

Development of MultiUtility Wheelbarrow

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Abstract

Wheelbarrow is a simple machine, which belong to the second-class lever. This is because the load or resistance is placed between the effort and the fulcrum. It is used in many areas of work to convey loads that are too heavy or bulky to be carried by hand. In 2020, we after all the hardships we faced one thing we learnt for certain is the paramount importance of disaster management from the lowest level in a household to the highest at the government. In these times we understand that safety of life trumps above all else. We tried to walk in that same direction with the help of this project that proves as an essential tool that may come in handy in times of floods. Our goal is to innovate a product that is useful on the everyday but also turns into a crucial equipment when needed. With extensive research we have designed a wheelbarrow that is multipurpose in nature. It can be used as a normal wheelbarrow on the day-to-day activities and as a floatation device for humans in terms of floods. Our process included everything from research into the selection of materials to research into the most optimum design that would be feasible both technically and economically. The analysis has been done by using Ansys. We also tuned the ergonomics of the wheelbarrow so that it is easy in operation when used from day to day.

Index Terms – Natural calamities, floods, rescue, wheelbarrow.

I. INTRODUCTION

Wheelbarrow can be used as farm equipment, industrial equipment, among others. A wheelbarrow consists of a tray or bed composed of steel, wood, or plastic. A steel brace attaches this bed to steel support legs and to a steel or plastic wheel, with a rubber tire around it. In two- or four-wheeled models, the wheels may be similar to bicycle tires, complete with inner tubes. Materials used in the construction of the wheelbarrow. The body of the wheelbarrow will be constructed with plastic due to its various desirable properties that it possesses. Power assisted wheelbarrows are now widely available from several manufacturers. Power wheelbarrows are commonly used in a range of applications. The technology has improved to enable wheelbarrows to take much heavier loads, beyond weights that a human could transport alone. Wheelbarrows with motors are generally diesel powered or electric battery power. This wheelbarrow is often used in a small-scale construction application where access for larger plant machinery is not needed. Every year various parts of the Indian subcontinent are hit with floods due to the country's vast coastline. The country over the years has been exposed to a multitude of cyclones and heavy rains. Flooding has many impacts. It damages property and endangers the lives of humans and other species. Rapid water runoff causes soil erosion and concomitant sediment deposition elsewhere (such as further downstream or down a coast). The spawning grounds for fish and other wildlife habitats can become polluted or destroyed. Some prolonged high floods can delay traffic in areas which lack elevated roadways. Floods can interfere with drainage and economical use of lands, such as interfering with farming. Structural damage can occur in bank lines, sewer lines, and other structures within flood ways.

II. LITERATURE REVIEW

Disaster management is one of the most crucial area, that helps in devising a proper strategy and allocating resources efficiently to places that are affected by natural calamities. A deeper study in this field allows us to recognize the various challenges that arise while dealing with affected areas. With extensive research we have identified the problems that occur during rescue operations and the best ways to tackle them. We have also studied the various design methodologies and tried to over come the usual draw backs that occur.

[1] Emanuel Littieri et al,

The paper aims to discuss a systematic review of the literature about disaster management within the period 1980-2006. We came to gather about the principles of disaster management in recent times with the use case of flash floods. Wheelbarrows are compound machines which consist of three simple machines that are lever, wheel and axle, and inclined plane. Wheelbarrows use more than one simple machine to reduce the effort needed to do a work, making them compound machines. Adding extra simple machines spreads the effort and force required to do the job and enables the wheelbarrow to do more than one job. Another invention of a wheelbarrow was the rear wheel system wheelbarrow. The invention was filed on 25th of March 1999 and patented on the 24th of April 2001. This wheelbarrow was invented by Guadalupe Garcia from California. Rear wheels are used to replace the leg supports of a conventional wheelbarrow. This was a simple innovation towards the conventional wheelbarrow to improve the ease of its usage.[1]

[2] Ezrha C Godilano et al,

Design of wheelbarrow that has ease of use to everyone without strain on the body. Challenges that come along with designing a wheelbarrow that is sound in design. On 13th of August 1935 a wheelbarrow design was patented in the United States which was invented by George M. Carter, Jackson, and Mich. The wheelbarrow design is as the conventional wheelbarrow that is used now. The framework of the wheelbarrow is made up of strong aluminum alloy to reduce from one half to two third of a similarly constructed steel wheelbarrow. It is also stated in the patent that pneumatic tires replaced with solid tires. The low- pressure pneumatic tire is applied to replace solid tire which undergoes material failure and rapid where due to crystallization of metal from severe shock resulting from irregular surface and load. This characteristic of the wheelbarrow allows it to absorb sharp stresses without fracture of materials and shocks. The modulus of elasticity when using a strong aluminum alloy is one third of the steel which means the sharp stress is distributed over a great distance of flexure and the maximum strain (ϵ) is reduced. The overall design of this wheelbarrow has brought a positive impact to its users and is still being applied till now.[2]

[3] Mohammad Nabil bin Ahmad Tarmizi et al,

Wheelbarrows are very useful means of transport for the community to carry out transportation activities of gardeners, farmers, or building goods and so on. When viewed from the definition of a wheelbarrow, it is a hand-driven, one-wheel-drive vehicle, driven by an operator through a handle. The Smart Wheelbarrow is an innovated wheelbarrow than a regular wheelbarrow. It is a combination of hydraulic and innovative wheelbarrows that can facilitate the lifting and moving of objects from place to place over a distance of 10-50 meters. first invented this product, which is to save labour. Freight transportation is an activity that requires a significant amount of energy. The average energy consumption required by a wheelchair operator is ± 4080 kcal / day during work hours. This value is close to the upper limit of energy allowed for heavy work, which is ± 4800 kcal / day. NIOSH explains that 40% of energy is spent on lifting loads and 20% on pushing and pulling loads. This study makes it easy for employees and users of the cart to enable them to use this product safely and comfortably. The second objective achieved is the addition of a brake system that enables users to stop the cart quickly, especially on sloping roads. It is intended to ensure the safety of users when carrying heavy loads.[3]

III. PROBLEM STATEMENT

The purpose of this work is to design a wheelbarrow with increased stability and efficiency which can be used for utilizing two laterally spaced wheels removably secured to the front edge of a wheelbarrow. In this regard, the present work substantially full fills this need. The production of this machine is to reduce difficulties and probably eliminate the suffering time, money, cost of manpower and most especially the need for technological breakthrough and self-reliance which has been a major concern of the human being. Carrying of load on human head has been a tiring problem in the society from this commercial especially towards it.

It helps eradicate those problems; this project write up has been delivered into simplifications and the constructions of this machine that can be used in carrying different types of this machine that can be used in carrying different types of heavy objects to different areas. Wheelbarrow is a machine that makes use of a bowl, made of metal used in carrying loads or is a simple machine that helps us life, pull, increase direction of heavy things change the direction of force and increase force.

The problems above can be simplified as:

- The conventional wheelbarrow is not multi-functional.
- The conventional wheelbarrow is not stable when in use.
- Users are not able to use a wheelbarrow of their preference.

IV. OBJECTIVES AND SCOPE

The main objective of this work is to design an industrial wheelbarrow with increased stability and efficiency comprising, in combination, a container with side walls and a bottom wall having a front and a back and an open top; handles having lower ends coupled to the bottom of the container and upper ends holdable by a user; rear legs depending downwardly from the container adjacent to the rear end and position able on the ground; front legs depending from the container adjacent to the front end; an axle formed of a rod with external threads, the axle having a center and opposed ends; brackets secured to the front legs adjacent to their lower extents with apertures for receiving the axle adjacent to its center cylindrical wheels secured to the axle adjacent to the ends with tires thereon for rotation; two internal bracket nuts threadedly secured to the axle on opposite sides of the center in contact with the brackets at their internal faces; two external wheel nuts threadedly secured to the axle adjacent to their ends in contact with the wheels at their external faces; and intermediate nuts between the brackets and wheels in contact with the external faces of the brackets and the internal faces of the wheels.

- Our vision is to design a wheelbarrow that can be used normally but also act as a life raft in times of floods when rescue operations are difficult to carry out.
- The wheelbarrow will be designed in a way so that it acts as a floatation device capable of carrying people making it possible for them to escape the flood struck area and make it easier for them to be rescued.
- To design and fabricate a new type of wheelbarrow that is multipurpose in nature.

V. METHODOLOGY

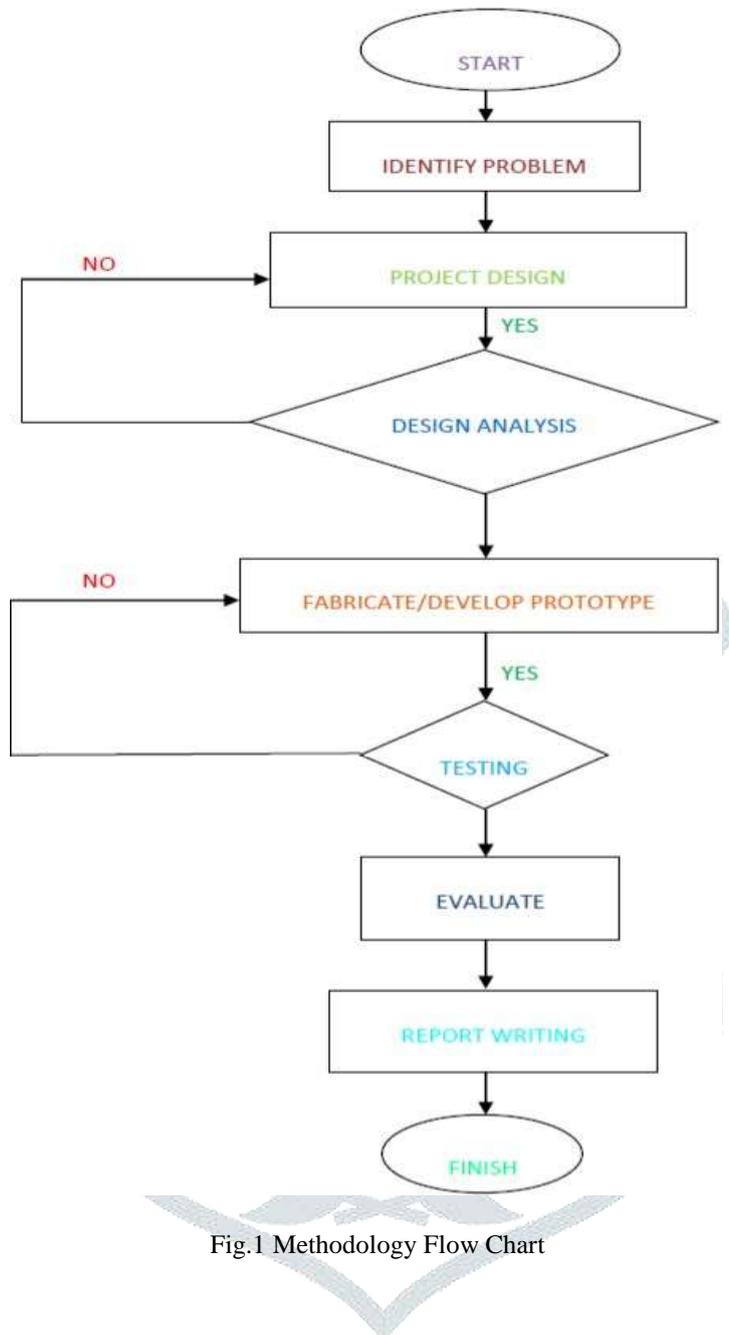


Fig.1 Methodology Flow Chart

VI. RESULTS AND DISCUSSIONS

Through the medium of this project, we were able to assess the damage caused by floods and understand the core problems that arise during human rescue operation. This enabled to identify a product that is present in most households and modify it to serve as a method of transportation in times of distress. The multi utility wheelbarrow is a device that serves the dual purpose of being used as a normal wheelbarrow from day to day but also serve as a life raft for transportation of humans or animals or objects in times of floods. The design is such as a wheelbarrow it is ergonomic in nature which helps in reducing injuries caused by the heavy load lifting. It is easy to use and is also durable owing to its materials and construction. Materials were selected in such a way that it serves all the objectives we needed to achieve in terms of function but also keep the overall cost of the product low to make it accessible to whoever needs it.

VII. CONCLUSION

Wheelbarrows are mostly used by laborer's, farmers, gardeners, petty traders, and others commonly known as wheelbarrow pushers, to transport goods too heavy to be moved by hand. Until recently, most wheelbarrows used in the country were imported. In industrial, Wheelbarrow is used to convey industrial tools, equipment, and goods from one place to another apart from these common uses of the wheelbarrow it can be used during floods, landslides etc. for transporting people from flooded region to a safe distance.

Our vision is to design a wheelbarrow that can be used normally but also act as a life raft in times of floods when rescue operations are difficult to carry out. The wheelbarrow will be designed in a way so that it acts as a flotation device capable of carrying people making it possible for them to escape the floods struck area and make it easier for them to be rescued.

IX. FUTURE WORK

We hope this product is adopted as we see a great potential and use case in both urban and rural areas where floods have become a common occurrence lately. The future scope of this product maybe modification to design or materials that may enable one to carry larger loads or make the lifting effort more efficient. The main objectives of the research report elaborate on the overall market overview on wheelbarrows market dynamics, historic volume and value, robust market methodology. The research report presents a detailed analysis of the competitive landscape along with company profiling of key players competing the global wheelbarrows market.

- This study presents the analytical depiction of the global wheelbarrow industry along with the current trends and future estimates to determine the imminent investment pockets.
- The report presents information related to key driver's restraints and opportunities along with detailed analysis of the wheelbarrow.
- The report provides a detailed global wheelbarrow market analysis based on competitive intensity and how the competition will take shape in coming years.

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