

# Design and Development of Trolley for Welding Machine and Accessories

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## ABSTRACT

**The project focuses on the Design and Development of Trolley for Welding Machine and Accessories. The design of the product aims to provide trolley for welding machine and all of its accessories for efficient working & ease of portability. Factors like safety of the worker, working conditions where it is used and finally the ease of use are all considered while designing the product.**

**The Aim and objective of this project is to design a trolley that incorporates suggestions and improvements of the existing welding trolley and provide better ways of implementing it for an effective use in the Industrial Sites. The process of designing incorporates multiple steps which include literature study, material study, case study, location study, environment study, user study, market study, patent study & working of the welding trolley to obtain the final product.**

**These studies include understanding the existing problems in the trolleys, the mechanism used for the moving and other parts. This will give an in-depth understanding of the trolley. This also provides information regarding the components present in the welding machine and other necessary tools required when welding process has begun. The final product results in a portable trolley which can be carried to different site work or other factories, this is clamped into place in the rear of an APE Auto. This has an adjustable gas cylinder handle which can be moved up and down to adjust the overall height of the trolley. It has a removeable tray which can be easily cleaned, this is used for placing of accessories required for the process of welding.**

**Keywords: Sentiment analysis, Data mining.**

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## INTRODUCTION

The project focuses on the Design and Development of Trolley for Welding Machine and Accessories. The design of the product aims to provide trolley for welding machine and all of its accessories for efficient working & ease of portability. Factors like safety of the worker, working conditions where it is used and finally the ease of use are all considered while designing the product. The initial process is literature study which includes types of Industrial Trolley, Components Used in Welding Machine, Components used in Trolley and Trolley Mechanism. These were collected from Articles, E – Newspapers, Books, and Journals.

Data collection & Analysis of the project plays an important role in generating ideation sketches finalizing the concepts & selecting of the concept. Data Collection was done through Market Study, Product Study, Patent Study, Trend Study, Environment and Location Study, Material Study, User Study, User Journey, User Persona, and Case Study. Analysing the data collected lead to exploratory sketches, brainstorming and mind mapping. The evaluation of brainstorming, mind mapping and exploratory sketches lead to the concepts and selection of the final concept.

The concepts are then validated by creating a prototype for understanding it better, this helps in selecting the concept which tackle the problems better while adhering to the points told by the user and suited to the trends present. The selected concept is then visualized using Blender to better explain the usability and functionality of the product. The dimensional detailing is done by conducting an Ergonomic study of the product using Indian Anthropometric Values.

The Materials are then assigned to the Virtual model present in Blender to provide realistic renders, context renders and exploded view of the product. This helps understanding human and product interaction while also showing the internal

components present in the product. An animation video is generated to show the working of the product, this is done using Blender, Adobe Media Encoder and DaVinci Resolve. All of these helps in understanding the effectiveness of the product and meeting the expectations of the consumer.

The selected concept is then made into a physical model with all the working present in it, the virtual model created in Blender helps better create the model while the Ergonomics values are used to create the parts. While creating the physical model feedback is taken to improvise the product by making changes to the model or changing the placement of some parts to better support the working of the model.

## **LITERATURE STUDY**

### **2.1 Industrial Trolley Types**

Single Platform Trolley, consists of a simple design of single platform and handle which comes below the waist. Used for carrying heavy loads from one place to another. Can be folded to be carried making it highly portable. The weight of these trolleys is around 10 – 15 kgs. The weight capacity is 160 – 200 kgs. Double platform trolley, consists of a simple design of two platform with two handle bars. It is used for carrying multiple items, heavy equipment's at the bottom and tools on top. It is bulky in nature to encompass larger number of items. The weight of these trolleys is around 20– 30 kgs. The weight capacity is 400 – 500 kgs. Wire Mesh Trolley, has an enclosure to house all the components with the space. It is mainly used for storing larger amount of raw material. It is used mostly to store fabrics for storing sensitive fabrics which require a lot of ventilation. Component Trolley, is used for placing and segregation of different components. This helps in organization of different components with it part for orderly arrangements. It has a soft covering to prevent damage to the components with the frame and provides sufficient cushioning to prevent any scratches. Material Handling Trolley, is used for segregation of materials. It consists of a pouch structure to store the materials; this is all used for placing different type of rod and tubes based of the dimensions. This helps in making the portability of multiple materials much easy. Automotive Packaging Trolley, is used for moving large & heavier components. It helps in the packaging of the components and moving them to different stations. These are used in large scale industries to speed the process decreasing work load and work time of the workers.

### **2.2 Types of Trolley based on Category of Welding**

Arc Welding have an angular platform for easier operation of the nobs. There are three platforms of equal distance for placing of tools and extension box. The rear wheels are smaller while the front wheels are larger. TIG Welding have a flat platform while the handles are angular. There are chains on each platform for holding the components in place. The rear wheels are of medium size while the front wheels are larger. Plasma Welding have a flat platform and a flat handle for easier cable management. The welding machine is placed at the bottom for easier accessibility while keeping it in one place. The platforms are unequally spaces for allowing the welding machine to fit.

### **2.3 General Components of Welding Machine**

Welding Machine contains all the nobs for changing the voltage. All accessories are connected to the welding machine for the welding process to being. It consists of vents to allow for cooling of the machine while it is in use. Gas Cylinder comes in mainly in two sizes the medium which is about 3 feet and the large cylinder which is about 5 feet in height. The most commonly used gases for welding are Shielding gases which are Carbon Dioxide, Argon, etc. Welding Torch is connected to the welding machine to provide the electrodes. It has a switch near the handle to pass the current through the rod for the welding to happen. This is one of the main parts which comes close in contact with the welding surface. Earthing Cable is used for grounding of the electricity. It is connected to welding machine & attached to the component or any conducting surface to make the current pass into the ground. This prevents electrical shocks to the person and in major cases can create sparks or even a blast.

Welding Shield provides protection to the face and eyes. It is made out of plastic to prevent conduction of electricity and provide covers to the entire face with excess space for easy breathing. This has a glass through which the person must see during welding. Nozzles attach to the welding torch. It comes in in varying sizes, but the most commonly seen are small medium and large. The smaller size nozzle allows less electrodes while the large allows of the spread of electrodes. The accuracy increase as the size of the nozzle becomes smaller. Tungsten Rod is the most commonly used material for welding. This provides protection from the atmospheric contamination. This melt and provides the coat between two surfaces. Filler Wire are the metal which are heated and melted. These liquify and flow to the gap or space between to close fitting points or parts.

### **2.4 Components of the Trolley**

The frames make up the body of the trolley. This provides the structural rigidity for the trolley. The thickness of the frame is more at the base with respect to the top. This is either cylindrical pipe or tube which are used to create the form of the body. Handle are the support for moving of the trolley. It is placed horizontally or at an angle based on the height of the trolley and the ease of use. This provides space to hold the trolley and move it. This is usually a solid rod which is used to withstand the weight and provide sufficient grip for the movement of the trolley. Wheels are used for the movement of the trolley. The larger the wheel, the easier it is to move on uneven surface. It has a brake attached to the side. The front

wheels are usually smaller than the rear wheels. Platform is the horizontal plane present on the trolley. It is used for placing tools, welding machines and other accessories on top of it. The platform is thicker where the welding machine is to be placed to provide sufficient strength to keep it afloat. This is usually a metal sheet which is held on together with the body frame.

## 2.5 Trolley Mechanism/ Physics

The reasons why the trolley are used is because it reduces fatigue and improves ergonomics. It has excellent maneuverability & flexibility in a working environment. It is suitable for many types of cargo load. This drastically reduce the risk of accidents happening in the work space. When moving around it protects the transported items. This helps in improved the productivity of the worker. It houses safe material handling which moving around.

## PROBLEM STATEMENT

The initial stage of the project is to conduct literature study on existing trolley and observe how to get ethnography finding on the use of the current trolley and necessary improvement needed. To conduct research on trolley for welding machine, study about the material used & the weight it can carry. To design and develop trolley for welding machine and accessories for efficient working & easy portability. Through the research stage, we develop ideation sketches, which are narrowed down to one selected concept and a detailed product detailing regarding their functionality and ergonomics is created. This concept is then made into a digital 3D model, photo realistic render and context render. Finally, a working model is created of the selected concept.

## DATA COLLECTION AND ANALYSIS

Data Collection and Analysis is the collections of important data about the topic which has been done. This is done to utilize the data collected for research purpose and analyzing it. The Data collection conducted here were Product Study, Market Study, Location Study, Material Study, Case study, User Study, User Persona, User Journey and Online Survey.

### 4.1 Product Study

Table 1 Product Study

| Product Name                                              | Dimensions                                                         | Features                                                                     | Pricing                    | Packaging                                                                   |
|-----------------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------|-----------------------------------------------------------------------------|
| VIVOHOME Iron 3 Tiers Rolling Welding Trolley with Wheels | 800 x 396 x 690 mm, Wheel Type: 2 Straight Wheels & 2 Reversible   | Attachable Tray, Adjustable Platform, Weight Capacity: 80 kgs, 3 Cable Wraps | \$50 (Approx. Rs. 3,800)   | Pre- Assembled, Wooden Case                                                 |
| Welding cart trolley for welding tools                    | 596.5 x 488 x 1115 mm, Wheel Type: 2 Straight Wheels               | Tools, Large Cylinder                                                        | \$71 (Approx. Rs. 5,300)   | Pre- Assembled, 600 X 500 X 1120 mm, 1pcs/carton, 50 kg                     |
| Metal Man UWC4 Dual Bottle Welding Cart                   | 387 x 572, Wheel Type: 2 Straight Wheels & 2 Reversible            | Fold Down Handle, 2 Cable Wraps, Weight Capacity: 182 kg                     | \$366 (Approx. Rs. 27,200) | Pre- Assembled, 1010 X 590 X 130 cm, Box                                    |
| Klutch Deluxe 3-Drawer Welding Cart with Drawers          | 305 x 229 x 470 mm, Wheel Type: 2 Straight Wheels & 2 Reversible   | 3 Storage Draws & 1 Storage Cabinet, Weight Capacity: 68 kg                  | \$366 (Approx. Rs. 27,200) | Pre-Assembled, 1010 X 590 X 130 cm, Wooden Case                             |
| Miller TIG Dynasty 280 208-575 V, CPS                     | 346 x 219 x 571 mm                                                 | Adjustable Shoulder Strap, Cooler Power Supply, Weight: 25 kg                | -                          | Accessories: Welding machine; Rocker, Rotary & Pushbutton Fingertip Control |
| ESAB ARC CPRA 1200S-415V                                  | 1368 x 410 x 1145 mm, Wheel Type: 2 Straight Wheels & 2 Reversible | Trolley Style Wheels, Submerged Arc Welding Type, Weight: 375 kg             | -                          | Accessories: Welding machine; Rotary & Pushbutton Fingertip Control         |

#### 4.2 Brand Study

Eastwood; the costing is close to \$ 120 - \$ 300 (Approx. Rs. 9k – Rs.22k). They are known for producing various accessories for welding. They produce welding trolley / cart which have a uniform design to fit TIG, plasma & arc welding components and machines. They provide a rigid structure for the trolley which promises longer use of the trolley. Taparia; the costing is around Rs. 10k – Rs. 30k. They are known for their tools trolley, it comes in different size with varying number of drawers. The wheel size remains the same on all the sides, at the rear one wheels has the brakes present. They provide durable products while keeping the design very simple and easy to understand for use. Zally; the costing is around Rs. 50k – Rs. 2L. Their products work on electrical components which provides the functionality. Most of their products can be operated remotely making it easier to move larger & heavier loads. They provide an amazing brake system which halts the cart in an instance, making it less prone to accidents. Stanley; the costing is around Rs. 2.5k – Rs. 8k. They are known for their compact trolley which can be easily carried around when not in use. The trollies are also multi-functional. The wheels are foldable giving it longer product life. Their products have an amazing build quality which makes for a structurally strong trolley.

#### 4.3 Welding Machine Study

Esab; the costing is around Rs. 4k – Rs. 1L. They are the largest manufacturer of welding equipment's in India. The welding machines they produce are lightweight and has a compact design present. Their products offer multi – voltage flexibility making it easier to choose a specific voltage usage. Kamppi; the costing is around Rs. 30k – Rs. 60k. They are the design leader of arc welding industry. Their products boost the quality and productivity of welding. The products are highly reliable and durable which makes them highly successful. Indus Arc; the costing is around Rs. 20k – Rs. 80k. The welding machine offered by them are reliable and affordable.

In India they are one of the leading companies. They provide all the features offered by the premium brand but are much more cost effective in providing them. The durability of their products is not as good when compared to other brands. Miller; the costing is around Rs. 50k – Rs. 4.5L. They are known for their premium quality welding machines. They offer all additional accessories to the welding machines which are also of premium quality. The products are on the expensive end making them a premium brand. The quality and the multi operational products offered by them are much better than their competitors.

#### 4.4 Environment Study

Safety Factors for Welding Environment; there is checking of the equipment's present for their working conditions. When the worker is welding there must be a minimum space of 460 mm (18 inches) for welding process. If there is a site work which has to be done there is a mandatory temperature and health check of the worker, if a worker is sick, he is immediately is asked to rest for his and others safety. When welding is located in another site the location of the fire extinguisher is a must for precaution from a fire during welding. Safety Factors for Welding Person; the most important part during welding is the safety of the person in this case the welder and the people around him. There are certain items and tools which the welder must carry and wear during the welding process these include Respirators, Welding Shield, Ear Plugs, Tester, Fire proof clothing, Industrial Shoes, Hard Hats and finally Leather Chest Apron.

These are the necessary tool through which keep the welders face and body safe, if there are multiple people present, a welding shield and fire proof clothing must be worn. Industrial Area; most of the Industrial sites have an area of approximately 2000 sq. foot in this, there must be minimum of 6 to 8 electrical outlets evenly spread across the site, failing which can cause fire hazards. After welding is done it requires at least 50 liters of water for cooling purpose, this is taken as a general consumption of water when welding is performed. Within this site some industrial companies provide welding floor area, this is where all the welding must be performed, it is generally taken as 250 sq. foot.

#### 4.5 Location Study

Indoor Conditions; when working indoors, there must be proper ventilation of the area, if there isn't sufficient ventilation all the fumes emitted after welding can have an adverse effect on the body. There must be sufficient availability of power, especially high voltage currents for powering up the tools. If we take a trolley there must be sufficient space for the moving of the trolley within the confined space, if there isn't it can cause delays in work or can also lead to accident by bumping into other components present in the site. Finally, there must be an easy access to safety equipment within the space, it must be in arms reach in case of an emergency.

Outdoor Conditions; when working outdoor, the most important thing one must look for is shade during working, this is necessary both for the person and the welding machine; too much exposure to heat the welding machine might get damaged. The other factors are the availability of high voltage current and an easy access to safety equipment's. But there is another factor which cannot be controlled which is the weather condition, the ideal weather condition for welding is a semi humid temperature with sufficient wind.

#### 4.6 Trend Study Welding Machine

**Table 2 Dimension for Welding Machine**

| Electricity | Dimension                | Weight |
|-------------|--------------------------|--------|
| 200 A       | 300 L x 180 W x 250 H mm | 7.5 kg |
| 300 A       | 400 L x 250 W x 300 H mm | 14 kg  |
| 500 A       | 500 L x 325 W x 400 H mm | 20 kg  |

Gas Cylinder

**Table 3 Dimensions for Gas Cylinder**

| Size   | Dimension        | Weight |
|--------|------------------|--------|
| Medium | 3 Feet (914 mm)  | 16 kg  |
| Large  | 5 Feet (1524 mm) | 65 kg  |

#### 4.7 Design Trend

The approximate dimension for a trolley present is: 800 x 400 x 700 mm, this is considered as a medium-size trolley. The weight of this is almost 65 -70 kg while the weight capacity it can withstand is up to 150 - 200 kg. The accessories size, depends on the task at hand the accuracy required to complete the task, the most common used is medium this is usually used in general as it is accurate enough for most of the works present. The smaller sizes are much accurate but cover only a smaller area, this makes it more time consuming to complete the task; on the other hand, large accessories help in covering larger surfaces but is not as accurate, this may lead to failed weld joints during the process.

#### 4.8 Material Study

Trolley

**Table 4 Material Details for Trolley**

| Material        | Mild Steel        | Stainless Steel   |
|-----------------|-------------------|-------------------|
| Product Life    | 10 Years          | 15 years          |
| Durability      | Extremely Durable | Long Term Durable |
| Discard-ability | Easy disposable   | Easily disposable |

Welding Machine

**Table 5 Material Details for Welding Machine**

| Material        | Mild Steel        | Plastic Nobs     | Earthing Nob - Cu |
|-----------------|-------------------|------------------|-------------------|
| Product Life    | 5 Years           | 3 years          | 10 Years          |
| Durability      | Extremely Durable | Less Durable     | Highly Durable    |
| Discard-ability | Less disposable   | Least disposable | Easily disposable |

Wheel

**Table 6 Material Details for Wheel**

| Material        | Steel Rim         | Rubber                | Plastic          |
|-----------------|-------------------|-----------------------|------------------|
| Product Life    | 5 Years           | 10 years              | 15 Years         |
| Durability      | Less Durable      | Most Durable          | Least Durable    |
| Discard-ability | Easily disposable | Not Easily disposable | Least disposable |

#### Gas Cylinder

**Table 6 Material Details for Gas Cylinder**

| Components      | Cable             |                   | Outer Sleeve     |
|-----------------|-------------------|-------------------|------------------|
| Material        | Copper            | Aluminum          | Plastic          |
| Product Life    | 15 Years          | 20 years          | 2 Years          |
| Durability      | Highly Durable    | Highly Durable    | Less Durable     |
| Discard-ability | Easily disposable | Easily disposable | Least disposable |

#### Welding Torch

**Table 6 Material Details for Welding Torch**

| Components      | Body            | Nozzle            |                        |
|-----------------|-----------------|-------------------|------------------------|
| Material        | Mild Steel      | Copper            | Brass                  |
| Product Life    | 5 Years         | 10 years          | 25 Years               |
| Durability      | Highly Durable  | Highly Durable    | Most Durable           |
| Discard-ability | Less disposable | Easily disposable | Efficiently disposable |

#### Welding Shield

**Table 6 Material Details for Welding Shield**

| Components      | Outer Casing     |                  | Eye Protection    |
|-----------------|------------------|------------------|-------------------|
| Material        | Fibre            | Plastic          | Hard Glass        |
| Product Life    | 3 Years          | 5 years          | 1 Years           |
| Durability      | Less Durable     | Highly Durable   | Extremely Durable |
| Discard-ability | Least disposable | Least disposable | Least disposable  |

#### Nozzle

**Table 4 Material Details for Trolley**

|                 |                 |                   |
|-----------------|-----------------|-------------------|
| Material        | Ceramic         | Fibre             |
| Product Life    | 15 Years        | 20 years          |
| Durability      | Highly Durable  | Less Durable      |
| Discard-ability | Easy disposable | Easily disposable |

#### 4.9 User Persona

Our persona is a 32-year-old male who is a part-time welder working in a factory, he has been recently finding it really hard to weld for prolong period of time. He wants a trolley which will help him reduce the workload while also giving him the mobility for the tools and accessories. The daily task performed by him mainly include; running conditions of machines, tool checking, checking of safety gears, material checking, daily check in, working –completion of work, total hours worker–factory & at site work and next day working plan. The problems; include that he finds it hard to carry the equipment's around as they are heavy. When going to a site, he is provided with the simple trolley which does not help keep all the tools and accessories on it. When provided with a welding trolley is either too high or too low for easy use this makes for a delay while welding. When carrying the cylinder and welding machine it has caused him back pains and muscle cramps.

#### 4.10 User Journey

Provides detailed look at how a task is performed step by step to avail at the final destination. This helps break down the task into four parts the preparation phase, movement phase, welding and after welding or final (finishing). Preparation; first there is equipment checking, gas cylinder checking for the proper and safe working. The running condition of welding machine and its accessories is checked to any damages present. Lastly wearing of safety gear and following the safety guidelines is done. Movement; before the welding process all the components are attached and kept. This is then placing it on the trolley and moving it to site work. The only things which are not attached are the cables to the cylinder and welding machine. Welding; during the welding process there is a constant change in the voltage that must be let in. This is seen by checking of power / current range. It is then changed to the required current by rotating the nobs. After

Welding; comes buffing of the surface and giving it a final finishing to it, after which all the components are detachment and kept aside. Then the checking of the gas gauge for the level of gas present in the cylinder. Finally, a mandatory health checking of the welder after the welding is complete.

#### 4.11 Case Study

The pain points include that there is variation in the heights of the trolley. There is no cable management present to assort the cables. There is lack of space to keep accessories and other tools. There are issues with base platform to keep the cylinder. The cylinder over time cause damage to the trolley due it constant bumps. There is insufficient space to keep welding torch cable after using. Due to its open design when an uneven surface is present, the weight shift can cause the welding machine to fall. After hitting one-wheel brake there is a pivotal movement which can cause the loss of control over the trolley. The suggestions given include; improving the placement of extension box in the trolley, lowering height of base platform where cylinder must be placed, placing of hooks at the side of the trolley and finally adding cushioning to the inner layer of the trolley where cylinder is placed.

#### 4.12 Case Study

To better understand problems and feedback from users a survey was shared, the survey findings highlight; the need for cable management, preference towards wheels with 2 reversible wheels at the rear and 2 straight wheels at the front, the most common accessories they require to be able to keep on the trolley are big hammer and cut-off machine, some of the features from the mesh trolley can be implemented to improve the welding trolley, the trolley needs to be compact for easy portability on uneven surfaces and finally features like height adjustment has been recommended.

#### 4.13 Research Findings

The problems faced include; spread of wires across the area, making it hard to find the ideal wire, lifting the welding machine and cylinder across is quite tiresome, while transporting all the components are taken separately making hard to know if everything is taken, without proper storage all the elements and components are just scatted across the area, if there is a large facility, it is hard to move it from one place to another, in other facilities trolley isn't provided making it hard to starting the welding process and finally when provided a trolley it is just a multi-purpose trolley where not all equipment's can be placed.

#### 4.14 Conclusion

The Collected Data has information about Product Study, Market Study, Material Study & Case Study using Articles, Books & Journals, and E – Newspapers. The information regarding Case Study & User Study were done through Online Survey and In- Person questioning. This provided the problems which are currently faced by the User (Welder), the current material information, the current brands which provide the product and the location at which they are played. This helps in bring a general benchmark of the products and to compare features to take the inspiration.

### CONCEPT GENERATION

Concept Generation aims to generate concepts that meet the requirements expressed by the Welders and Workers, this is done by using Mind-Mapping & Brainstorming, Visual Theme, Exploratory sketches, Concept Generation and finally selecting one concept. These are influenced by existing products. These concepts are further improvised and rendered in various software's.

#### 5.1 Mind – Mapping & Brainstorming



Figure 1 Mind Mapping

## 5.2 Ideation Sketches

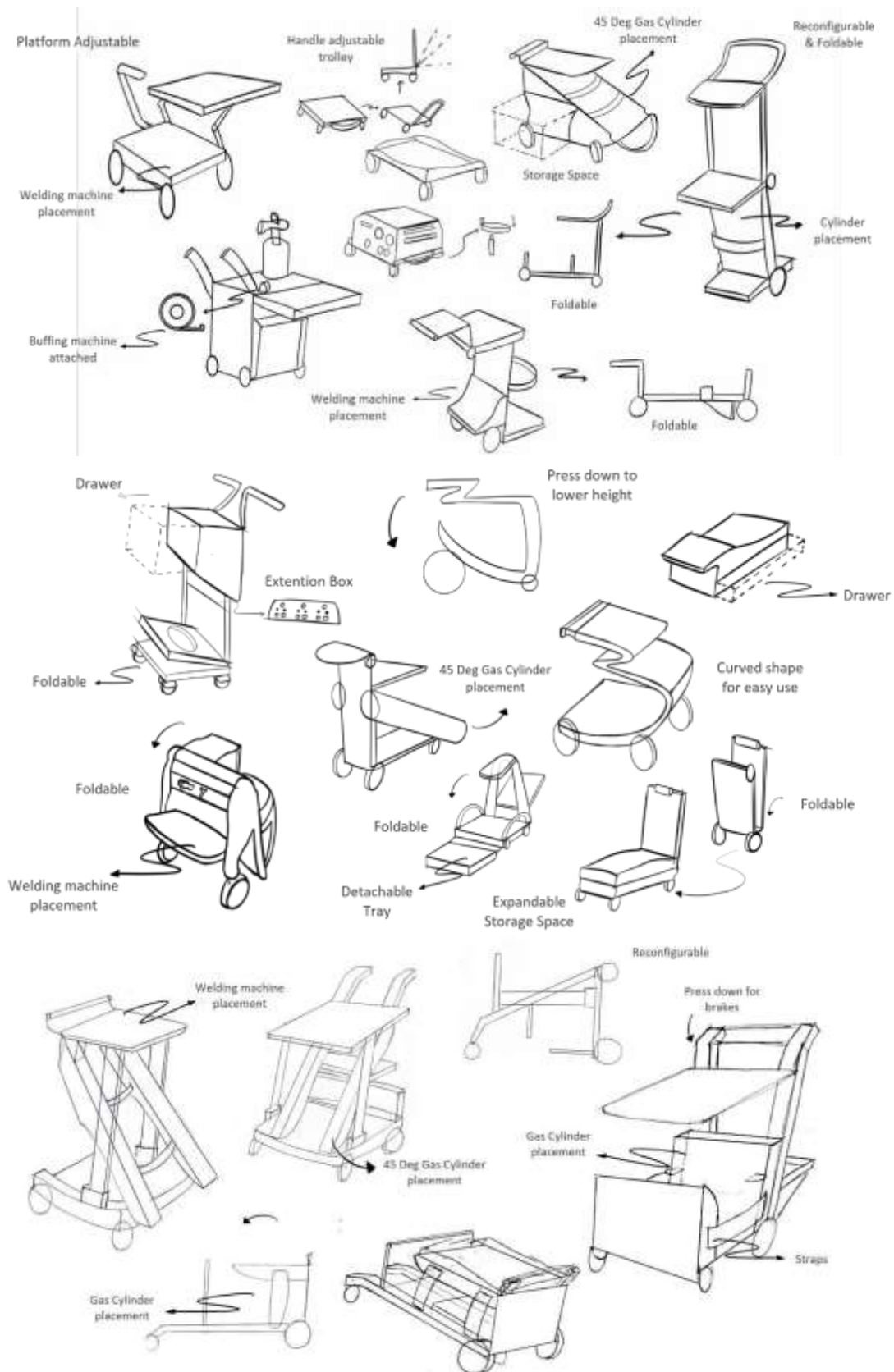


**Figure 2 Ideation Sketches**

The sketches generated focuses towards created a more compact form factor and easy portability in taking the trolley more accessible in multiple places, it focuses mainly of incorporating sufficient space for placing the tools and other accessories of the welding machine.

### 5.3 Concept Validation

#### Concept 1 Prototype



**Figure 3 Final Model of Concept 1 Prototype**

#### Concept 2 Prototype



**Figure 4 Final Model of Concept 2 Prototype**

#### Concept Validation:

This helps to determine which concept is valid and workers in the real world with respect to the actual dimensions. The use of comparative weights helps in seeing if it can withstand the actual weight when put, this helps in thinking of other ways in adding the supports if by chance it fails.

#### 5.4 Concept Selected



Figure 5 Concept Selected

#### Final Selected Concepts:

This concept was selected after validating by creating prototypes of the two most valid concepts. This concept is much more feasible as the height is much lower and provides the compact form factory. It is also much light weight when compared to the other concept as this consists of mainly frames.

#### CONCLUSION

Concept Generation includes putting new ideas in the form of exploratory sketches to tackle the current product present in the market and its problems. After the exploration, different concepts were generated after considering the working and the internal working of the product. Finally, a concept is selected after validating the real-world use by creating the prototype of them this helped tackle the requirements of the market.

#### CONCEPT DETAILING

Concept Detailing includes detailed virtual modelling, product context renders that represent the product with respect to the environment and humans, exploded view which represents the components, the working of the product and the physical model of the Final concept selected. Concept detailing incorporate, aesthetic details, construction details, ergonomic study, functional details, structural details, and surface details of the product virtually. The aesthetic detail comprises the exterior look & form. The constructional details comprise the modularity of the product. The ergonomic study comprises of human factors with respect to the product and its use. Structural details encompass materials, parts, etc. The surface details include texture, colour, etc.

#### 6.1 Suggested Dimensions for the Product

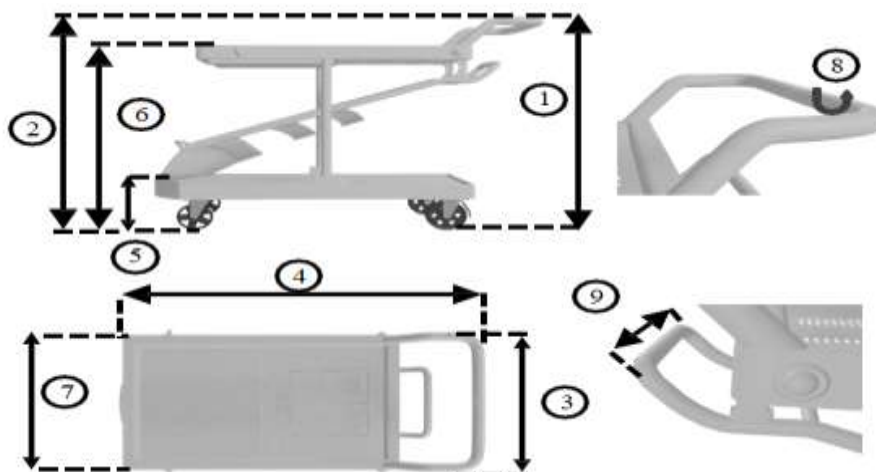


Figure 6 Suggested Dimension  
Table 5 Suggested Dimensions for the Product

| Sl. No. | Parameters                                       | Measurements (mm) |
|---------|--------------------------------------------------|-------------------|
| 1.      | Total Height of Trolley from the Ground          | 1100 mm           |
| 2.      | Height of the Trolley Handle from the Ground     | 1100 mm           |
| 3.      | Width of the Trolley                             | 500 mm            |
| 4.      | Length of the Trolley                            | 950 mm            |
| 5.      | Height of Trolley Base from the Ground           | 150 mm            |
| 6.      | Height of the Top Platform Frame from the Ground | 950 mm            |
| 7.      | Width of the Top Platform Frame                  | 500 mm            |
| 8.      | Width (Diameter) of the Trolley Handle           | 50 mm             |
| 9.      | Length of Handle for Gas Cylinder Support        | 250 mm            |

## 6.2 3D Modelling & Rendering

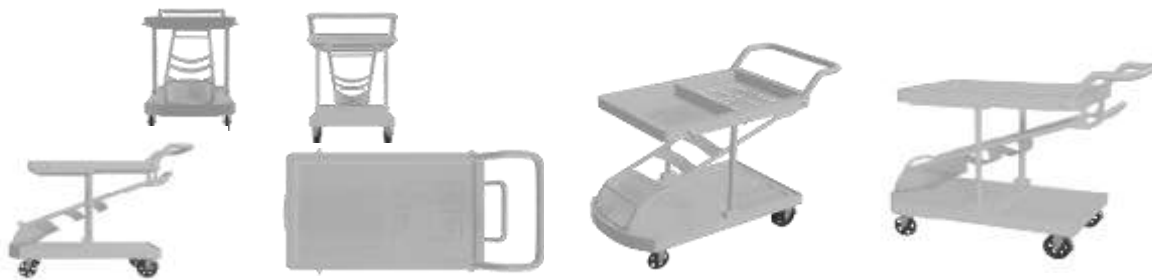


Figure 7 Virtual Prototyping

## 6.3 Photo-realistic Renders



Figure 8 Product Render



#### 6.4 Context Render



**Figure 9 Context Render**

#### 6.5 Exploded View



**Figure 10 Exploded View**

#### 6.6 Materials Selected for the Final Concept

Outer Frames: Mild Steel Removable Trays: ABS Plastic Wheels: Rubber  
Handle: Mild Steel with Rubber Grip

Mild steel is used to withhold the weight of the gas cylinder, welding machine and all of the other components present. This is also relatively light weight when compared to other metals and is easier to weld together. It gathers rust much later, which help it last much longer for the product life. ABS plastic is used for the trays; it makes for a light weight which is essential when its removeable. This also help in creating perforations much easier and more precise which helps making it much cheaper to obtain. This also adds much less weight to the trolley itself. Rubber is used for having much more grip on uneven and is better suited for uneven surfaces. This also is used for its amazing ability for stopping immediately, this is important in dire circumstances.

#### 6.7 Physical Model Process Creating the components

The various parts of the trolley are made using the appropriate materials. These includes the bottom frame and plate, the

top frame, the gas cylinder support, the handles and the removeable trays. After the completion of the making of the component, it is kept aside for assembling.



**Figure 11 Exploded View**

### Assembling the components

The various components which are created are assembled together, form attaching the mechanism, the gas cylinder support, the top frame, the removable trays, the handle and finally the handle of the trolley.



**Figure 12 Assembling Process**

### Finishing

The components are then powder coated with the necessary colors selected by the workers. This adds a layer of coating to prevent it from rusting and adds life to the trolley.



**Figure 13 Finishing**

## 6.8 Final Physical Model



**Figure 14 Powder Coated Physical Model with Cylinder and Welding Machine**

## CONCLUSION AND FUTURE WORK

### 8.1 Conclusion

The Project address the current problems of the welding trolley present in the market and improves them utilizing various research methods. The main aim of the project is to develop a trolley for welding machine for efficient worker and easy portability. The development of concepts is made first by ideating ideas, selecting few and improvising based on the research and other information collected. The concept is then validated by creating a prototype to understand the real-life application. After validating the concepts, one is selected which is much more valid to tackle the problem better. After selecting the concept dimensional details are got using ergonomics, this help makes the trolley easily usable by majority of the workers. This also helps in understanding how exactly the worker uses the product and see if there are any additional changes that has to be made.

After this a virtual model of the product is made with the dimensions in mind, this help visualizes the look when created. Then a scaled model is created for the product which can then be used by the workers. By using Convolutional Neural Network (CNN) and K Nearest Neighbor (KNN) we developed a successful sentiment analysis music player. Happy, sad, angry, neutral are emotions detected by the application respective playlist is generated. Application developed was able to generate accuracy of an average 88 percent, which means we successfully created an application. By using CNN and K-NN we created promising results for emotion recognition using face detection. In future, this accuracy of application will be increased with the development of Artificial Intelligence and Deep Learning technology.

### 8.2 Future Work

This Project can be taken further by seeing the feedback of the workers after the use, this will give an insight of what other changes can be made to better improvise it. This can be later implemented into some factories who require this trolley. Adding of multi-channel hydraulic mechanism. This will make using or portable trolley much more accessible to industrial facilities as the factor of portability of a trolley is not much seen in the present trends. This can be seen as a step towards creating an efficient trolley for ease of working and portability much more then functionality.

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