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DESIGN AND FABRICATION OF SOLAR BASED CULTIVATOR

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ABSTRACT

After the huge industrial revolutions, the next huge step from mankind was to invent new ways of transforming the energy from the sun, into useful energy for all kinds of activities. Practically, sun will not expire before the end of earth's life, this fact drives to the assumptions that these types of energy sources are considered renewable. Apart from energy, another major good that is fundamental for all societies is food. Agriculture is the science that circulates all activities related to food production. It seems that the future of both goods will find them bounded and especially food production will be directly dependable to the energy. Adding to this, the demand for food production industry will increase and require more energy, hence it will add to the environment depletion, by releasing CO_2 to the atmosphere. The aim of this study is to present, a potential alternatives solution regarding the covering of energy needs, required for farming activities related to the arable lands. As the car industry, gradually heads to the electric engines and electric vehicles, the farming tractor industry will not fall behind with traditional diesel engines. Assuming that it is possible to manufacture electric farming tractors, this paper is studying the energy balance between solar energy generation and the demands of the farming activities in the field. The main parts of this concept are, the solar array scheme, the electric motor of the tractor, and of course the battery that will store the energy from panels and produce it to farming tractor, while operating in the field. Expect from evaluating the technical and financial feasibility of this project, this paper aims to enforce the combination of two fields into one. Agriculture and sustainable engineering to sustainable agriculture practices.

KEYWORDS: Solar Energy, Renewable, Food, Agriculture, Co2, Farming Activities, Electric Engines, Farming Tractor, Batteries.

1. INTRODUCTION

The attempt of this study is to examine if an electric tractor can fulfil all the farming activities in equal quality and efficiency as the classic farming tractors. Currently there is no specific model of an electric farming tractor in commercial size production. Hence for the needs of this study the electric tractor will be assumed to be a classic farming tractor with electric motor and no technical design details of any particular model will be discussed. The traditional fossil fuel, which is diesel, will be replaced from electricity from solar PV panels and the fuel tank will be the battery. Innovation and modification is the nature of engineering. Hence we have introduced "SOLAR MULTI PURPUSE FARMING VEHICAL". Main purpose of our project is to provide less maintenance in the vehicle and available in low cost easy to transport at affordable cost for common man. Our project is totally based on solar and DC electricity. Our project in which no need of AC supply, mostly in today era big problem is highly fuel consumption and regularly CO_2 producing that is why we made solar based project.

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2. TRADITIONAL CULTIVATING METHODS

The basic idea of soil scratching for weed control is ancient and was done with hoes or mattocks for millennia before cultivators were developed. Cultivators were originally drawn by draft animals (such as horses, mules, or oxen) or were pushed or drawn by people. In modern commercial agriculture, the amount of cultivating done for weed control has been greatly reduced via use of herbicides instead. However, herbicides are not always desirable—for example, in organic farming.

The powered rotary hoe was invented by Arthur Clifford Howard who, in 1912, began experimenting with rotary tillage on his father's farm at Gilgandra, New South Wales, Australia. Initially using his father's steam tractor engine as a power source, he found that ground could be mechanically tilled without soil-packing occurring, as was the case with normal ploughing. His earliest designs threw the tilled soil sideways, until he improved his invention by designing an L-shaped blade mounted on widely spaced flanges fixed to a small-diameter rotor. With fellow apprentice Everard McCleary, he established a company to make his machine, but plans were interrupted by World War I. In 1919 Howard returned to Australia and resumed his design work, patenting a design with 5 rotary hoe cultivator blades and an internal combustion engine in 1920.In March 1922, Howard formed the company Austral Auto Cultivators Pty Ltd, which later became known as Howard Auto Cultivators. It was based in Northmead, a suburb of Sydney, from 1927.

Meanwhile, in North America during the 1910s, tractors were evolving away from traction engine-sized monsters toward smaller, lighter, more affordable machines. The Fordson tractor especially had made tractors affordable and practical for small and medium family farms for the first time in history. Cultivating was somewhat of an afterthought in the Fordson's design, which reflected the fact that even just bringing practical motorized tractive power alone to this market segment was in itself a milestone. This left an opportunity for others to pursue better motorized cultivating. Between 1915 and 1920, various inventors and farm implement companies experimented with a class of machines referred to as motor cultivators, which were simply modified horse-drawn shank-type cultivators with motors added for self-propulsion. This class of machines found limited market success. But by 1921 International Harvester had combined motorized cultivating with the other tasks of tractors (tractive power and belt work) to create the Farmall, the general-purpose tractor tailored to cultivating that basically invented the category of row-crop tractors.

In Australia, by the 1930s, Howard was finding it increasingly difficult to meet a growing worldwide demand for exports of his machines. He travelled to the United Kingdom, founding the company Rotary Hoes Ltd in East Horndon, Essex, in July 1938. Branches of this new company subsequently opened in the United States of America, South Africa, Germany, France, Italy, Spain, Brazil, Malaysia, Australia and New Zealand. It later became the holding company for Howard Rotavator Co. Ltd. The Howard Group of companies was acquired by the Danish Thrige Agro Group in 1985, and in December 2000 the Howard Group became a member of Kongskilde Industries of Soroe, Denmark.

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3. LITERATURE SURVEY

In recent years, there has been an acute shortage of agricultural labourers during sowing season due to increased employment opportunities in urban areas for rural youth. Due to non availability of labour and work animals during sowing seasons, in many places the seed is sown even when the soil is at a low moisture content which affects the germination, plan I. Stand and yield. Therefore in order to mechanize crop sowing operation under rain fed conditions, a suitable cultivator is vital as it places the seed in the zone of adequate moisture and at desired depth. The bullock drawn cultivator gives proper seed rate, uniform distribution and correct placement of seed resulting in higher yield and reduces human physical strain.

4. COMPONENTS OF SEED METERING DEVICE

- Steering system-Steering system, consist of steering wheel, gears, linkages, and other components. Used to control the direction of a vehicle’s motion. Because of friction between the front tires and the road, especially in parking, effort is required to turn the steering wheel.
- Chassis system-The term “chassis” is used to designate car means the body. The chassis therefore consists of the engine, power transmission system, and suspension system all suitably attached to, or suspended from, a structurally independent frame.
- Suspension system-Suspension is the system of tires, tire air springs, shock absorbers and linkages that connects a vehicle to its wheels and allows relative motion between the two. Suspension system must support both road holding/ handing and ride quality, which are at odds with each other.
- Wheel-The rim is the outer edge of a wheel, holding the tire. It makes up the outer circular design of the wheel on which the inside edge of the tire is mounted on vehicles such as automobiles.
- Solar panels-Photovoltaic solar panels, absorbs sunlight as a source of energy to generate direct current electricity. A photovoltaic is (pv) module is a packaged connected assembly of photovoltaic solar cells available in different voltages and wattages
- Plate or disc breaking system.-A disc is a type of brake that uses calipers to squeeze pairs of pads against a disc rotor to create friction. This action slows the rotation of a shaft, such as a vehicle axle. Either to reduce its rotational speed or to hold it stationary. The energy of motion is converted into waste heat which must be dispersed.

5. METHODS AND PRINCIPLES

Method

The first requirement of every customer is that get cheaper and best working product and our model fulfils both requirements. If we buy any ordinary tractor of 5Hp then we need 1.5lakh and we purchased cultivator then we need 58k, if we purchased the SOLAR MULTIPURPOSE FARMING VEHICAL of 1Hp then we need only 65k .We will be operating it by solar energy and we can also use it at night with the battery which is stored by the solar energy, this model doesn’t requirement any maintenance. This system does not require fuel it’s fully based on renewable energy, And in the SOLAR MULTIPURPOSE FARMING VEHICAL also gain the power from solar panel in this condition we control the battery supply .It is used form multipurpose use like we connect Trolley, Cultivator, Seed Drill, Spraying, .In this cultivator we fitted the 900W and 48Volt Motor is fitted and there are 4 battery are connected in series and the one battery specification is 48Volt and 100Aph is connect. And we made the cultivator box of 31inch in length and 12inchare in breadth

Principles

Fleming’s left-hand rule

A machine that converts DC electrical power into mechanical power is known as a Direct Current motor. DC motor working is based on the principle that when a current carrying conductor is placed in a magnetic field, the conductor experiences a mechanical force.

The direction of this force is given by Fleming’s left-hand rule and magnitude is given by;

$$F = BIL \text{ Newton's}$$

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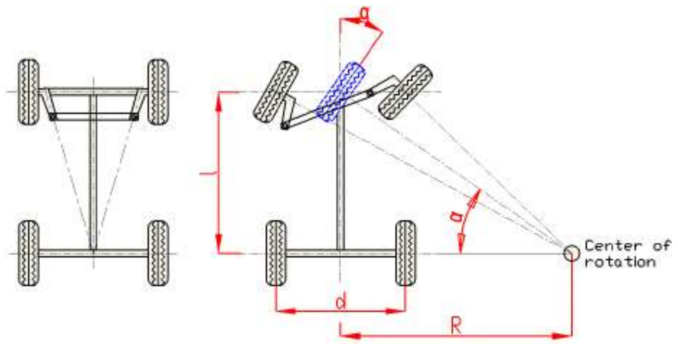
According to Fleming's left-hand rule when an electric current passes through a coil in a magnetic field, the magnetic force produces a torque which turns the DC motor.

Ackermann principal for steering

When a vehicle is turning, the inner front wheel needs to turn at a different angle to the outer because they are turning on different radii. The Ackermann steering mechanism is a geometric arrangement of linkages in the steering of a vehicle designed to turn the inner and outer wheels at the appropriate angles. This model is fully parameterized, allowing customization and component sizing. Using this model, the ideal Ackermann Angles can be identified, providing an effective starting point for further analysis in Maple.

Figure



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1. RESULTS AND DISCUSSION

Simscape results of the physical vehicle model

Road sllop(a)	**Simscape input variable**	**Simscape Numerical value**	**Simscape output variables**	**Simscape numerical value**
0°	Applied torque	109.035(N-m)	Longitudinjal velocity Load on the front axle Load on the rear axle	25(km/h) 2.627(kN) 2.2782(kN)
6°	Applied torque	239.18(N-m)	Longitudinjal velocity Load on the front axle Load on the rear axle	25(km/h) 2.5425(kN) 2.3360(kN)

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12°	Applied torque	367.589(N-m)	Longitudinjal velocity Load on the front axle Load on the rear axle	25(km/h) 2.4295(kN) 2.3684(kN)

Mechanical designing parameters of the three

S.No.	Design parameters	Design value	SI unit
1	The rolling friction coefficient(μ_r)	0.015	
2	The drag coefficient(C_p)	0.333	
3	The mass factor of rotation(λ)	1.000	
4	The air density(p)	1.220	$Kg/^3$
5	The front area of the four wheeled vehicle(A_t)	1.750	m^2
6	The overall efficiency of the drive train(μ_M)	0.900	
7	The speed of the four wheel vehicle(V_x)	25.000	Km/h
8	The estimated weight of the vehicle(M)	500.0	Kg
9	Wheel diameter of vehicle(d_w)	0.508	m
10	The wheelbase of the four-wheeled vehicle(L)	2.200	m
11	The distance between vehicle C.G. and front axle(a)	1.000	m
12	The distance between vehicle C.G. and rear axle(b)	1.200	m

6. CONCLUSION

Concluding this study it is important to comment all important points that stemmed out. The first is that this project is proved feasible. Although many assumptions occurred, the results can be judged as rational and realistic. From a technical aspect, this project is parted from matured and relatively simple technologies such, as PV panels, batteries and electric motors. Hence major problems of compatibility between technologies do not occur. This is very important when it comes to applicability in real conditions. Financially the project is feasible and under certain conditions it can be very profitable. Last but not least the project, as an idea, seems to comply with the EU environmental standards and goals, while offering solution to the matter of the environmental degradation from farming activities. As mentioned in the previous paragraph, this study proves that the project has a lot of potentials regarding its application. All technologies that were combined have proven their reliability and of course their drawbacks (battery unreliable technology) through last decades.

It is important for example to have for granted that the proposed PV panel will produce the electricity that is predicted, because it is generally acceptable that polycrystalline technology can reach electric efficiency of 12%. Although the technical details of the farming tractor are not analysed in this study, the simplicity of the technology (e.g. motors, cables, charging controllers, meters, batteries etc.) offers margin in success of the functionality of a real electric farming tractor that resembles the hypothetical one, which is used in this study. A very popular advantage in EV industry is the available torque that the electric motors produce from zero rpm. This can be more beneficial in farming tractors, where large traction forces are required in order to pull the heavy farming machinery.

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