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Problem Identification on Bamboo Stripping Process

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Abstract: At Present the Bamboo stripping is done manually and some sort of machines are available in market but did not achieve minimum thickness of 2mm so that is the reason we are planning to develop a machine will achieve min 2 mm thicken bamboo strip using pneumatic and electrical energy as the machine is fully Automatic and operated even by unskilled labour.
Keywords: 2 mm thickness, Fully Automatic, Pneumatic, Electrical, Unskilled labour.

I. INTRODUCTION

As the modern trend is moving more towards handcrafted art and natural artifacts, the demand for such hand-crafted art has increased tremendously. To meet this increasing market demand, there is always a need for advancement in conventional production techniques so as to counterbalance the ever-increasing market demand for such handcrafted arts. India is known for many cottage industries and handicraft designs, but still, continuous efforts are required to design and produce unique handicrafts to satisfy customer demands. In most large-scale industries, production is achieved with the help of machines, but whereas in small-scale production, the manpower is a must to carry out the entire production manually, which results in an increased workload on workers, which ultimately affects production rate as well as quality. To overcome this and to minimise the stress on the worker, an attempt has been made to design a bamboo stick making machine that is simple in design and can even be handled by unskilled labor.

With the recent development of bamboo mat weaving machines, they are now an extension of the bamboo mat weaving machine for making the strips of bamboo. As previously, we designed a bamboo mat weaving machine. Now here is a design for a fully automatic strip making machine as an extension to the bamboo mat weaving machine. This machine will produce bamboo strips with more precision as well as be more productive than the conventional method of strip making. This machine will be fully automatic and operated with pneumatic actuators, as the bamboo mat weaving machine uses compressed air as a medium. In this machine we use pneumatic actuators, stepper motors, proximity sensors, knurled rollers, cutting blades, microcontrollers, solenoid valves, etc.

Bamboo, commonly known as "cradle to coffin" timber, is closely associated with the life and livelihood of human beings. So far, nearly one thousand five hundred uses of bamboo have been documented so far. The diversified uses of bamboo range from farm equipment to storage devices, from dolls to measuring tools, from furniture to decorative items. The credit for this varied utilization of bamboo goes to the bamboo artisans, who for centuries have been engaged in shaping the bamboo strips into such varied uses. Though the number of bamboo artisans in Orissa was enumerated at about 30,000 in the year 2003, as quoted by the Director of Handicraft and Cottage Industry, the actual number is fairly large and is expected to cross one lakh if thoroughly surveyed. Apart from this, quite a large number of populations get their livelihood from bamboo cutting operations in the state.

The initial processes to be done on bamboo to make it into a useful product are called "bamboo processing." The initial processes include splitting, external and internal knot removing, slicing, bamboo stick making, stick length setting, and stick polishing. Bamboo and bamboo splits are used as fencing materials and for making various types of tool handles, ladders, and scaffolding. In its natural form, bamboo as a construction material is traditionally associated with the cultures of South Asia, East Asia, and the South Pacific, to some extent in Central and South America. Bamboo sticks are used for various purposes, like building construction. Splits as well as slivers are used to make a wide range of products, such as baskets, the core of incense sticks, kites, toys, flutes, and a large number of handicraft items. They are also used to make cages for poultry, for drying, packaging, and transporting grains. Bamboo splits are woven into mats and used to manufacture mat boards.

Bamboo is a naturally occurring composite material that grows abundantly in most tropical countries. It is considered a composite material because it consists of cellulose fibres imbedded in a lignin matrix. Cellulose fibres are aligned along the length of the bamboo, providing maximum tensile flexural strength and rigidity in that direction [Lakkad and Patel 1980]. Over 1200 bamboo species have been identified globally [Wang and Shen 1987]. Bamboo has a very long history with human kind. Bamboo chips were used to record history in ancient China.

Bamboo is also one of the oldest building materials used by human kind [Abd., Latif 1990]. In Asian countries, bamboo has been used for household utilities such as containers, chopsticks, woven mats, fishing poles, cricket boxes, handicrafts, chairs, etc. There are about 35 species now used as raw materials for the pulp and paper industry.

Bamboo-based products are produced from thin strips of bamboo. There are a wide variety of such products and they have been closely associated with the development of civilizations in the bamboo-growing regions of the world for many millennia. The products may be primarily intended for agricultural use, such as baskets for vegetables or animals, and winnowing trays for cereals, or they may be household products such as baskets, trays, jars, cases, lampshades, fans, and mats. The techniques require considerable skill and experience on the part of the weavers, and the designs require innovation on the part of the designers. A bamboo-based product unit provides income generation and skills development to those that it employs. Weaving can be done on site or at home in spare time or full time. Increasing the use of local bamboo resources also encourages their sustainability. Bamboo cultivators benefit from management and benefits from bamboo cultivation.

The production of bamboo-based products is a traditional technology that has been practised for more than a thousand years and is widely distributed. Manufacturing bamboo-based products combines traditional weaving skills with modern technology. The majority of the bamboo-based industries are grouped as cottage and small-scale enterprises. There are various bamboo-based products, including sofas, dining tables, baskets, trays, jars, boxes, cases, vases, folding screens, models of animals and figures, buildings, furniture, lamps, lanterns, bags, toys, fans, and mats. Some are graceful pieces of art for decoration or enjoyment, and some of them are indispensable commodities.

The style of the products often varies according to the place of production. This natural resource plays a major role in the livelihood of rural people and in rural industry.

Bamboo is utilised for various purposes depending upon its properties. It plays an important role in the daily lives of people for house construction, agricultural tools and implements, as well as food, weaponry, etc. Besides being a convenient source of cellulose for paper manufacture and rayon, it also supports a number of traditional cottage industries. The bamboo-based industry is one of the oldest traditional cottage industries in India. The origin of this rural craft is traced back to the beginning of civilization when men started the cultivation of food crops. People started making baskets, mats, and many other household products from bamboo that was abundantly available in nearby forests. Later, tribal and rural people in the vicinity of the bamboo forest took this up as a means of livelihood.

Now, bamboo-based industries are spread in all rural areas of the country, and they provide jobs for millions of traditional workers. Bamboo is emerging as a major source of raw material for a variety of processed products, owing to its rapid growth, widespread occurrence, and numerous applications.

Bamboo has versatile uses as a building material, paper pulp resource, scaffolding, food, agriculture implements, fishing rods, weaving material, substitute for rattan, plywood and particleboard manufacture. Pickled or stewed bamboo shoots are regarded as delicacies in many parts of the country. The major user of bamboo in India is the paper industry, which consumes a sizeable proportion of the total annual production. Bamboos are good soil binders owing to their peculiar clump formation and fibrous root system, and hence play an important role in soil and water conservation. Call it green gold or nature’s band-aid, bamboo is a great protector of the earth’s health and wealth.

It is a critical element in maintaining the balance of oxygen and carbon dioxide in the atmosphere. Carbon gets trapped within bamboo forests, thus reducing carbon dioxide emissions. It also lowers the intensity of light and protects us from harmful ultra-violet rays. Bamboo exists naturally on every continent except Antarctica. It has found a niche for itself in the sea-level tropics and on 13,000-foot mountain slopes. It is a cheap, abundant resource that is recyclable and can outgrow any other plant. A 60-foot tree cut for the market takes 60 years to replace, whereas a 60-foot bamboo takes just 59 days to replace. Bamboo can tolerate diverse soil moisture regimes, can heal degraded land, stop soil erosion and help with drought-proofing. Bamboo foliage acts as a shelter for the top soil against tropical downpours and cloudbursts, while the leaf litter helps with moisture conservation by forming a soft cushion on the soil. Bamboo has an extensive underground root-and-rhizome system that effectively binds the top one foot of soil, which is critical for soil health. A single bamboo plant can bind up to six cubic metres of soil. Bamboo forests nurture wildlife. Apart from the endangered panda, the most famous symbol of bamboo forests, many birds (including monkeys and sand boars) depend on bamboo shoots. Their very survival depends on this grass. Bamboo is a good substitute for fossil fuels in the form of charcoal briquettes. Experiments indicate that the charcoal obtained from bamboo is of good quality and can be used in industrial processes after activation. Gasification with bamboo is a process in which a solid fuel is burnt at very high temperatures, between 700 °C and 900 °C, in the presence of a gasification agent such as air. By this process, the energy present in the biomass is converted into a gaseous combustible, or chemical energy. Gas products are easier to handle.

They can be used in combustion engines or gas turbines. The combustion is clean and less polluting. The resulting gas has a calorific value of 25–30% that of natural gas and is a valuable source of bioenergy for a variety of applications.

Bamboo has a number of desirable fuel characteristics, such as low ash content and an alkali index. The heating value is higher than most agricultural residues, grasses, and straw. Besides, bamboo has high biomass productivity and is self-regenerating. It can thus provide power on a sustainable and environmentally friendly basis.With the continued rapid development of the global economy and a constant increase in the population, the overall demand for wood and wood-based products will likely continue to increase in the future.

According to a FAO (Food and Agriculture Organization) global outlook study on the trends of demand for wood products, there will be an increase in demand of the order of 20% by 2010. As a cheap and fast-grown resource with superior physical and mechanical properties compared to most wood species, bamboo offers great potential as an alternative to wood. India is home to about 45% of the world's bamboo production. There are 125 species of bamboo in India, spread across 18 genera. According to a survey by BMTPC (Building Materials and Technology Promotion Council), India produces about 13.5 million metric tonnes of bamboo annually from 9.6 million hectares of land area (used only for bamboo plantation), Bamboo is a very complex material and many things affect it including.

1) Direction,
2) Moisture content (MC%),
3) Diameter,
4) Wall thickness,
5) Distance to node
6) Height,
7) Age, and
8) Species.

The strength properties of bamboo have already been tested by universities around the world and present outstanding results that are, in many cases, much superior to conventional building materials. However, building code standards require more than the strength properties of a material alone. Other properties to consider are:

a) Durability
b) Fire Safety
c) Environmental Impact
d) Energy Efficiency

II. STATEMENT OF PROBLEM

As the bamboo strips are done manually, which is time-consuming and requires a skilled worker to operate the cutter (Knief), which is used to cut the bamboo slivers into the thin strips, which are further used in our previous project, named "Design and Fabrication of Bamboo Mat Weaving Machine." That machine is capable of weaving a mat using the bamboo strips. During the market research for bamboo strip manufacturers, we found that most of the bamboo thin strips, which are less in thickness, are done manually. And we found that there is no machine for the bamboo stripping at the 2 mm thickened strip product

III.PROBLEM DISCUSSION

Traditionally, bamboo is processed in several steps, with each step requiring a different method and skilled labor, raising the product's cost. So, there is a need to manufacture a machine which can perform a number of operations. So the main goal here is to create a bamboo stripping machine that reduces the number of steps as well as the amount of money required to perform the stripping operation. Here are the traditional steps of bamboo strip making.

The below image shows how the bamboo strips are done manually as it is time-consuming and as they operate the tool manually, there is a chance of an accident happening at the time of cutting the bamboo strips as it is very risky at the time of operating where we want to achieve the 2 mm thickness of bamboo strips. As compared to the tremendous manual process, we will find out that the time required to achieve the 2 mm thickness of bamboo strips is greater than we anticipated. The following are the two steps in which the bamboo strips are processed to get the thin strips of bamboo.

A. Separate the Slivers

Fig. Separate the Sliver.

B. Cut the Slivers Into Fine Layers

Fig. Cut the slivers into fine layers

The above method is a traditional method of making bamboo thin strips, which is time-consuming and has a chance of causing accidents as the operator uses a tool (cutter knife) by hand. That is the main reason for developing this design of bamboo strip making machine, as it will be the extension of our previously developed bamboo mat weaving machine. During the research, we found some references which are previous works on bamboo processing. There is a huge market where the bamboo is processed for a wide range of bamboo products, and China is one of the top countries that has a wide range and variety of bamboo products.

IV. LITERATURE REVIEW

A. Design Development and Testing of an Integrated Bamboo Culm Splitting and Planning Machine.

Authors Rey Camillo Banawis, Richmond Elbert De Vera, Edwin J. Calilung, Ernest Shawn Quinones, and Richard Yao discussed the design of the bamboo splitting section, which was based on an existing design of a commercially available bamboo splitting machine, and the planning section, which used two sets of motor-powered portable wood planers integrated into the design, which planed the top and bottom sides of the bamboo strip simultaneously.The separation of split bamboo strips and sequential transfer to the planning section was designed by the authors and consisted of axial-mounted vanes within a cylindrical pipe that separate the split bamboo strips and move each strip sequentially to an exit slide onto a chain feeder to the planning section. The automation of the process utilised an Arduino Mega microcontroller board, which controlled a stepper motor drive and relays to control the feeding chain motor to the planning section. The testing of the individual processes of bamboo culm splitting and strip planning were However, the process of separating the split bamboo strips and sequential feeding to the planning section in the feed chain conveyor requires further improvements as misalignment problems were observed.

B. Bamboo Stripping Machine Using Pneumatic Pressure.

In this paper author, Sufiyan Ahmed Khan, P G Mehar, A V Vanalkar and S S Khandare discussed about Bamboo stripping process number of steps are involve to make Strips are: (1) Bamboo Cross Cutting, (2) Bamboo Spliting, (3) Bamboo Slicing. So the basic aim of this approach is to make a unique machine which can perform all the above processes. This can be done by pneumatic cylinder arrangement which reciprocates the bamboo holder, so that when air compress expand in the pneumatic cylinder it allow bamboo holder to reciprocates on the Horizontal blade which strips the bamboo into small pieces around 15 cm long and 1 cm to 2 cm wide and around 1 to 2 mm thick. Here bamboo holder is rectangular shape box which contains bamboo, spring pressure arrangement at the top of bamboo holder is provided. As the bamboo strikes on horizontal blade, strip is obtained.

C. Manual and Mechanised Processing Aspects for Bamboo Artisanal Technologies.

In this paper, the authors, Ranjeeta Dash and Anil Mundotiya, discussed aspects of mechanisation in the field of bamboo processing. Mechanization can also go a long way in estimating product outputs from round bamboo of different diameters () and wall thickness beside length. A schematic CFC layout has also been proposed in the present write-up to mark the beginning of mechanisation in the bamboo sector

D. Development of Experimental Set Up Of Improved Bamboo Processing Machine.

In this paper, authors K. G. Ahuja, Dr. A. V. Vanalkar, and P. G. Mehar discussed the development of an experimental set-up of an improved bamboo processing machine with the capability of doing two operations in a single unit. The details of different components, construction and working are explained in this paper. The force required to split the bamboo into 8 pieces is also included in this paper. This paper also includes the traditional process of processing bamboo.

E. Design And Fabrication Of Bamboo Mat Weaving Machine

In this paper the authors designed and manufactured bamboo mat weaving machine during the process of raw material selection this problem is discussed about Bamboo are ideal resources for development that integrates poverty reduction and environmental sustainability bamboo mat, a plywood-like wooden board made from layers of woven bamboo strips that have been pressed together, has enormous income generating potential for the rural poor, who make up the vast majority of weavers. The following technology describes how to produce bamboo mat. The bamboo mat technology is a commercially and socially effective means of processing bamboo into quality end products for the construction, packaging and transport sectors. Its development attributes imply considerable scope for income and welfare improvement for rural poor people. In addition, it enables governments and wood-based industries to cope with the problem of wood shortages and to reduce environmental degradation due to overharvesting of timber trees. If properly organised and guided by private enterprises, state agencies and/or NGOs, the technology as well as its backward and forward linkages can increase the income and welfare of many people in a sustainable manner.

V. PROPOSED SOLUTION

As considering the problem we designed a machine which is able to increase the production of bamboo stripping process as well, during design of machine the consideration of human safety is on priority which leads to minimize the accidents as well as decreases the human fatigue factor which will directly increases the production output.

At the time of designing this device, priority was given to make it as simple as possible. This would be a benefit in terms of conforming to the available manufacturing techniques on website and lowering costs so that this prototype is further produced in large quantities. This means two things: the number of parts is to be kept to a minimum and the complexity of each part should be as low as possible, at the design stage the consideration of some critical parameters is considered. These parameters are design feasibility, Automation in Design, Operator’s safety, cost of materials, Availability of material, Minimum manufacturing cost of Material etc. As during freeze the design all these parameters are analysed.

With all the points, The Freeze design is shows in Below figure.

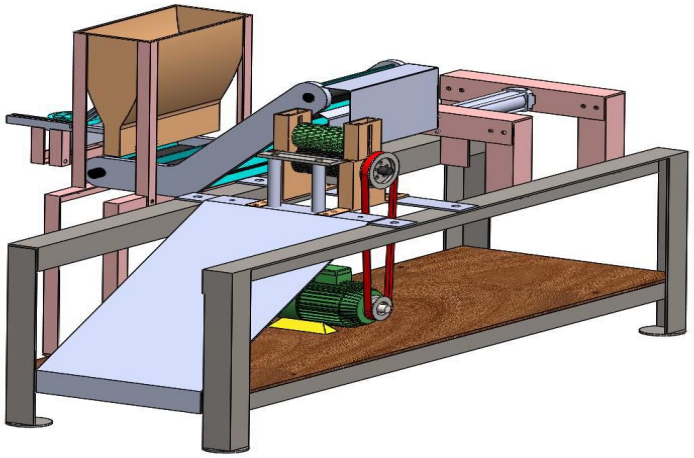


Fig. Bamboo Stripping Machine

Above Figure shows Principal parts of the machine are Frame, Pneumatic Actuator, Cutting Blade, Knurled Roller, Ball Bearing, Spring, Motor, Hopper, Belt Conveyor, Pulleys, Transmission belts, Etc. The functionality of the project is the strips are kept in hopper and then the conveyor keeps one strip and move towards the strip slot, then the pneumatic actuator move the strip forward towards the blade mounting with the help of knurled wheels. Then the bamboo strip is Divided into two parts. As well the cycle is repeated. and the whole cycle is controlled by PIC 16F877A Microcontroller. The best Advantage of these project is fully automated due to the use of PIC 16F877A Microcontroller. And due to these fully automation the human interference is eliminated.

VI. RESULT & DISCUSSION

As in the discussion, there are various types of machines available on the market, but these machines are not able to get the thin as required for the bamboo mat weaving machine, so we had the result that the problem identified has to be simplified as regards the bamboo stripping process. The machine has to be developed for the bamboo stripping process.

Below figure shows the output analysis of stripping process in which the manual stripping process time is shown in blue column & red line shows the output of stripping machine in minute. Hereby the machine is fully automatic the single operator can handle 3 machines simultaneously which leads to be increase in output as well as decrease in human fatigue. As the single operator able operate 3 machines at a time which means we increases the productivity 3 times. Which means the single input multiple output (SIMO) activity done on remaining 2 machines.

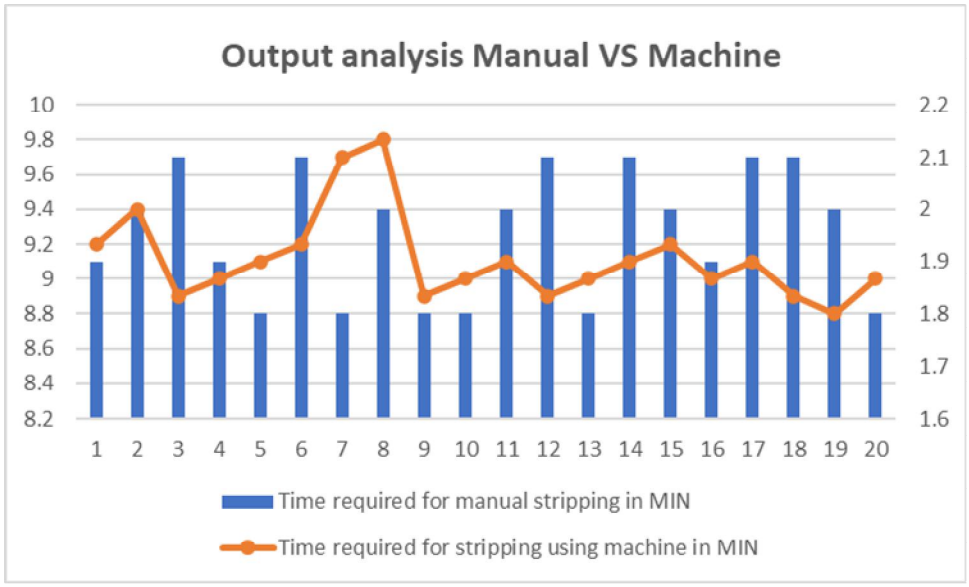


Fig. Output analysis of Manual VS machine operated stripping process.

REFERENCES

[1] "DESIGN AND FABRICATION OF BAMBOO MAT WEAVING MACHINE" Akash D. Waghmare, Amit K. Nandanwar, Ankit P. Patil, Badal B. Gawande, Tushar S. Rewatkar, Mohit V. Moon, Rahul M. Malve, , Saurabh V. Moon ,Name of the Guide: Prof. A. M. Kakde

[2] Mehar P G and Vanalkar A V (2012), "Development of Experimental Set Up of Improved Hydraulic Bamboo Processing Machine", International Journal of Engineering Research and Applications (IJERA), Vol. 2, No. 4, pp. 1572-1576, ISSN: 2248-9622, www.ijera.com

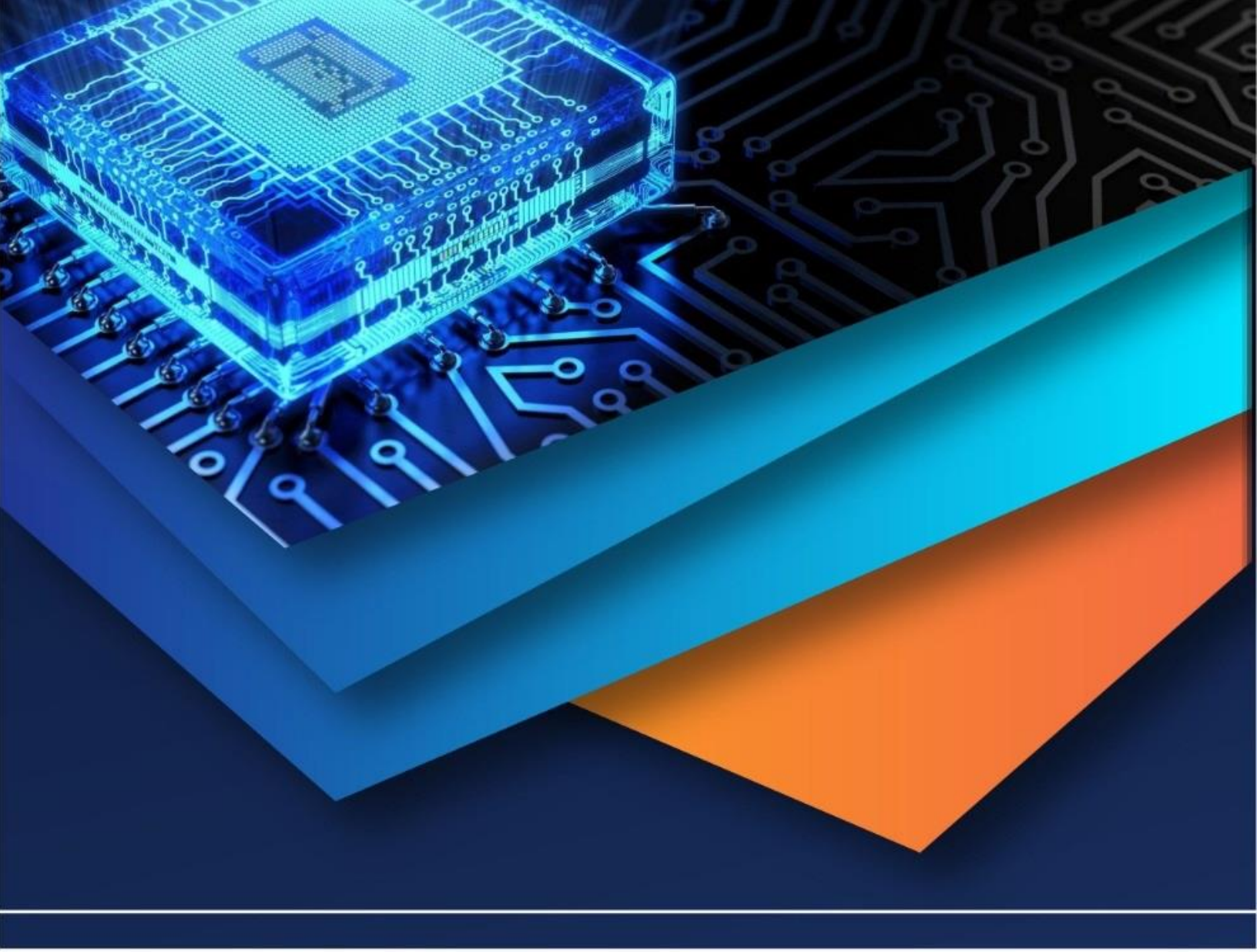
[3] "BAMBOO STRIPPING MACHINE USING PNEUMATIC PRESSURE" Sufiyan Ahmed Khan1*, P G Mehar1, A V Vanalkar1 and S S Khandare2

[4] M.B.Varma, An attempt to test suitability of bamboo strip as a structural material, Journal os structural engineering and management,ISSN:2393-8773(online),Vo;ume 2,issue 3,oct.2015,pp.60-64

[5] "Manual and mechanised processing aspects for bamboo artisinal technologies" ranjeeta dash* and anil mundotiya.

[6] Design and Construction of a Mechanized LoomA.S. Akinwonmi Department of Mechanical Engineering, Faculty of Engineering, University of Mines and Technology, Tarkwa, Ghana

[7] Marlyin waite, (fall 2009) saubstainable textiles: the role of bamboo and a comparision of bamboo textile properties, journal of textile and apparel technology and management, vol 6, 1-21.



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