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Design and Development of Automatic Fabric Feeding and Cutting Machine for Medical Field

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Abstract:- **In this modern world, machines play a crucial role in different industries and they have replaced the need for labor work. With the tremendous development in technology dependence on manual work is decreased significantly. Some of the leading manufacturers of material handling equipment, industrial machinery from India are recognized for their high quality products. In this machinery feeding and cutting machinery also plays the important roles and the modernization and new technologies are required in this field. In the medical field according to demand and requirement on time delivery is very important. In this field the demand is consistent, so medical equipment and accessories developers try to use modern and mechatronics machinery for better accuracy and on time delivery by reducing labor and manufacturing cost.**

In this project we have tried to develop automatic cloth feeding and cutting Machine for medical field.

I. INTRODUCTION

FractoAid is an orthopedic splint which provides early and instant immobilization to the fractured limb.

- Stabilizes and restricts the motion of injured limb
- Reduces muscle pain and muscle spasm
- Accommodates the muscle swelling
- Prevents the chances of closed fracture opening

FractoAid is an integrated package of composite material enclosed in a unique liner with in-built straps of hook-loop fastener for better securement of fractured limb. The hybrid composition gives high strength to weight ratio and provides stiffness with quick setting time of 3 minutes. The functional strength is achieved within 5 minutes of time. The unique liner allows easy access of water into the splint. The layer in contact with skin is biocompatible, breathable and provides cushioning to the patient. The device provides therapeutic positioning thus conforms to the specific area of patients' extremity. The 3 step application process makes the device user-friendly.

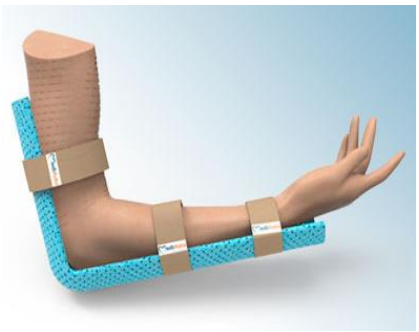

Fig:- Handicapped person uses the fabric material

Relevance /Motivation

In this modern world, machines play a crucial role in different industries and they have replaced the need for labor work. With the tremendous development in technology, it reduces the dependence on manual work. Some of the leading manufacturers of feeding and cutting machine from India are recognized for their high quality products. In the medical field the timely delivery of the product is very important so the timely delivery condition demands modernization of machinery with reduce manufacturing cost.

In this project we would like to develop automatic cloth feeding and cutting machine for medical field. The products for medical field are splint for fractured hand, splint for fractured leg, masks, hook-loop fastener for better securement of fractured limb etc.

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Sponsored company: -

MediAsha Technologies Pvt. Ltd. is a Startup industry which is certified by ISO standard ("ISO 13485:2016" certified Healthcare). This is start-up focusing on development of novel medical devices which is beneficial to society at an affordable price.

- The Company was incorporated with a vision of delivering easy solution for a healthy life by solving the required needs in healthcare sector. Team MediAsha emphasize continual improvement to meet the patient comfort. We at MediAsha strive to develop innovative medical devices which adhere to the regulatory specifications of Medical Statutory Body that satisfy customer and market requirements.

Problem Definition

In India, 10-30% of hospital admissions are due to road traffic injuries and a majority of these people tend to develop varying levels of disabilities. An accident victim may just have a fracture, but not handling the person properly while transferring them to a hospital can worsen the condition. A simple splint could prevent matters from getting worse.

Presently the company is using the manual method for cutting the raw material as per required length. To increase the production and to avoid manual interference, the sponsorship company wants the automatic cutting and feeding machine.

Literature survey: -

Yong-Seok Kim, Chan Se Jeong[1] has given information for the automatic cutting mechanism of the perforation pipes in an automobile muffler. This cutting mechanism makes continuous work possible, because it performs the batch work via the sequential operation of loading, feeding, cutting, and discharging. The proposed cutting mechanism consists of the frame unit, escape unit, turning unit, feeding unit, vision system, clamping unit, spindle/cutting unit and cooling unit. And, these mechanisms have been modularized through mechanical, dynamical and structural optimized design using the SMO (Sim Designer Motion) analysis module. Also, the virtual prototype was carried out using the 3-D CAD program. The cutting process cycle is performed in the order of loading, vision processing, feeding, clamping, cutting and discharging. And the cycle time for cutting one piece was designed to be completed in four seconds.

M.Khaja Gulam Hussain [2] author has explained about, many efforts being made for taking away the burden on the humans. For this purpose there are many efforts going on for the Automization of machines. This paper has taken up the fabrication of Automatic Feeding and Cutting Mechanism. This machine automatically feeds its stock and performs the cutting operation. It involves simple lever mechanisms. Here the power input for the machine is provided by means of a motor. It involves simple mechanisms which transfers the motion from one form to the other. This mechanism is very useful in making holes on metal sheets in industries, by changing the tool. By using this mechanism for stitching of big bags in agriculture

Shital K.Sharma1, Ashish V.Waghmare, [3] has explained about to reduce human effort for repetitive work of cutter pieces of pipes as well as providing a convenient fixture to support and hold the pipes/rods during cutting. The subject is undertaken as a part of B.E mechanical project. It can be termed as smart machine. There are many industrial applications where round bar or square bars are required to be operated on different machines to make machine components such as Shafts, Bolts, Screws, etc. This needs more and more number of pieces to be cut for mass production of those components. The bar feeding mechanism is a metal cutting machine tool designed to feed the metal. The machine is exclusively intended for the mass production and they represent faster and more efficient way to feed the metal. The clamping arrangement can be varied according to need of operations suitable. The overall system is compact in size, light weight, modular and flexible to be used in small works jobs who need batch production. The setup overall configuration can be adopted by a semi-skilled worker easily and can vary the operations by making certain small changes. The system even has the potential to add up a PLC system to control its overall working with ease and with less effort provided. This system has the potential to adopt higher level of automation if desired in future.

Mohan M, Sathish M author, [4] given information on the objective of this work is to automate the conventional power hacksaw machine in order to achieve high productivity of work-pieces than the power hacksaw machine. The automated machine the number of pieces to be cut and the length of each piece that is required to be cut. The inputs are given by with the help of a battery. The operator need not measure the length of the work-piece that is to be cut and to load and unload the work-piece from the chuck each time after a piece has been cut. The machine automatically feeds the given length of work-piece in to a chuck and starts to cut till the given number of work-pieces has been cut. which is driven by a DC motor and an IR sensor ensures that the feeding stops when the specified length has been reached. Bring about the reciprocating motion required for cutting the work-pieces. There is an electromagnetic self-weight attached with the reciprocating mechanism to provide the necessary downward force required for penetration of hacksaw blade in to the work-piece. The machine we designed and fabrication is used for cutting any shape of object like circular. According to the type of material to be cut, the cutting tool can be changed .This project givens details of pipe. This machine can be widely applied in almost all type of industries. The pipe cutting process is a main part of the all industries. Normally the cutting machine is manually hand operated one for medium and small scale industries. Automation in the modern world is inevitable .Any automatic machine aimed at the economical use of man machine, and material worth the most. The pipe cutting machine works with the help of motor .In our project small and large size pipe cutting used adjustment in various type of pipe.

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Methods of Fabric Cutting in Garment Industry,[5] During cutting, separate garment components are cut out from the fabric spreading in accordance with their shape and number determined by the marker. Fabric cutting is completed by different types of fabric cutting machines. In most of the cutting methods, a sharp blade is pressed against the fibers of the fabric to separate them. The cutting knife has to present a very thin edge to the fibers, to shear the fibers without exerting a force that will deform the fabric. The act of cutting desharpens the blade, which should be sharpened frequently. The cloth cutting types of methods are discussed on *https://clothingindustry.blogspot.com.*

Continuously cold rolled sheet products IS/ISO16162: 2005,[6]This draft standard covers the requirements of cold reduced low carbon steel sheets and strips for bending and drawing purpose and where the surface is of prime importance. It covers sheets and strips up to 4.50 mm thick both in coil form and cut lengths.. The ladle analysis of steel, when carried out either by the methods specified in relevant part of IS 228 or any other established instrumental/chemical method, shall be as given in Table 1. In case of any dispute, the procedure given in relevant parts of IS 228 shall be the referee method. When specified, the tensile test shall be carried out in accordance with IS 1608 as applicable, and the values of tensile strength, yield stress and percentage elongation shall conform to the requirements specified. Cold rolled sheets and strips shall conform to the hardness requirements specified in Table 3 and Table 5, when tested in accordance with IS 1586 and IS 1501 as applicable. However, by way of departure from these standards, a visible deformation on the back side of the specimen is permitted. The values determined in this way shall be identified by using symbols HRBm and HR30Tm, so as to differentiate these from the hardness values determined on thicker products (which are not allowed to exhibit a visible deformation on the back side of the specimen). The angle of bend and the internal diameter of the bend for the different grades of material shall be as given in Tables 6A and 6B. The axis of the bend shall be in the direction of rolling. The test pieces shall be deemed to have passed the test if the outer convex surface is free from cracks.
Mohamad zulhisyam, Bin mohd razmi,[7] author explained in Analysis on thin sheet metal feeding characteristic by a servo roll feeder, This thesis was carried out to analyses thin sheet metal feeding characteristic by a servo roll feeder. Although servo roll feeding has been seen to be very successful in conventional sheet metal forming, no significant effort has been made to enable the application of this technology to micro sheet metal forming. A metal strip in micron size is very fragile, and it may be severely deformable if an inappropriate feeding facility is deployed. A model of feeder was created and simulation was further conducted to analyses the performance of servo roll feeder in term of accuracy and repeatability during feeding process of thin sheet metal. Several parameters were changed during simulation to acquire more data about servo roll feeder performance. The analyzed showed that many factors affect the feed process in term of accuracy such as feed frequencies, feed distances and materials thickness.

Literature Summary:-

In the present literature survey information about mainly bar and pipe automatic feeding- cutting machineries/ mechanisms are discussed. In garment sector automatic machineries are available but cost and constraints are there. Specific for fabric cutting as per requirement the machineries are not available. In the present literature the maximum information is available for raw material cutting and feeding.

Literature Gap:-

The semiautomatic machines in fabric cloth industries are not available easily, also some constraints are there. Special purpose machineries are required to develop for required size and shape. In this project work we have tried to develop semiautomatic machine, which have huge scope and demand in fabric / garment industry.

Proposed work:-
Design and development of automatic fabric feeding and cutting machine for medical field.
1. Referring the Specifications for the given requirements:
i. Type: fabric material cutting and feeding.
ii. Power: - AC /DC.
iii. Man power requirement: - one operator
iv. Overall dimensions (Tentative): 1230 x 1250 x 835 mm
v. Fabric cutting: By using Cutting blade / Dies.
vi. Capacity: As per size and length of the fabric material.
vii. Selected size: - As per manufacturers chart.
viii. General Information:
Standard timing roller and microcontroller electronics circuit, feeding conveyor, control panel are selected for designing the machine.

The proposed assigned work is divided into the following phases.

Phase I: Literature Survey
A detailed literature survey will be carried out in the related area. Majorly the selected project is come under industrial field influence, So In this phase we will do small scale industrial visits, Feedbacks and problems faced by vendors.

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Phase II: Concept Generation and selection of parts

In this phase, we are going to do schematic arrangement design and drawing of major component which we can use for completion of our project. In this phase we will generate the schematic drawing on the basis of problem statement and feedback and suggestion received from end customer and vendors.

Phase III: Design calculations

In this phase we are going to do the design calculations by referring the standards, catalogue and reference books. In this work we will finalize the design and components dimensions. We are also selecting the material according to parts and components function and loading conditions. In this phase we will decide the size and shape of components and its position in the assembly. Also we will decide the limit and tolerance between components and also machining methods required to select to manufacture the components.

The detailed design and development of parts are given below-

i) Design and Development of guide roller shaft.
ii) Design and Development of fabric grip mechanism.
iii) Design of spring.
iv) Design of Dies.
v) Design of Cutting mechanism (Blades/Dies vertical reciprocating mechanism)
vi) Design and Development of guide roller.
vii) Design and Development of mechanical linkages used for cutting of fabric.
viii) Design and Development of drive shaft.

Phase IV:

Study and CAE (using CAD / CAE software's like ANSYS) analysis of different critical parts of machine.

a) Analysis of guide roller shaft, fabric grip mechanism, spring, dies, Cutting mechanism (Blades/Dies vertical reciprocating mechanism) and drive shaft.
b) Analysis of critical mechanical linkages
c) Selection and preparation of standard fabrication procedure.

Phase V:

Manufacturing :-

Selection of materials, components, bearings, Motor, Coupling and drives for automatic mechanism.
i) Manufacturing of guide roller and guide roller shaft.
ii) Manufacturing of fabric grip mechanism.
iii) Manufacturing of spring.
iv) Manufacturing of Dies.
v) Manufacturing of Cutting mechanism (Blades/Dies vertical reciprocating mechanism)
vi) Manufacturing of guide roller.
vii) Manufacturing of mechanical linkages used for cutting of fabric.
viii) Manufacturing of drive shaft.

Phase VI:

After its actual field trial and if it is found satisfactory then final report will be prepared.

Action Plan:

Phase I and phase II will be carried out during September & October 2020 respectively. During month of November and December 2021 phase II will be carried out. Phase III will be carried out during the month of January. Phase IV will be carried out during month of February 2021. Phase V will be carried out during month of March 2021 and Phase VI will be carried out during month of April 2021.

MONTH	Phase I	Phase II	Phase III	Phase IV	Phase V	Phase VI
September						
October						
November						
December						
January						
February						
March						
April						

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a] Scope

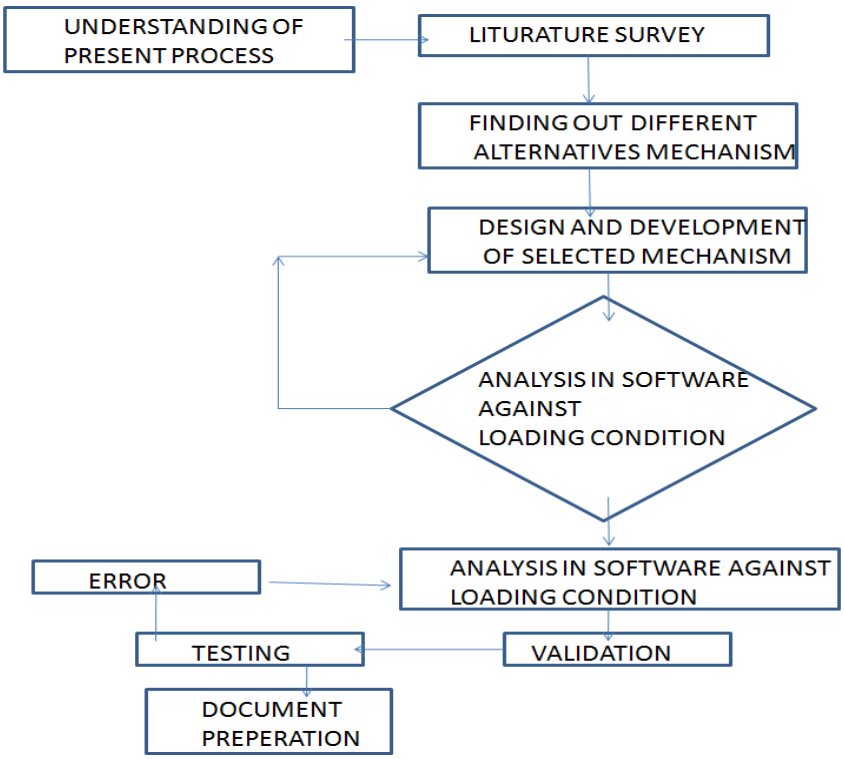
- Well definition of the problem.
- Design and development of machine logic and mechanism.
- Design of Shaft considering input parameters and loading conditions and analysis by using CAD / CAE software's like CATIA / ANSYS.
- Selection of bearing according to axial and radial load conditions.
- Suggestion of proper feeding and collection of raw materials.
- Design and development of die for specific model.
- Preparation of manufacturing drawings.
- Results & discussion on observations
- Conclusions on results

b. Facilities Available and Requirements

1. Central and Departmental Library.
2. Computer Lab and Internet Lab equipped with High speed Broadband and Lease Line.
3. Central Workshop.
4. CAD/CAE Lab equipped with UNIGRAPHICS, CATIA, ANSYS, and NASTRAN software.
5. "MediAsha Technologies Pvt. Ltd., Pune" has sponsored this project. They have agreed to extent full co-operation and permitted to use necessary workshop facilities available with them.

c. Methodology

So, in the view of above objective methodology of current research objective will be outlined as shown in the flowchart below



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c. Proposed set up:-

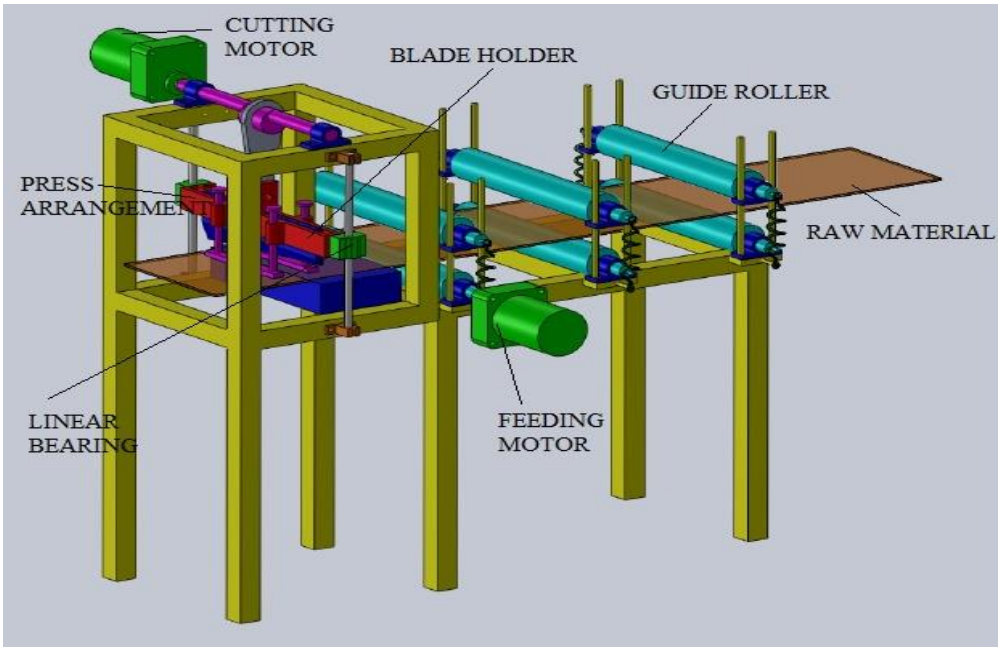

Fig:- Proposed set up

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