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An Exploratory Examination on Small Scale Sugarcane Harvesting Machine

Amith A Kulkarni, M K Punith Prasad, Manjunatha s bilagi, Rishi J P, S A Mohan Krishna, Amruth E

Abstract*: *The work in this paper is focused , about the sugarcane harvesting machine, as India is considered as one of the higher consumers and producers of sugarcane and its by products and to due to huge population, there is a high demand of sugarcane and to meet the demand of population, large scale production has to be adopted, hence for farming and harvesting the sugarcane an automated, low cost harvester is necessary for the farmers to reduce the efforts of sugarcane harvesting and to increase the rate of sugar cane cutting. This machine will be helpful for the farmers having both small and big farms, the work on this paper was carried to identify the major options along with the opportunities and major chances for future enhancement in the field of agriculture industries.

Keywords*: Sugarcane harvesting, *Automation, agriculture, harvesting, cutters, reduction of time, manual harvesting, mechanized harvesting

I. INTRODUCTION

Nowadays, agriculture is facing a huge labour shortage due to various reasons, and to meet the agriculture demand the various machines are being used for application of the agriculture, sugarcane is one world's largest growing crops, and India is one the leading producers of the sugarcane, sugarcane is a type of crop that are found to be grown in subtropical regions, and are grown in clumps having 1.25 to 1.75cm in thickness and 6 to 7m in height, hence harvesting of sugarcane is a tedious work which is usually a series of work involving such as cutting of sugarcane and gathering it from the crop, it is usually done manually by hands using a sharp machete,

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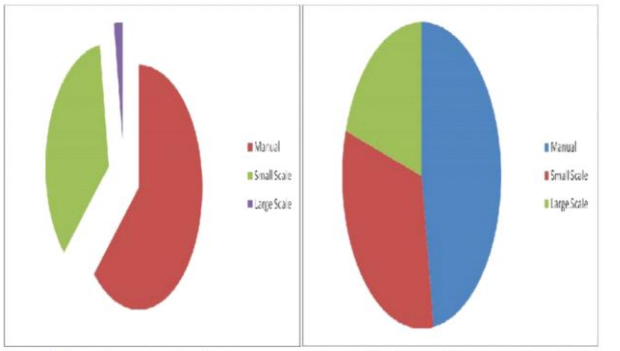
* Correspondence Author
Amith A Kulkarni*, Department of Mechanical Engineering, Vidyavardhaka College of Engineering, Mysore, Karnataka **Amith.kulkarni.54@gmail.com**
M K Punith Prasad, Department of Mechanical Engineering, Vidyavardhaka College of Engineering, Mysore, Karnataka] **punithkumar199847@gmail.com**
Manjunatha s bilagi, Department of Mechanical Engineering, Vidyavardhaka College of Engineering, Mysore, Karnataka **majunathbilagi9@gmail.com**
Rishi J P, Department of Mechanical Engineering, Vidyavardhaka College of Engineering, Mysore, Karnataka **majunathbilagi9@gmail.com**
Dr. S A Mohan Krishna, Department of Mechanical Engineering, Vidyavardhaka College of Engineering, Mysore, Karnataka **mohankrishnasa@vvce.ac.in**
Amruth E*, Department of Mechanical Engineering, Vidyavardhaka College of Engineering, Mysore, Karnataka **Amruth.e@vvce.ac.in**

which lead to minor to major cuts to farmers but the crops are exposed to harmful pesticides and untreated chemicals which may involve toxic risks, that can cause health issues to the farmers due to skin absorption or inhalation of toxic chemicals during the manual harvesting hence a small scale sugarcane harvester is required for the cutting faster rate of sugar cane providing ease to the farmers.



Number of Hours Required to Cut One Acre Total Cost of Harvesting/Acre in Rupees

II. REVIEW CRITERIA

There are various innovative machinery development in the field of agriculture and yet it is still not being used in the real time applications in the agriculture field, and the root cause being is the high cost expense, hence a system is required which is durable, dependable, and sustainable and which is affordable to the customers with low power usage must be prepared having a high capacity of cutting the sugarcane and gather it irrespective of the height and thickness of the sugarcane.

Siddaling et al, his work was focused on producing A semi-automatic sugarcane harvesting machine is designed driven by a two stroke petrol engine, the engine is placed over a rigid structure, the engine prime mover rotates the driver sprocket which in turn tends to drive the connected sprocket through the chain mechanism and as the driven sprocket is connected to a solid shaft which will rotate and transmit power to the bevel gears which is connected to the either sides of the vertical shaft which is supported by a Plummer blocks, the rotating Plummer blocks will drive the cutters, which are placed at the both the ends of the vertical shaft, and provision can also be made to ensure that the height of the shaft holding cutters are variable hence the cutters cut the sugar cane and the whole structure is placed over wheels so that the operation and handling the harvesting machine is easy for the farmers, hence the harvesting of sugarcane can be done easily with the sugarcane harvesting machine and the labours required is also less to carry out the work [1].

Vahid jamadar et al, his work was focused on designing and fabricating of a sugarcane cutting machine using an electric power sourced motor to drive the cutting process, initially a electric motor of around 1 HP was is used for producing the power required to cut the sugarcane, the electric motor can be sourced by the by battery or by using the solar panels, the motor is placed vertically in the frame plate, and the prime mover of the electric motor is connected to a power transmission device either a chain drive or belt drive based on the efficiency factor, the belt transmits power to the two vertical shafts, to which the blades are attached, and the blades tends to rotate, and the mechanical action of cutting is done by the blades, and all the devices are connected in one frame structure, and the yielding of the model is monitored by a scale, and an data collector which gathers the information collected by the data acquisition system and an global positioning system which gives digital output and the scale is connected to the weigh scale supported through differential mechanisms, and sometimes a yield sensor to predict the sugar cane yield, and some sensors to analysed the working condition and environment.

The second criteria for the design and analysis for the sugar cane harvesting machine are the various kinematic forces which are occurred due to the weight of the material and also due to the movement of the manipulator which has a mobile platform in nature, and based on the end application of the machine, which is material handling and harvesting the care must be taken to ensure the optimization of scattering of the crops which are usually horizontal in nature, hence based on the requirement the design criterion must meet the manipulation conditions and based on most of the most of the observations a multiple axis manipulator, which has high degree of independent movements can be used for the application [2].

Dr. sharad S. Chaudhary, et al their work was focused on the sugar cane harvesting machine which is driven by a high power rated engine, and by using various intermediate mechanisms to drive the machine, to increase the production rate and to reduce the labour efforts, the design of the sugar cane harvesting machine was initially done analytically and graphically in a computer based system. And based on the working condition and environment, a single controller is used to control all the devices.

Considering the end application of the expected model, the force and torque required for harvesting can be obtained using the mathematical models and the based on the end forces required, the structural analysis can be carried out using ANSYS simulation by which it be easier for the decision making on the selection of the controller for the better correspondence of the machine towards the quality of work [3].

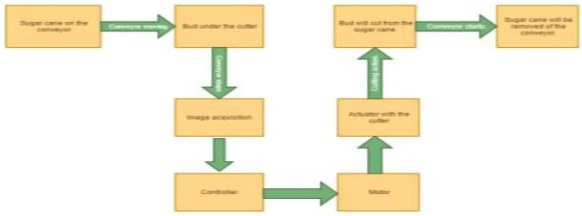
Juan Tomas Sanchez, et al their work is focused on More Power full harvester also known as the automated mechanized harvesters used for the multi operations for the sugarcane fields such as ploughing, and tiling for the water guide ways, and the other necessary process which are done initially in the fields, can be done using this type of innovative machines which can be highly beneficial comparing to the conventional method of farming and the complete model of mechanized harvester is designed considering various specifications such as kinematics, dynamics, and engine criterions for nominal or autonomous operation and the inputs are the direction control signals, and input from the inertial measurement unit (IMU) attached to primary source of power which enables to provide data for the comparison of the model using non-digital matching , the output of the system is a suitable representation for the harvester machinery, the steering of the machine is achieved by various mechanisms that allows to drive wheels with individual clutches for the direction of rotation of the wheel.

The steering system mechanism allows many benefits which gives ease to control the harvester to work in various ground conditions with ease, hence these type of machines can be utilized for the seasonal cultivation, the hand device operator can be achieved by fixing an pair of electronic actuators to control clutches, and signals are transmitted via signals, then the inertial measurement unit located at the centre senses the acceleration which is heading and the torque required for the tiller is delivered through to the diesel engine which will provide high efficiency for the cultivation [4].

Mr. sanket Patel et al designed and fabricated a very simple harvester by using a simple parts which includes two wheels connected to a frame which forms a structure for locomotion, connected to a handle to push the machine, and two constant rotating cutters for harvesting purposes, the model is analysed mathematically calculating the forces and experiment and testing was carried out experimentally [5]

P. A. Scharf et al focused on working on a highly automated sugar cane harvesting machine, which operates on the machine vision system, the machine is either rear or front wheel driven system and for driving the wheels various differential mechanisms can be used and overall control of the vehicle can be done by image processed by the machine vision system and the control and processing unit verifies whether the final level and the organizing level is not differentiated and the and final level of implementation are confirmed to give information for the final process, this type of system can also adjust to the environmental changes, and status of the body and information of position and inclinations if any and handle any emergency of the system.

For the path guidance of the machine the vision system is used which has instruments like camera which is placed at the top of the machine to have a clear vision of the area of work and also it helps to find accurate and stable navigation information from the binary output, the output consists various data and information such as the heading angle and based on the coordinates of the machine the offset from the image can be varied for the application, such as the crop edge detection, in case of variance the processing can be refined to proper stage by correcting algorithm which is in ladder type programme, the programme after correcting ensures that the image processed is compared to the specification and then the algorithm converts the grey scale image to the binary format and based on this format the machine ensures proper functioning of the process in agriculture applications.[6].



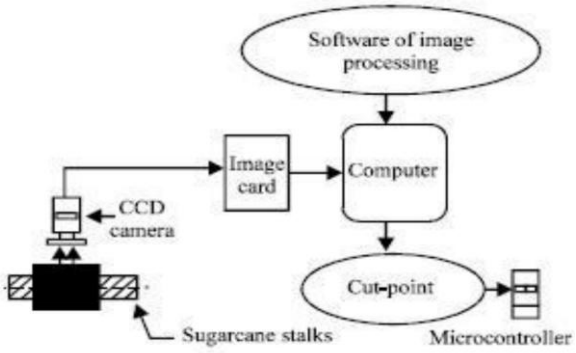
Adarsh J Jain et al , the authors work focuses on designing the mechanization of small scale sugarcane harvesting machine, various parts with different mechanisms are mounted on a strong chassis, where the wheels are attached on the sides of the frame to move the in fields , the petrol engine is mounted on the top of the chassis, which transmits the power to the cutters through the transmission devices, the gear box and the shaft which are connected to wheels and cutter are interconnected by means of gears and chain or belt transmission mechanism to provide variable speed, the output shaft of the engine is connected to pulley, which in turn drives the gear and then the belt through which the power is connected to the cutters [7].

Amit s. lomate et al their methodology focused a simple mechanism which can be attached at the end of the tractor, as the tractor has a high power take off [PTO], using this power from the tractor this mechanism is actuated, the mechanism includes a cutter driven by the belts, which are connected to the shaft of the tractor engine, hence it provides more than enough power to the cutter blades for the cutting process of the sugar cane [8].

In recent years as there is a rise in population the regular traditional methods of agriculture practises has not able to meet the demands of the consumers and to meet the demands of customers the traditional practises have to be replaced and renovated which can be done by E agriculture practises which includes innovation in the field of the agriculture such as automation and robotics, the inclusion of these in the agriculture has led to faster productivity, as the reason being is the multifunction applications such as the ground preparation, soil treatment and reduction in greenhouse gases in some part of machineries and then post harvesting and gathering, all the tasks are completed under higher accuracy and monitoring hence the automation leads to reduction of wastage of energy and environmental hazards [9].

kiran bhange et al, the worked on automated sugarcane cutting machine using image processing by using charged coupled devices [CCD] camera, image card, software of image processing, and a computer or controller , the components are connected to each other through either wireless network, or through elongated wires, and it includes various sensors.

Water management is one of the major problem in the agriculture, as the water consumption for the crops is utmost important key factor, and some regions have water scarcity due to climatic or seasonal changes hence considering all the inputs a single solution is to include mechatronic formation in the agriculture system, which collects the data from the sensors, process the data and provides the necessary actions based on the data obtained, the water wastage can be reduced by using some additional instruments in the machinery such as the soil sensor, humidification sensors, by which the transpiration and evaporation of water can be reduced and data obtained by these sensors helps in decision making which and for every short period of time, the inputs are again gathered for regular monitoring of the climate or change in the temperature hence sensor technologies provide benefits in reduction of water wastage and helps in improving the irrigation of crops. [10].



And, along with the use of ICT (information and communication technology) in the field of agriculture is an additional benefit as it provides information for the farmer about the various crops, weather, and production and cultivation methods, usage of fertilizers and elimination of seeds and increasing the plant nutrients and the usage of water for these to implement the knowledge of E-agriculture is necessary, as the E-agriculture provides the complete knowledge about reducing the wastage and improper methods and fills the gap for the procedure to increase the productivity and increasing the quality of growth, by using rational unfined process (RUP) an two way interactive method having modelling language for the design, documentation, and construction for the development of software, the RUP method uses a fl8ow process to describe the process in detail, the RUP has 4 phases, the initial phase is the idea inception phase where it is decided what to do, and required procedure along with the required material for the work, and then the projection elaboration which is the second phase in which the structure of the basic software architecture is built, the third phase is dedicated to software construction and testing and the fourth phase is representing the software transition in which the software comparison and validation is carried out, and with these combined, then the visual modelling can be performed for the quality of crop growth hence it is highly recommended for the quality hence it is highly beneficial for the farmers [11].

III. RESULT AND DISCUSSION

Based on statistics and general information the traditional or conventional method agriculture practises must be replaced with the major automated changes , and in case of sugarcane harvesting it is process to be automated and modernized as it is a tedious work to be carried out manually, the optimum performance through the sugarcane harvesting machine provides a stability in economic consideration and will help the farmers having both small and big farms, as it is feasible and cost of the model for the sugarcane harvester is also less and based on the output of the machine the investments on the machine will be returned in a short period of time,

and most of all it repl8aces the harm to the farmers which is caused by the sharp machetes during manual harvesting, and by using solar powered sugarcane harvesting machine encourages the conservation, and increases the scope of renewable source of energy [12].

IV. CONCLUSION

The aim of this paper was to increase productivity of the crop and reduce the cost, time incurred and human efforts.

And this can be done by incorporating the automation and various smart farming methods and procedure along with the E-agriculture techniques, farmers can change the agriculture trend of action according to the necessity of crop, climate conditions, and ground conditions, etc. the sugarcane is one of the important and major growing crop in India hence the utilization of time and crop according to the necessity is a must.

- Still, needs to explore the applications of automation in agriculture safety and appropriate selection of various materials for the agriculture machinery.
- Still, needs to explore the applications of various renewable sources for the powering the various automated agriculture equipment's.
- By the application of mechatronics and E agriculture system it will lead to high productivity and good quality and quantity of crops.
- Still, need to explore the various other smart farming methods such as hybrid farming. Which may lead to efficient product and less wastage of energy and provide other external data such as humidity, temperature etc, which will be helpful in decision making

REFERENCES

1. N.M. Pachkhande, Dhiraj V. Rade, Vikas G. Nagapure "SMALL SCALE SUGARCANE CUTTER MACHINE", International Journal For Engineering Applications and Technology, Manthan-15, ISSN: 2321-8134S.
2. Sakai, M. Iida, and M. Umeda, "Heavy material handling manipulator for agricultural robot," in Proceedings 2002 IEEE International Conference on Robotics and Automation (Cat. No. 02CH37292), 2002, vol. 1, pp. 1062–1068.
3. G.D Shelke, S.S Borikar, M.P Awathale, A.P Khante ," DESIGN OF SUGARCANE HARVESTING MACHINE" International Journal for Innovative Research in Science & Technology, Volume 1 , Issue 11 , April 2015, ISSN (online): 2349-6010
4. "Design and Fabrication of Multipurpose Robust Cutting Machine for Agriculture" (2011-2012 Project Report) (Retrieved on April 17, 2013).
5. A. Ruiz-Canales and M. Ferrández-Villena, "New proposals in the automation and remote control of water management in agriculture: Agromotic systems," Agric. Water Manag., no. 151, pp. 1–3, 2015.
6. Suleiman Samaila, Hamid Mohammed Al-Sharief and Salihu Ahmed Abdulkadir "Development of a Tool to Determine the Energy Required to Cut and Top Sugarcane." AU J.T. 16(1) 59-62 (Jul. 2012)
7. Makrand Patil, P. D. Patil, Optimization of blade angle for cutting system of sugarcane harvester,International indexed and referred research journal, march 2013,ISSN-09753486,vol-4
8. S. Singh, I. Chana, and R. Buyya, "Agri-Info: cloud based autonomic system for delivering agriculture as a service," arXivPrepr. arXiv1511.08986, 2015.
9. G. R. Mendez and S. C. Mukhopadhyay, "A Wi-Fi based smart wireless sensor network for an agricultural environment," in Wireless sensor networks and ecological monitoring, Springer, 2013, pp. 247–268.
10. M. Arroqui, C. Mateos, C. Machado, and A. Zunino, "RESTful Web Services improve the efficiency of data transfer of a whole-farm simulator accessed by Android smartphones," Comput. Electron. Agric., vol. 87, pp. 14–18, 2012.
11. N. D. Shingarwade and S. C. Suryavanshi, "Performance Evaluation of Cloud Based Farm Automation," in 2017 International Conference on Computing, Communication, Control and Automation (ICCUBEA), 2017, pp. 1–6.
12. J. Xue and L. Xu, "Autonomus agricultural robot and its row guidance, " in 2010 international conference on measuring technology and mechatronics automation, 2010, vol.1,pp.725-729
13. Juan Tomás Sánchez "SUGARCANE MECHANICAL HARVESTING FUTURE APPLICATIONS IN THE SUGAR BUSINESS IN CUBA" Cuba in Transition ASCE 2011
14. A C Lynn Zelmer "MECHANICAL SUGARCANE HARVESTER", series editor

AUTHORS PROFILE

Amith A Kulkarni, Department of Mechanical Engineering, Vidyavardhaka College of Engineering, Mysore, Karnataka

M K Punith Prasad, Department of Mechanical Engineering, Vidyavardhaka College of Engineering, Mysore, Karnataka

Manjunatha S bilagi, Department of Mechanical Engineering, Vidyavardhaka College of Engineering, Mysore, Karnataka

Dr. Rishi J P, Assistant professor (B.E, M tech, PhD)
Department of Mechanical Engineering, Vidyavardhaka College of Engineering, Mysore, Karnataka

Dr. S A Mohan Krishna, Associate professor (B.E, M tech, PhD) Department of Mechanical Engineering, Vidyavardhaka College of Engineering, Mysore, Karnataka

Amruth E, Assistant professor (B.E, M tech)
Department of Mechanical Engineering, Vidyavardhaka College of Engineering, Mysore, Karnataka