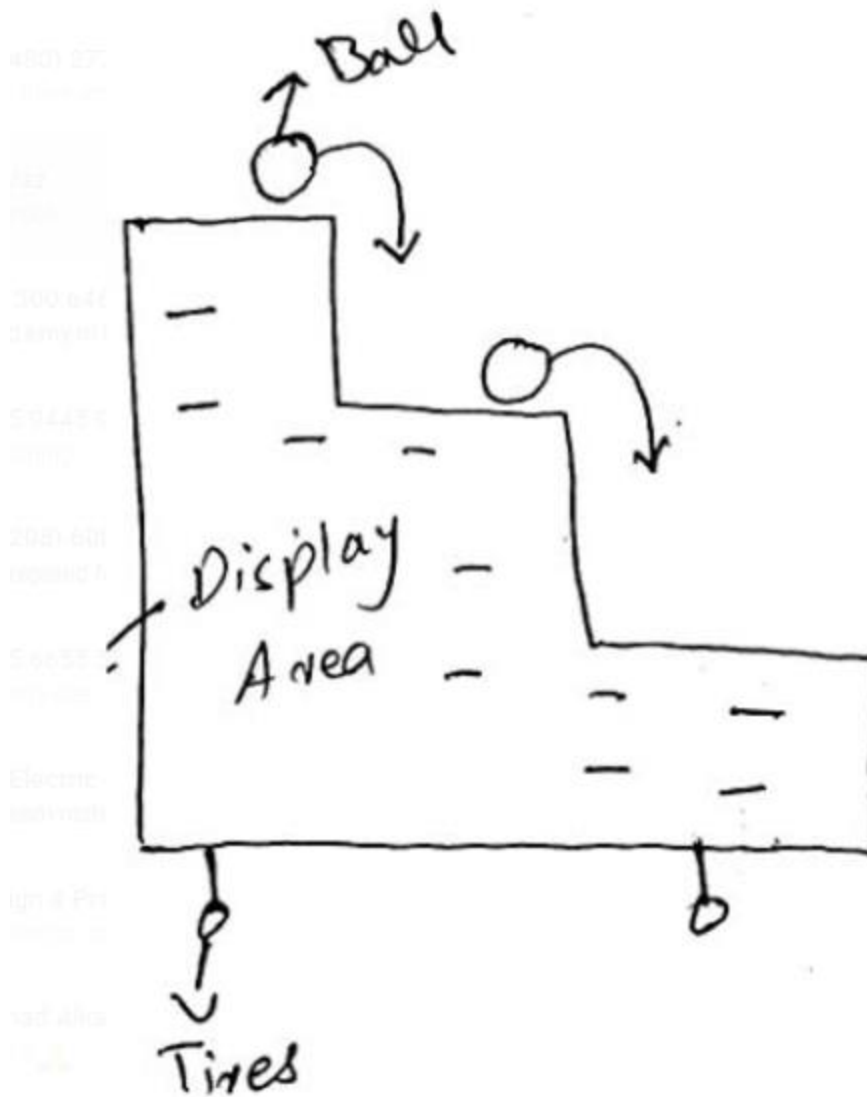


Figure 3: Moving Stairs

Advantages

- Easy to use
- Moveable
- Portable

Disadvantages

- Sharp edges
- Difficult to control because of weight

Disadvantages

4.4 Design # 4: Motor car with play cards

This design is consist of motor car which has play cards in it. Play cards will move up and down and keep changing their logo. And there is a color ball attached at the back side which has multi colors light in it. As the car move those lights starts blinking in different colors. This is a motor car so it operates on battery and move with any push. Idea is showing in the following figure.

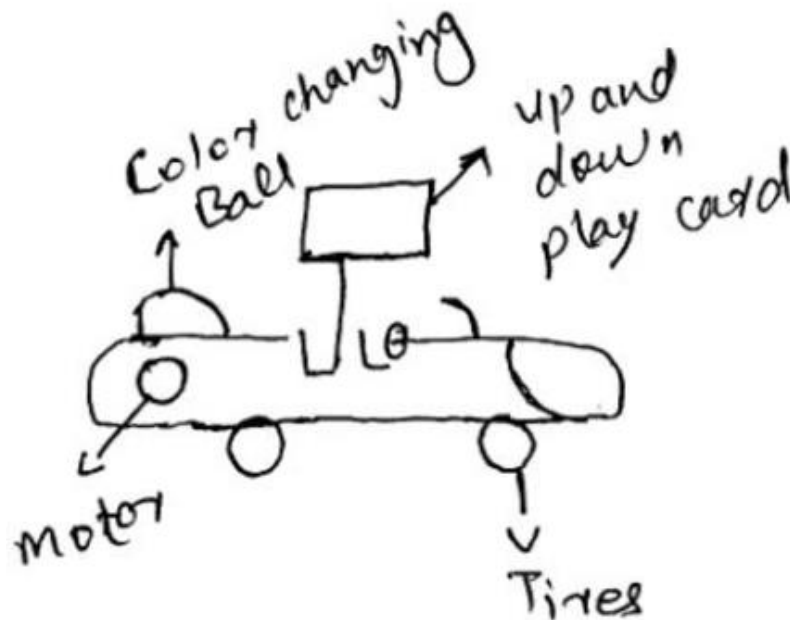


Figure 4: Motor Car

Advantages

- Moveable
- Safe
- No toxic material

Disadvantages

- Motor can cause trouble for running the car by children
- Battery need to replace after some time of interval

4.5 Design # 5: Sliding Mobile

This is a sliding mobile design which a mobile screen with the keypad over it as well. It have tires and a stand over which the mobile will move and children will press the button and different pictures and themes will appear on the screen. It has a sound motivation as well. Following figure is showing below

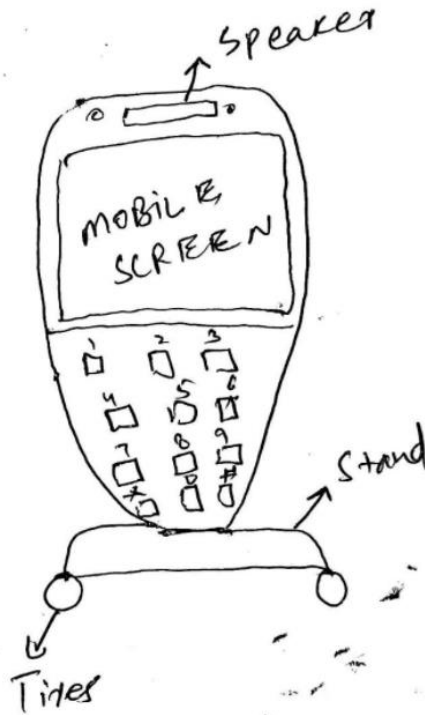


Figure 5: Sliding Mobile

Advantages

- Easy to use
- Sound motivations
- Portable

Disadvantages

- Mobile holder is a sensitive thing
- Mobile can drop

4.6 Design # 6: Bubble Ball

This is like a gun machine in which a ball through from the top and ball moves in different directions and come out of the gun from three different points and the gun has the capability to move around with the help of tires so any disabled child can move the gun and the design is showing in the following figure.

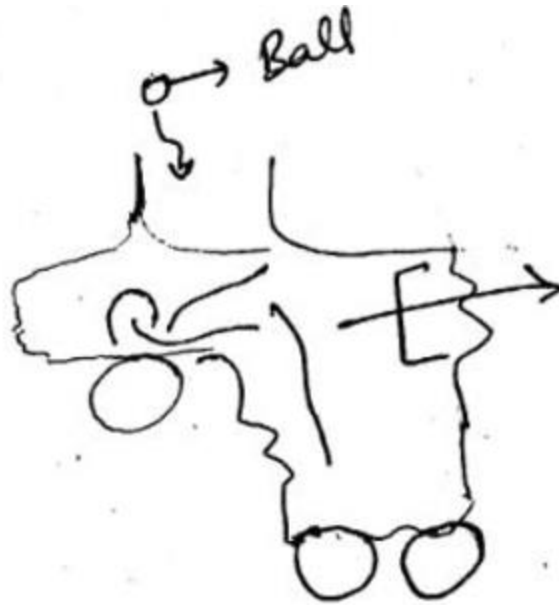


Figure 6: Bubble Ball

Advantages

- Easy to use
- Sound motivations
- Portable

Disadvantages

- Ball is sensitive to hit

4.7 Design # 7: Push wall with baby walker

A disabled child can sit in the walker and then push the wall in a way that it feels like some door moving out of the way and it is showing in the figure.

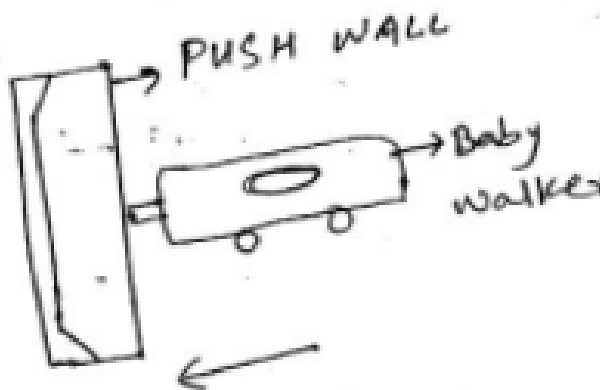


Figure 7: Push Wall with Baby Walker

Advantages

- Easy to use
- Sound motivations
- Portable

Disadvantages

- Not Safe

4.8 Design # 8: Baby Car

Disabled child who cannot walk around have a good apparatus that they will drive the car and they can travel as well to some other locations with the help of this car. This is an electric car which has all the controls and children can move as the following figure has the design.

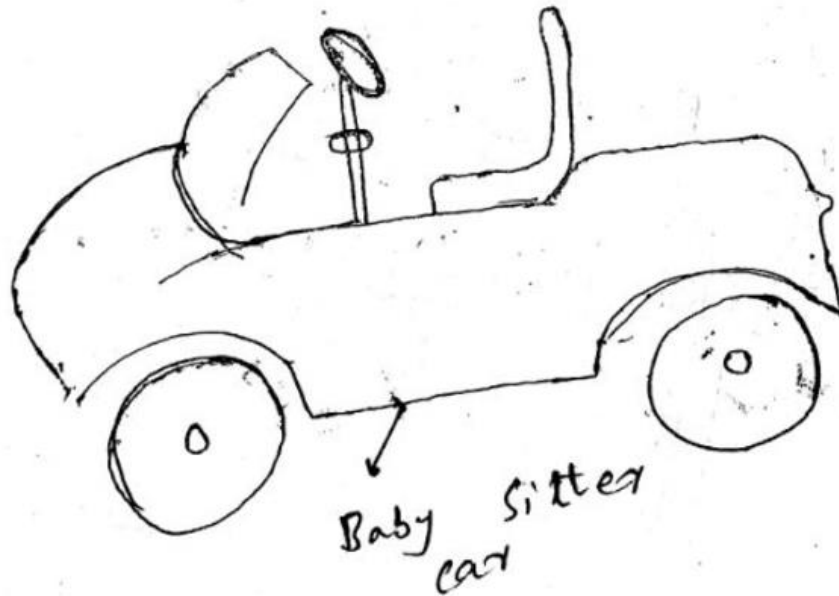


Figure 8: Baby Car

Advantages

- Easy to use
- Sound motivations
- Portable

Disadvantages

- Need to put baby in it
- Control is difficult for child

4.9 Design # 9: Electro Mechanical Hand

This is a hand with electro mechanical movement in it and it can control the hand whereas it has a pencil at the end and disabled children can write through it. Being a fun apparatus the main thing is to handle the hand and write correctly as showing below.

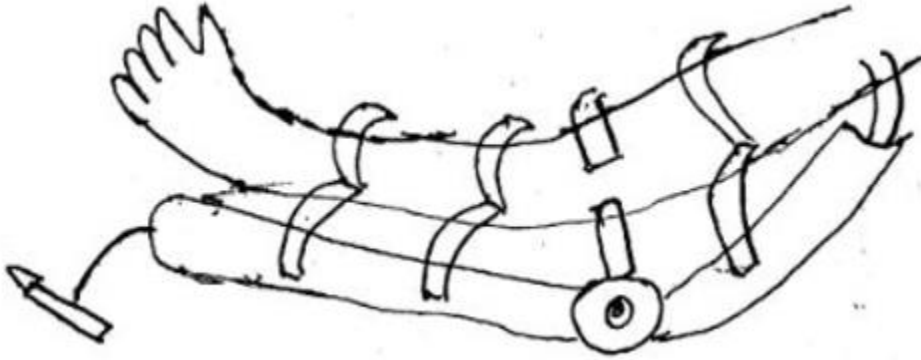


Figure 9: Electro Mechanical Hand

Advantages

- Easy to use
- Sound motivations
- Portable

Disadvantages

- Pencil control is difficult

4.10 Design # 10: Moving baby cart over the railroad

A specific track will carry the child sitting in the cart to some other place and it will be a fun travelling in the cart as showing below

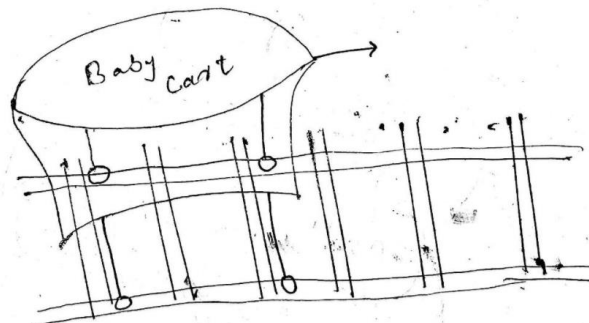


Figure 10: Moving Baby Cart

Advantages

- Easy to use
- Sound motivations

Disadvantages

- Not safe

5 Design Selected

In this chapter selection of design methods have presented like Pugh chart, Decision matrix etc. which will be using in the next section to finalize the result.

5.1 Rationale for Design Selection

Purpose of this project is to build such an apparatus which provides fun to the disabled children and therefore few designs have presented for it. In this section we are going to finalize our design using two different methods. One is Pugh chart and second one is decision matrix. Following is the Pugh Chart.

Table 4: Pugh chart

5 Designs for Fun Apparatus	Weightage	Moving Stairs	Moving Wall	Moving Cart	Motor Car	Sliding Mobile	Bubble Ball	Push Wall Baby Walker	Baby Car	Electro Mechanical Hand	Moving Baby Cart
Fun Apparatus	8	+	+	+	+	+	-	-	+	+	-
Play on outside	7	S	S	+	-	-	S	+	+	+	+
Withstand in weather conditions	6	-	+	+	+	-	-	S	+	-	-
Portable	5	+	+	+	+	+	S	-	-	-	S
Easy to set up	4	+	S	+	S	+	+	-	-	S	S
Safe	3	+	+	+	-	-	-	S	S	-	+
Easy to use	2	-	+	+	+	-	-	-	S	S	-
Pluses		4	6	7	4	3	1	2	3	2	2
Minus		3	0	1	3	5	5	4	3	4	3

Now we have two final designs from Pugh chart now move on to decision matrix and finalize the single design.

Table 5: Decision matrix

Criteria	Weight	Design 1	Design 2
1	8	5	4
2	7	6	5
3	6	2	3
4	5	7	1
5	4	5	2
6	3	5	4
7	2	1	2
Total	1	183	87

From decision matrix the result we have found is the moving cart. Moving cart has got the maximum numbers and if we see the advantages of moving cart, it has all the plus points which are looking by customer requirements. So on the basis of these results we are going forward to use the moving cart design.

5.2 Design Description

Moving cart is the design which has finalized on the basis of selection methods results. In this cart we will build a cart and a track and a display board. Material of these things will decide later. Cart will move over the track and display board will hold over the cart and different sort of pictures and icons will display over it.

References

- [1] P. Family, “Great Toys for Children” available [online],
<http://www.parenting.com/gallery/10-toys-great-for-kids-with-special-needs>
- [2] PBS parents, ‘Learning Disabilities’ available [online],
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