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Smart Turmeric Harvester

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Abstract: ***Turmeric is a very important spice in India, which produces nearly the world's crop and uses 80% of it. Harvesting is the process of gathering ripened crops from the field. The general practice of harvesting is to dig out the rhizome manually with the help of hand tools. This type of harvesting causes damage to rhizomes. It is a difficult task for the farmers to get the required labor force during the harvesting season. Delay in the harvesting process results loss in the yield and also the quality of rhizomes is affected adversely. So, it is necessitate the need to develop a suitable mechanical harvester for turmeric, which helps farmer to harvest turmeric with minimum losses within a specific time by reducing the human effort as compared to manual effort. This machine consists of digging blade, wheel, motor and blade driving unit. The machine starts moving as soon as the device is powered up. This harvesting technique leads to the development of mini tractor in order to reduce the efforts of human beings and also it increases the digging efficiency.***

Keywords: ***Mechanical design, Speed control of dc motor, Turmeric Harvester.***

I. INTRODUCTION

Turmeric is one of the most important spice crops which earns sizable foreign exchange through the export of its end products. Turmeric with its brilliant yellow color has been used as medicine, dye and flavoring since 700 BC. Marco Polo described Turmeric as "a vegetable with the properties of saffron, yet it is not really saffron". Turmeric has been used as a medicine throughout world to treat liver and stomach ailments. It was used as a cosmetic and also used externally to heal sores. Turmeric cultivation is widely done in India. India is the world's leading producer of turmeric. It is also called as 'Indian Saffron'. Erode in Tamil Nadu is known for the production of turmeric in its peak in the southern part of Asia. India stands seventh in the production among the top producing countries in and around Asia. India is the largest producer of turmeric with 80% of turmeric production and about 60% of the world's export[13]. Harvesting of turmeric is labor intensive and requires skilled labor to dig out the rhizome. The non-availability of such skilled labor and high wages demanded by them to harvest the crop, the higher field losses and damage to the crop by manual harvesting, so there is a necessitate the need to develop a suitable harvester for turmeric. Almost 60% of the cost is spent in harvesting. The aim of the project is to develop a harvester for turmeric which will not damage the rhizome of the turmeric stem. This harvesting machine will simply the efforts of human beings and also reduces the harvesting cost and harvesting time [2], [8],[9]. The size of the harvesting machine is reduced to make it convenient. This makes it distinct from other available harvesters.

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II. PROPOSED SYSTEM

The embedded based harvester consists of a shaft connected to digging blade, wiper motor, and speed control circuit of dc motor. This machinery will move with the help of dc motor while operating. The digger pulls up the turmeric clumps and loosens the soil from the clumps with the help of blades [1], [7],[10]. Then the turmeric is left in the field. The space between the rows must be 2 -3 feet, lengthy ridges and furrows and most opted to field with drip irrigation system [4],[5].

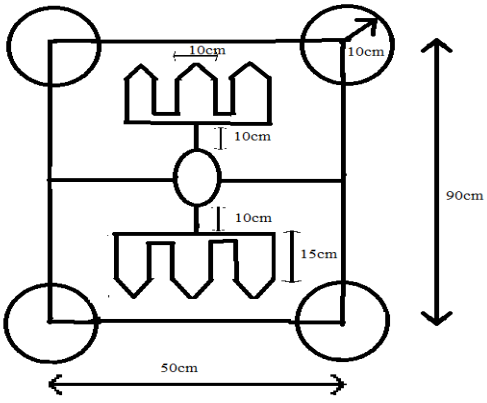

Figure 1. Mechanical Design

The mechanical design of proposed system is shown in figure 1. The machine consists of a main frame having dimensions 50x90cm for mounting digging blade, power transmission system and depth gauge wheel. Digger blade having length and width of 15cm and 40cm respectively. Two digging blade was mounted at the center of the rod which is of length 50cm. Four depth gauge wheels having diameter of 25cm

were mounted at both sides (front and rear side) of the main frame with the spacing between two rear wheels are 50cm and spacing between two front wheels are 50cm. Based on the requirement, the length of the blade can be varied by adjusting the screw attached to it.

A. General Requirements

The power unit of the machine must be able to pull the harvester at the required speed under full load. A row spacing of 45cm which is normally adopted for most of the turmeric varieties was considered for design calculation. The blade should be able to penetrate the required depth of 20cm in the soil to dig out the whole rhizome clump. Cut the stems off an inch or so above the mass of rhizomes.

B. Block Diagram of Turmeric Harvester

The harvester starts moving when it is powered up. This turmeric harvester consists of two ON/OFF buttons (user control inputs). One is used for blade movement and other one is for wheel movement. When the wheel switch is ON the harvester starts moving in forward direction through pulley attached to the motor and similarly for blade. Speed of the wheel and blade unit can be varied by adjusting the potentiometer (speed control circuit). There is a separate speed control unit for wheel movement and blade movement. And also a separate wiper motor for each. The wiper motor starts from the power supply of 12V battery. If the blade switch is ON, the digging blade is activated through pulley (chain and sprocket) attached to the motor and it starts uprooting the turmeric and the rhizome of the turmeric is left in field and it can be collected by using some women labors. In flat surfaces, the machine runs in smooth manner and in case of ups and downs the length of the blade is adjusted with help of screw attached to it [3], [11]. The concept of this harvester is shown in figure 2.

Sprocket Ratio Formula(R) = Driven / Driver

R = Sprocket Ratio

Driven = Number of teeth on driven sprocket

Driver = Number of teeth on the driver sprocket

This ratio tells how many times the driven sprocket turns for every revolution of the driving sprocket. From this, we can calculate revolutions per minute (rpm) for the driven sprocket.

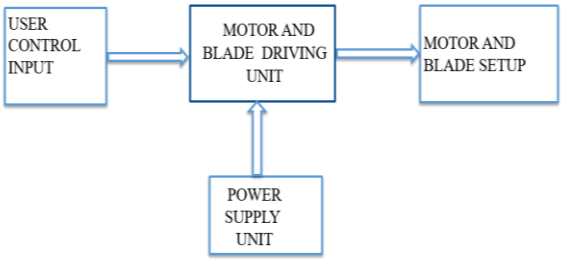

Figure 2. Block Diagram of Turmeric Harvester

C. Speed Control of DC Motor

The time taken for any operation can be reduced by increasing the speed of operation, but it should be optimized for better operational performance. Depending upon the machine speed, the field capacity also varies. While increasing or decreasing the forward speed of opeation, care should be taken to ensure completing harvesting operation and rhizome free from damage. The 555 Timer is capable of generating PWM signal when set up in an astable mode. In the astable mode, the IC works as a free running multi vibrator. The output turns high and low continuously to give pulsating output as an oscillator. In this circuit, the DC motor is operated by a 555 integrated circuit. In figure 3, IC555 is being operated in astable mode, which produces a continuous HIGH and LOW pulses. In this mode, the 555 IC can be used as a pulse width modulator with a few small adjustments to the circuit. The frequency of operation of the circuit is provided by the passive parameters of resistances and capacitors attached to it.

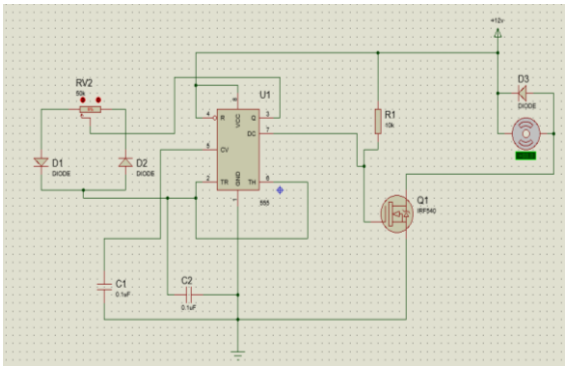

Figure 3. Speed Control Circuit

Pulse-width modulation (PWM) as it applies to motor control, is a way of delivering energy through a succession of pulses rather than a continuously varying analog signal. By increasing or decreasing pulse width, the controller regulates energy flow to the motor shaft. The motor's own inductance acts like a filter, storing energy during the ON cycle while releasing it at a rate corresponding to the input or reference signal.

III. RESULTS AND DISCUSSION

Performance evaluation of the developed turmeric harvester was carried out in a field and the mechanical set-up is shown in figure 4, 5 and 6. The mechanical set-up is having digging blade, motors, speed control unit and battery. This smart harvester starts moving in forward direction when the switch is ON. In addition, the blade starts rotating when the blade switch is ON.

Figure 4. Front View of Mechanical set-up

Figure 5. Top View of Mechanical set-up

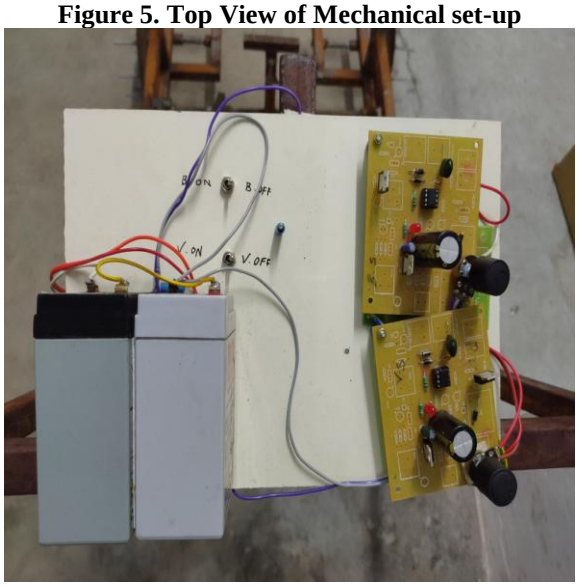

Figure 3.3 Speed Control Circuit

IV. CONCLUSION ND FUTURE SCOPE

The harvester developed by the proposed system consumes less energy than the existing system. The efficiency is increased and it reduces the damage to the rhizome of the turmeric. The proposed system consumes less time and less manpower compared to existing system. In addition, this process consumes less money because it utilizes less manpower. It is very helpful to farmers and reduces their risk and expensive. Cost is economically low and reduces human needed power. The harvester can also be used as a ploughing tool in small and medium farms [6]. The system can be made more effective by upgrading it. The machineries cause loss of energy in digging unnecessary areas. It can be overcome by using image-processing technique [12]. Thus, the unnecessary energy consumption is avoided. This technique can be used for accuracy of digging and also prevent damages to turmeric rhizomes. It provides an alternative approach in harvesting mechanism.

REFERENCES

1. Khambalkar, Vivek & Kalbande, Surendra & Thakare, S & Khambalkar, Shilpa & Rajput, M. “An Apparatus for Up-Rooting of Turmeric Rhizomes”, ACTA SCIENTIFIC AGRICULTURE (ISSN: 2581-365X), 2019, Pp.182-189.
2. Nagendra, Kawale, et al. “Development and Evaluation of Tractor Drawn Ginger Harvester Cum Elevator.” *International Journal of Current Microbiology and Applied Sciences*, vol. 7, no. 12, Dec. 2018, pp. 1942–49. *DOI.org (Crossref)*, doi:10.20546/ijcmas.2018.712.224.
3. Department of Mechanical Engineering, University of Derby, Derby, UK, et al. “DESIGN OF MINI COMBINED HARVESTER.” *Journal of Production Engineering*, vol. 20, no. 1, June 2017, pp. 55–62. *DOI.org (Crossref)*, doi:10.24867/JPE-2017-01-055.
4. Manjeet Prem, Nikhlesh Kumar Verma, K. L. Dabhi, R. Swarnkar,
5. ‘A Critical Study on Crop Harvesting Machines’, An International Refereed, Peer Reviewed & Indexed Quarterly Journal in Science, Agriculture & Engineering,Vol: 07, OCT-2017, pp. 63-68.
6. Sharma P.K, Kasar S.V, ‘Review Paper on Crop Harvesting Machine’ International Journal of Advance Engineering and Research Development Vol. 3, Issue 12, December -2016.
7. Sakhale C.N, Waghmare S.N, ‘Multipurpose Farm Machine’, International Research Journal of Engineering and Technology (IRJET) Vol. 03, Sep-2016.
8. Amare, Dagninet. “Potato Harvester for Smallholder Producers.” *International Journal of Mechanical Engineering and Applications*, vol. 3, no. 6, 2015, p. 103. *DOI.org (Crossref)*, doi:10.11648/j.ijmea.20150306.11.
9. Khambalkar V.P, and Agrotechnol ‘Development of machine for turmeric harvesting’, Third International Conference on Agriculture & Horticulture vol. 5, 2014.
10. Chitra R, Shoba N, Jansirani P, Saravanakumar D, ‘Standardization of processing method for high dry yield and quality of turmeric’ in Symposium on Spices, Medicinal and Aromatic Crops SYMSAC-VII, 2013, pp.224.
11. S.Sathesh, S.Maheswaran, P.Sivaranjani, B.Vivek, P.Priyadharshini, Smart Robot for Coconut Maturity Level Identification and Harvesting Using Embedded Linux" , International Journal of Applied Engineering Research, ISSN 0973-4562 , vol. 10, no. 93, 2016.
12. Ademosun O.C, Adewumi B.A, Olukunle O.J Adesina A.A, Development of Indigenous Machines for Weeding and Grain Harvesting: FUTA Experience. FUTAJEET, vol. 3, no. 2, 2013, pp. 77-84.
13. S Maheswaran, R Asokan, RP Karthik, S Sathesh , “Embedded System Based an Automatic Coconut Deshusker with Identification of Decay in Copra for Export packaging” International Journal of Printing, Packaging and Allied Sciences, vol.4, no.1, 2016, pp. 592-601.
14. Maheswaran Shanmugam, Ramasamy Asokan, “A machine-vision-based real-time sensor system to control weeds in agricultural fields”, Sens. Lett., vol. 13 ,2015, pp. 489–495.

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