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Abstract

About 75% of people in India depend on agriculture. This project is an environmentally friendly and non-polluting business, which includes agricultural cultivation, planting seeds, harvesting and spraying pesticides, etc. We can reduce a lot of energy and time using this tool. Bridging the gap between farmers and the adoption of technology in agriculture is very important. Energy demand is one of the main areas for our country. Finding a solution to meet the energy demand is a big challenge for social scientists, engineers, entrepreneurs and industrialists of our country, the use of non-convective energy is the only alternative solution to the convective energy demand. Now this unconventional energy concept and technology is becoming popular for all kinds of development. One of the main areas where we find many applications in agriculture is where we produce multi-purpose agricultural machines, new innovative models that are generally used for tillage, seeding and irrigation. This project aims to design and develop a multi-purpose agricultural system capable of carrying out various agricultural tasks such as planting, planting, managing and harvesting. The device is powered by solar energy and is environmentally friendly and energy efficient. The proposed design has a light and compact structure equipped with solar panels, batteries and electric motors. The machine works on a remote control system, which allows the user to control its movements and performance functions according to specific agricultural tasks. The project aims to enable small-scale farmers with limited access to conventional farming equipment to increase productivity and yield while reducing labor costs and environmental impact. Agriculture is an important sector of the economy in many countries. Farmers are always looking for ways to improve productivity, efficiency and profitability. Using solar powered multi-purpose farming machines can help farmers achieve this goal. This research paper explores the design and implementation of solar powered multipurpose agriculture. The machine is capable of performing various agricultural operations such as ploughing, planting, fertilizing and harvesting. The article also discusses the benefits of solar energy in agriculture, including cost savings and environmental sustainability.

Keywords: Agriculture, solar powered, seed sowing, fertilizer spraying, Weed cutting.

1. Introduction

Agriculture has been the backbone of the Indian economy and will continue to be so for a long time. A man without food for three days will quarrel, fight for a week, and die for a month or more. Agriculture is a branch of applied science. Agriculture is the science and art of farming which includes cultivating land, producing crops and raising livestock. It is the most important enterprise in the world. Using solar powered multi-purpose agricultural machines can be a great way to increase efficiency and reduce costs in agricultural operations. These machines are designed to be versatile and can be used for various tasks, from planting to harvesting, they are powered by solar energy, which

is a renewable and sustainable energy source. These tools are used for land preparation, sowing, weeding and harvesting. Modern agricultural techniques and tools are not used by small land holders because these tools are very expensive and difficult to obtain. By adopting scientific farming methods we can get maximum yield and quality crops which can save the farm from going bankrupt but most of the farmers still use primitive farming methods due to lack of knowledge or lack of investment to use modern equipment. These machines are designed to be efficient and cost effective, and can help farmers increase employee safety. The project is an eco-friendly and pollution-free operation and is carried out in agriculture such as intercropping, sowing of seeds, well drainage and spraying of pesticides etc. By using this machine we can reduce most of the human power and time. Bridging the gap between farmers and implementation of technology in agriculture is very important. Energy demand is one of the key issues for our country. Forming machine in agricultural implements is fitted with rotary tiller which gives easy resistance to all farming activities. Forming machine mainly used for cultivation, seeding, spraying and leveling of land. However, it is mainly used for seed preparation in lowland paddy fields. It is also used as a power source or other sowing and fertilizer application in agricultural fields.

- Multipurpose, can carry out cultivations operations
- consisting of ploughing, cloud breaking, sowing, fertilizing, levelling, weeding, weedicide application
- Manuring: The nutrients are provided to the seeds at regular intervals. Manure is the decomposition product of plant and animal wastes.
- Weeding: Weeds or unwanted plants are removed using weedicides or removing them manually.
- Soil preparation: The soil is plowed, leveled and manured before sowing the seeds.
- Sowing: Seeds of good quality are sowed or dispersed in the soil.
- Our equipment is completely flexible for smooth assembly and disassembly
- The number of people required is decreased excessively, which in flip reduces labor charges.

2. Design

Multi-purpose agricultural vehicle with four-wheel drive and roof drive. It is designed so that it can go to the field without affecting the track. Each of the four legs has a motor-mounted wheel, each with the same 300 rpm to prevent unwanted tracks from escaping. A remote controls this motor. Basic movements like forward, backward, left and right. The sprinkler mechanism is attached under the roof. Multipurpose agricultural machinery is designed to perform various agricultural operations such as ploughing, planting, fertilizing and harvesting. The device is solar powered, stored in batteries for use during low sunlight. The design of the device is simple and can be easily assembled and disassembled. This machine is equipped with various tools and equipment, including plows, seed drills, fertilizers and harvesters.



Fig.1:-Multipurpose agriculture machine using solar energy

2.1. Weed cutting mechanism

It is a robotic hand like structure with three servo motors allowing three degrees of freedom. As soon as a weed is detected, the hand targets the weed with the bounding box's coordinates. The servo motors align at different angles based on the calibration between them and the weed coordinates.

2.2 Ploughing mechanism

The number one reason of ploughing is to turn over the top layer of the soil, bringing clean vitamins to the surface, while burying weeds and the stays of preceding vegetation and letting them breakdown. As the plow is drawn through pressure withinside the form of torque implemented on the motor's shaft..

2.3 Water sprinkling mechanism

The control system is used to regulate the water flow and ensure that the right amount of water is delivered to the land. It can be operated manually or using an automated system. The nozzles are attached to the sprinkler heads and are responsible for controlling the flow of water. They can be adjusted to deliver different amounts of water depending on the needs of the land.

2.4 Soil moisture analysis

By monitoring soil moisture levels, farmers can avoid over-watering their crops, which can be wasteful and expensive. This can also help reduce the risk of waterlogging and other problems associated with excessive soil moisture. Soil moisture sensors are an essential tool for agriculture, allowing farmers to monitor soil moisture levels and optimize crop growth and yield. By providing accurate data on soil moisture content, these sensors can help farmers make informed decisions about irrigation, fertilization, and other management practices, ultimately leading to more sustainable and profitable farming practices.

2.5 Seed Sowing Operation:-

Seed sowing is the process of planting seed. Tradition method of seed sowing based on assumption of seed to seed spacing & depth of placement which is not efficient & it required lot of timed effort to. Some time it results in backache of farmer.

2.6 Spraying operation

Spraying of pesticides is an important task in agriculture for protecting the crops from insects. Farmers mainly use hand operated or fuel operated spray pump for this task. This conventional sprayer causes user fatigue due to excessive bulky and heavy construction. Due to that reason we design and fabricate a model that is basically trolley based solar sprayer.

the operation of Solar based multipurpose purpose farming machine. The solar panels which are observed the solar radiation in the form of heat energy or DC. This DC is stored in battery charged circuit. There is steady static blade is used at rear side of machine with shaver blade. But in this machine we modified the tooling system is steady into rotary which is driven by Electric dc motor with producing the torque. This consist of a solar panel and it generates energy to run this machine the solar radiations are immerse on Solar panel by this process the solar energy is converted into electrical energy is stored in a battery then the battery passes electric energy to controller kit, when controller kit is energized we can minimize or maximize motor speed as per our need. After controller kit gets it supply to run motor, when the motor runs and finally work is done by rotor where there is turn machine we can turn it easily ,can be charged from solar panel or alternatively by direct electrical source. Here we are using DC motor To run the DC motor, the supply is taken from the battery. Energy required for spraying purpose will be supplied from

battery. Motor shaft is arranged to place vertically, gear system makes conversion of vertical rotation into wheel movement in forward direction. The required energy will be drawn from battery. Seed container is used to store the seeds. Lever is fitted to close the seeds after the seed sowing. The blade is rotated in clockwise direction but the shaft rotates in anti-clockwise direction to develop a torque. The whole machine requires the 12V battery to operate the system. In the absence of solar energy we can use alternative source of supply.

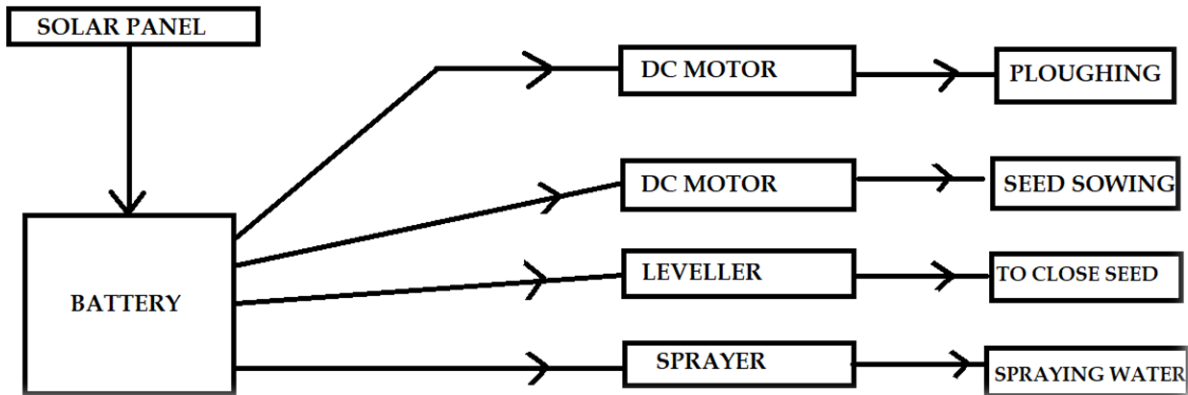


Fig.1:-Block diagram of machine

3. Conclusion

Multi-Purpose Agricultural Machine using solar energy. It aims to carry out various agricultural operations using various components such as motors and drive mechanisms. The various components required to build multi-purpose agricultural equipment are designed as planned. A multi-purpose agricultural vehicle is a single system that can perform many operations, such as planting, watering, cultivating, solar multi-purpose agriculture, and can be a good way to improve efficiency and reduce costs in agriculture. It is powered by solar energy which is a renewable and sustainable energy source. Designed to be efficient and cost-effective, it can help farmers increase yields and reduce operating costs. It can also help reduce the need for manual labor and improve worker safety. However, these machines can be expensive to purchase and maintain and require special training for operators. In addition, it may not be suitable for all types of agricultural operations and may require additional attachments or accessories to perform certain tasks. Despite these disadvantages, solar powered multi-purpose farming machines can be a great way to increase efficiency and reduce agricultural costs. The use of solar powered multi-purpose farm machinery can help producers increase efficiency and profitability while reducing environmental impact. . Solar powered machines are stable, economical and easy to maintain. As the world faces increasing pressure to combat climate change and improve sustainability, the adoption of solar farm machinery is an important step towards achieving these goals.

4. Future scope

The future scope of a multipurpose agriculture machine using solar energy is quite promising. As we move towards a more sustainable and eco-friendly future, the use of renewable energy sources such as solar energy is becoming increasingly important. A multipurpose agriculture machine that runs on solar power has the potential to revolutionize the way we farm, by increasing efficiency and reducing the carbon footprint of agriculture.

Here are some potential benefits and future applications of such a machine:

1. **Increased Efficiency:** A multipurpose agriculture machine that runs on solar power would eliminate the need for traditional fuel sources, reducing costs and improving efficiency. This would allow farmers to increase productivity while minimizing environmental impact.
2. **Reduced Carbon Footprint:** By using solar energy, the machine would produce zero emissions, making it an eco-friendly option that would help to reduce carbon emissions and combat climate change.
3. **Versatility:** A multipurpose agriculture machine would be able to perform a wide range of tasks, from planting and harvesting crops to tilling soil and spraying pesticides. This versatility would allow farmers to save time and resources while improving their overall yield.
4. **Remote Monitoring:** With the help of IoT (Internet of Things) sensors, the machine's performance can be remotely monitored and tracked, allowing farmers to make real-time adjustments to optimize its efficiency.
5. **Cost-Effective:** As the cost of solar panels continues to decrease, the cost of solar-powered agriculture machines will also decrease, making them a more cost-effective option for farmers in the long run.

Overall, a multipurpose agriculture machine using solar energy has great potential to transform the agriculture industry, by reducing costs, increasing efficiency, and promoting sustainability.

References

- [1] Van der Geer J, Hanraads JAJ, Lupton RA. The art of writing a scientific article. *J Sci Commun* 2000; 163:51-9.
- [2] Strunk Jr W, White EB. The elements of style. 3rd ed. New York: Macmillan; 1979.
- [3] Mettam GR, Adams LB. How to prepare an electronic version of your article. In: Jones BS, Smith RZ, editors. *Introduction to the electronic age*, New York: E-Publishing Inc; 1999, p. 281-304.
- [4] Permin, O., L. N. Jorgensen, & K. Persson. (1992). Deposition characteristics and biological effectiveness of fungicides applied to winter wheat and the hazards of drift when using different types of hydraulic nozzles. *Crop Protection*, 11(6), 541-546.
- [5] Zhao, S., G. S. P. Castle, & K. Adamiak. (2008). Factors affecting deposition in electrostatic pesticide spraying. *Journal of Electrostatics*, 66(11-12), 594-601.
- [6] Sidahmed, M. M., H. H. Awadalla, & M. A. Haidar. (2004). Symmetrical multi-foil shields for reducing spray drift. *Biosystems Engineering*, 88(3), 305-312
- [7] Jukanti V., Matavalam H., Krishna T., "Design and Analysis of Plough for Agricultural Mechanized Robot" "International Journal of Research in Advent Technology" ISSN: 2321-9(3)(2019)
- [8] C. J. Jinoya , R. Yadav, S. R. Zilpilwar, V.R. Vagadia and V. Agrawal, " Development and Optimization of Mini tractor Mounted Clod Crusher cum Planker", "International Journal of Current Microbiology and Applied Sciences" ISSN: 2319-7706 Volume and Number 1(2019)
- [9] Prof. Pawar S.K., Mishra A. A., Modi A. A., Prasad A. A. (2017)," Rice Transplanting Machine" "Journal of Information, Knowledge and Research in Mechanical Engineering", ISSN: 0975-668X|Nov 16 to Oct 17, Volume-04, ISSN-02.
- [10] Rampuram Jayapalreddy & Dr. N. Sandhya Shenoy (2013), a comparative economic analysis of Traditional and System of Rice Intensification (SRI) rice cultivation practices in Mahabubnagar district of Andhra Pradesh, *International Journal of Scientific and Research Publications*, Volume 3, ISSN 2250-3153

- [11] Dushyant kalchuri, Shende PN, 2016 “an overview on rice transplanting machine: a review”, discovery, 52(246), 1222-1230. [6] A.K. Goel, D. Behera and S. Swain (2008), Effect of Sedimentation Period on Performance of Rice Transplanter, Agricultural Engineering International: the CIGR Ejournal, Vol. X., Manuscript PM 07034.
- [12] “Agricultural Research Communication Centre Journals” “Comparative performance of different paddy transplanter developed in India- a review” paper by Anoop Dixit, R Khuranna, Jaskam Singh and Gurusahib singh in 2007.
- [13] S. Pradhan and S.K. Mohanty (2014), Ergo- Economical Analysis of Different Paddy Transplanting Operations in Eastern India, IOSR Journal of Agriculture and Veterinary Science ,Volume 6, 23-2.
- [14] Baldev Raj Kamboj, Dharam Bir Yadav, Ashok Yadav, Narender Kumar Goel, Gurjeet Gill, Ram K. Malik, Bhagirath Singh Chauhan (2013), Mechanized Transplanting of Rice (*Oryza sativa* L.) in Nonpuddled and No-Till Conditions in the Rice-Wheat Cropping System in Haryana, India, American Journal of Plant Sciences, 2013, 4, 2409-2413
- [15] Bala Ibrahim and Wan Ishak Wan Ismail (2014), Development of System Rice Intensification (SRI) Paddy Transplanter, Asian Journal of Agricultural Sciences, 6(2), 48-53
- [16] Ranjitha B, Nikhitha M N, Aruna K, Afreen, B T Venkatesh Murthy(2019).Solar Powered Autonomous Multipurpose Agricultural Robot Using Bluetooth/Android App. Third International Conference on Electronics Communication and Aerospace Technology [ICECA 2019] IEEE Conference Record # 45616; IEEE Xplore ISBN: 978-1-7281- 0167-5
- [17] Thorat Swapnil, Madhu L. Kasturi, Patil Girish, Patil Rajkumar (2017). Design and Fabrication of Seed Sowing Machine. International Research Journal of Engineering and Technology (IRJET) 2017.4. (9)
- [18] Prof. P.V.Bute, Shailesh Deshmukh, Govind Rai, Chetan Patil, Vishal Deshmukh (2018). Design and Fabrication of Multipurpose Agro System. International Research Journal of Engineering and Technology. Jan2018.5(1).
- [19] Prof. Rahul Vittahalrao Kakde, Shubham Mahendra Lanjewar, Shreyash Marotrao Sukhadeve, Arpit Umeshrao Kadu, Rahul Ramkrushna Dethe, Shubham Rajendra Lohkare, Shiv Prakash Santosh Kumar Shukla, Manish Sureshrao Mohije(2018). Fabrication of Wireless Operated Solar Pesticide Sprinkler. 2018.4(8).IJARIE-ISSN. 5.
- [20] Nidhi P Shetty, Deiel Roshni Noronha, Deepa H Shetty, Ashwini Sheetal Dantis, Laxmi Shetty (2018). Solar Powered Seed Sowing and Pesticide Spraying Farmingbot with Wireless Control. International Journal of Scientific & Engineering Research. April-2018.9(4). 226 ISSN 2229-5518.
- [21] Jayakrishna PVS, Suryavamsi Reddy M, Jaswanth Sai N, Susheel N, Peeyush P(2018). Autonomous Seed Sowing Agricultural Robot. IEEE 2018.
- [22] Bharat Yadav, Dr. K M Kenchi Reddy (2018). Solar Powered Seed Planter Controlled By Using Bluetooth. International Journal of Innovative Research in Science, Engineering and Technology An ISO 3297: 2007 Certified Organization. June 2018.7(7)
- [23] Kalash Singhal, Gaurav Prajapati (2018). Solar Powered Seed Sowing Machine. International Journal of Applied Engineering Research ISSN 0973-4562.2018.13(6):259-262p
- [24] Dr Salah Sukkarieh An Intelligent Farm Robot for the Vegetable Industry University of Sydney 2014
- [25] A. Ruckelshausen , P. Biber, M. Dorna, H. Gremmes, R. Klose, A. Linz, R. Rahe, R. Resch, M. Thiel, D. Trautz and U. Weiss BoniRob: An autonomous field robot platform for individual plant phenotyping JIAC 2009
- [26] Owen Bawden, David Ball, Jason Kulk, Tristan Perez, Ray Russell A lightweight, modular robotic vehicle for the sustainable intensification of agriculture ICRA 2014
- [27] Ross Girshick Fast R-CNN. International Conference on Computer Vision 2015
- [28] Ross Girshick, Jeff Donahue, Trevor Darrell, Jitendra Malik Rich feature hierarchies for accurate object detection and semantic segmentation CVPR 2013
- [29] Shaoqing Ren, Kaiming He, Ross Girshick, and Jian Sun Faster R-CNN: Towards RealTime Object Detection with Region Proposal Networks CVPR 2015
- [30] Joseph Redmon, Santosh Divvala, Ross Girshick, Ali Farhadi You Only Look Once: Unified, Real-Time Object Detection CVPR 2015