Design and Fabrication of Coconut Tree and Palm Tree Climbing Machine

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Abstract

This paper describes the working of a coconut tree climbing machine. Primary goal of the project is to design a coconut tree climbing device for farmers and residents. It is very difficult to climb on coconut tree due to the constant cylindrical structure and single stem. In other type of trees there will be branches for holding and to support the climber. A professional climber with proper training only is able to climb coconut tree. Due to the risk involved, nowadays a very few are coming forward to climb on coconut trees. Considering this scenario, a device which will help the user to climb coconut tree easily will be useful for the people who is having large coconut cultivation as well as residents who is having less coconut trees. This kind of devices will encourage more people to come forward to agricultural sector.

Keywords: coconut tree, GI pipe.

1. INTRODUCTION

For this we first made a rough sketch considering average diameter of a coconut tree as 30 cm and designed it in Solid Works. After that we moved on to the fabrication part. The material used is GI steel. Final concept was selected by customer preference. A working prototype of final concept has made to validate the concept. The most of the common coconut tree climbing tree machine problems are solved in this machine like safety measures and functions Standing type coconut tree climbing machine first discovered by "M J JOSEPH '' (alias appachan).As the user lift the assembly by foot and raise the either assembly by hand the steel rope will get loosen and when he push back with foot after reaching to a particular height it will get tighten. By this process the user can climb to the tree. Sitting Type Climbing Device is a type of coconut tree climbing machine. In this project, we aim to design a mechanism which is simple and easy to operate. For this we first made a rough sketch considering average diameter of a coconut tree as 30 cm and designed it in Solid Works. After that we moved on to the fabrication part. The material used is GI steel. Final concept was selected by customer preference. A working prototype of final concept has made to validate the concept. The most of the common coconut tree climbing tree machine problems are solved in this machine like safety measures and functions.

2. PRODUCT DESIGN

For designing the parts of the product, first we developed a rough sketch of the product considering average diameter of a coconut tree as 30cm. After making suitable alterations and corrections we arrived at the final design. Based on the final design developed, the design was modeled using the software Solid Works 14. The design parts listed below.

3. MATERIALS AND METHODS

3.1 GI Pipe

Galvanized piping replaced previously-used cast iron and lead in cold-water plumbing. Typically, galvanized piping rusts from the inside out, building up layers of plaque on the inside of the piping, causing both water pressure problems and eventual pipe failure. These plaques can flake off, leading to visible impurities in water and a slight metallic taste. The life expectancy of galvanized piping is about 70 years, but it may vary by region due to impurities in the water supply and the proximity of electrical grids for which interior piping acts as a pathway (the flow of electricity can accelerate chemical corrosion). Pipe longevity also depends on the thickness of zinc in the original galvanizing, which ranges on a scale from G40 to G210 and whether the pipe was galvanized on both the inside and outside, or just the outside. These pipes are widely used for conveying raw water & distribution of treated water in majority of rural water supply schemes, where the requirement of water is less. Mostly medium quality GI pipes are used. These pipes are cheap, light in weight and easy to handle & transport & easy to join. Their sizes vary from 15mm to 150mm. These pipes are manufactured conforming to IS-1239 (pt-I) 1990. Generally screwed & socketed pipes are used. From Fig 1 shows GI pipe.

GI Pipe is used for the support of top and bottom of the machine.

The length of the GI pipe in the
1*1 sq pipe, 3 feet,
Number of pipe=4

Figure.1. GI Pipe

3.2 Rubber Bushes

A bushing or rubber bushing is a type of vibration isolator. It provides an interface between two parts, damping the energy transmitted through the bushing. This movement allows the suspension parts to move freely, for example, when traveling over a large bump, while minimizing transmission of noise and small vibrations through to the chassis of the vehicle. A rubber bushing may also be described as a flexible mounting or antivibration mounting. These bushings often take the form of an annular cylinder of flexible material inside a metallic casing or outer tube. They might also feature an internal crush tube which protects

the bushing from being crushed by the fixings which hold it onto a threaded spigot. Many different types of bushing designs exist. An important difference compared with plain bearings is that the relative motion between the two connected parts is accommodated by strain in the rubber, rather than by shear or friction at the interface. Some rubber bushings, such as the D block for a sway bar, do allow sliding at the interface between one part and the rubber. From Fig 2 rubber bush is shown.

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Figure 2 Rubber bush

3.3 Bolt and Nut

A nut is a type of fastener with a threaded hole. Nuts are almost always used in conjunction with a mating bolt to fasten two or more parts together. The two partners are kept together by a combination of their threads' friction (with slight elastic deformation), a slight stretching of the bolt, and compression of the parts to be held together. In applications where vibration or rotation may work a nut loose, various locking mechanisms may be employed: lock washers, jam nuts, specialist adhesive thread-locking fluid such as Loctite, safety pins (split pins) or lock wire in conjunction with castellated nuts, nylon inserts (Nyloc nut), or slightly oval-shaped threads. The most common shape is hexagonal, for similar reasons as the bolt head - 6 sides give a good granularity of angles for a tool to approach from but more corners would be vulnerable to being rounded off. It takes only 1/6th of a rotation to obtain the next side of the hexagon and grip is optimal. However polygons with more than 6 sides do not give the requisite grip and polygons with fewer than 6 sides take more time to be given a complete rotation. Other specialized shapes exist for certain needs, such as wing nuts for finger adjustment and captive nuts (e.g. cage nuts) for inaccessible areas. Wide variety of nuts exists, from household hardware versions to specialized industry-specific designs that are engineered to meet various technical standards. Fasteners used in automotive, engineering, and industrial applications usually need to be tightened to a specific torque setting, using a torque wrench. Nuts are graded with strength ratings compatible with their respective bolts; for example, an ISO property class 10 nut will be able to support the bolt proof strength load of an ISO property class 10.9 bolts without stripping. Likewise, an SAE class 5 nuts can support the proof load of an SAE class 5 bolt. From Fig 3 bolts & nut shown.

Figure 3 Bolts and Nut

3.4 Ropes

A rope is a group of yarns, plies, or strands that are twisted or braided together into a larger and stronger form. Ropes have tensile strength and so can be used for dragging and lifting, but are too flexible to provide compressive strength. As a result, they cannot be used for pushing or similar compressive applications. Rope is thicker and stronger than similarly constructed cord, line, string, and twine. Fiber rope is made from fiber, whereas wire rope is made from wire. Rayon is a regenerated fiber used to make decorative rope sets climbing-rope standards and oversees testing. Any rope bearing a GUIANA or CE certification tag is suitable for climbing. Despite the hundreds of thousands of falls climbers suffer every year, there are few recorded instances of a climbing rope breaking in a fall; the cases that do are often attributable to previous damage to, or contamination of, the rope. Climbing ropes, Fig 4 however, do cut easily when under load. Keeping them away from sharp rock edges is imperative.

Figure 4 Rope

3.5 Wooden Seat

A wooden seat is used to sit on the device. The wooden pieces are placed over the metal frame. Those are welded together with GI pipe & seat frame. And also wooden seat is tighted by bolt & nuts for extra safety. From Fig 5 wooden seat is given.

Figure 5 Wooden Seat

3.6 Seat Belt

Seat belt is used to give extra protection or safety of user. And also the user is always fixed with seat perfect manner. While the use of seat belt, user can keep more comfort with his seat & he gets more confidence. By the belt gives a tension free attachment with coconut tree climbing device. From fig 6.

Figure 6 Seat Belt

4. PROBLEM STATEMENT

The user's need and present status of the product is studied by the customer survey and GEMBA study. The designer should have to define the problem with these customer requirements to develop a new product\ which will satisfy the end user. Problem statement of this study is to design and develop the coconut tree climbing device for improved ergonomics and safety.

5. METHODOLOGY

The idea is to make a device which does not use Electrical energy but a device completely depending on mechanical linkages. Provide an alternative to the existing methods of climbing. To tackle the problem of unavailability of coconut tree climbers for coconut farming and plant protection activities. The Principle of working is based on the fact that if a certain minimum friction between the tree trunk and rubber bush is achieved then it will help in adhering to the tree with the help of a rubber bush. Research to understand target user's (farmers and residents) need was conducted. As the user lift the assembly by foot the steel rope will get loosened and when he pushes back with foot the steel rope will get tightened, by this process the user can climb to the coconut tree. In sitting type the size has to be adjusted as per the diameter of the coconut tree, but in standing type it is self adjusted. In sitting type device, the user need not change any parts, but in standing type device the user has to change the steel rope wire as it will damage due to continuous use. This machine worked on the base of the friction between the machine rubber bush and the tree. Due to this friction the machine the machine does not come down without control and adjustment.

6. PRODUCT DESIGN SPECIFICATION

The product design specification is a set of defined information that helps to meet the design considerations & the requirements. It gives the details all the considerations from design to manufacturing. In the PDS all the specified data has to be defined properly. The proper flow of process will be gained to achieve the concepts with this information.

7. WORKING MODEL

Working model of final concept has made. Major sequences of operation included in working model development are left and right frame construction, welding, painting and assembly. Major processes involved are bending, drilling and welding.

8. EXPERIMENTAL PROCEDURE

The device has two MS frames; one upper and lower; they are connected by a belt while the equipment is on the coconut tree. The user has to sit on the seat which is provided on upper frame and has to insert his foot between the rubber rollers available In the lower frame. The upper frame can be lift by hands and the lower frame has to be lifted by leg. The process has to be repeated for the continuous climbing. The size can be adjusted as per the coconut tree diameter. This can be done by adjusting the MS steel bar using the plastic knobs. In the construction, the user has to stand and operate the device. Initially the steel rope wires of both left and right assemblies has to be looped with the tree and has to be locked to the arrangement provided to the foot rest. Then the user can stand by placing foot on both assemblies. As the user lift the assembly by foot the steel rope will get loosened and when he pushes back with foot it will get tightened, by this process the user can climb to the tree easily. To go down the user has to loosen the loop by raising his leg and pulling the handle, then he has to move down the device to a particular distance. From there the loop has to be tightened by pushing the leg downwards. For easy climbing, the body posture has to be kept straight. The height of the equipment can be altered according to the convenience of the user. Also the equipment can be disassembled easily by removing the locking screw, which will help the user to transport the equipment easily from one place to another.

CONCLUSION

The machine is built by following the natural phenomena present before us. Machine works on timely gripping and release of the tree by the two metal wire ropes locked to the moving frame. By this design, the structure is able to carry a load of 100kg and anyone can use it easily. At the beginning it is time consuming but with continuous use and practice it will

reduced the time required for the Climbing. It is flexible to change the height of the equipment up to 100mm according to the requirement of the user. It has easy maintenance. This structure will be beneficial for middle class family with its affordable cost .The design and erection of this equipment involved a great deal of effort to make the project successful and useful. Comparing to the other coconut and palm tree climbing equipments, we are additionally given safety belt, wooden seat &rubber gripper for the user safety purpose.

FUTURE SCOPE

Our project has been to bring together both simplicity & safety, along with comfort to the user of the machine which is the duty of every engineer. The end result of our effort has resulted in the development of "Coconut tree climbing equipment". We feel the project that we have done has a good future scope. Benefits resulting from the use of this device will make it pay for itself within a short period of time & it can be a great companion for any agriculturalist. The device affords scope for modifications and further improvements. The weight of the equipment can be reduced by the use of alloys or composite material. It can be automated. Also better safety accessories can be thought of and included along with the equipment.

REFERENCES

[1] Don Norman., "The Design of Everyday Things Reach and control", volume 1, 1992.

[2] Jeff Jepson., "The Tree Climber's Companion", Beaver Tree Publishing, May2000.

[3] Debkumar Chakrabarti, "Indian Anthropometric Dimensions for Ergonomics Design Practice", IIT Ahmadabad, volume 1, 1992.

[4] Prof. G.S Bhalla., "The Nature of Agricultural Development in India" http://isid.org.in, retrieved on 22nd Oct. 2010.

[5] Melissa Jawaharlal., "Coconut Tree Climbing Device", www.nciia.org, retrieved on 22nd Oct. 2010.

[6] Rajesh Kannan Megalingam, R Venumadh Ashis Pavan K, Anandkumar Mahadevan Advancements in Electronics and Power Engineering, January 2013.

[7]. P. Mohankumar, D. Anantha Krishnan and Kathirvel, "Development of ergo refined Coconut tree climbing device", African Journal of Agricultural Research, Volume 8, November 2013.

[8] Mani A, Jothilingam A, "Design and Fabrication of Coconut Harvesting Robot: COCOBOT", International Journal of Innovative Research in Science, Engineering and Technology, Volume 3, Special Issue 3, March 2014.

[9] Melissa Jawaharlal, Sophia Chung, Philip Jia, Lisa Park and Grace (Yu) Qi, "Coconut Tree Climbing Device," Troy High School, Fullerton, CA.

[10] Akshay Dubey, Santosh Pattnaik, Arunava Banerjee,(2016) "Autonomous control and implementation of coconut tree climbing and harvesting robot", Procedia Computer Science 85 755 – 766.

[11] B.C.Widanagamage, T.N.Gallege, S.Salgado, J.Wijayakulasooriya, (SAITM – RSEA 2014) "Treebot: An Autonomous Tree Climbing Robot Utilizing Four Bar Linkage System", SAITM Research Symposium on Engineering Advancements 2014.