

Design and Implementation of Solar Powered Electric Vehicle for Multitasking Application in Agriculture

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ABSTRACT

Agriculture is a backbone of India and it is the main source of national income for our developing country. Agriculture is the science and art of cultivating plants and livestock. In recent year strength of backbone of country has been falling due to various factors. Some of the major problems in the agriculture are increase in input cost, lack of water resources and the availability of labors. In cultivation of crops involve seed sowing, weeding and spraying. There are many government schemes and subsidy for the water resource management but the main problem is availability of labors and the cost of fuel. Farmers has been using tractor for cultivation which includes planting, weeding, spraying and harvesting. Increasing the cost of vehicle and fuel price, the poor farmers of our developing country unable to afford it. In this paper we have developed a solar powered electric vehicle for multitasking purpose. The proposed vehicle can be used for multipurpose in agriculture such as seed sowing, leveling, pesticide spraying, weeding and harvesting the plants. It will reduce the production cost, makes cultivation simpler, more affordable and accessible. The proposed vehicle does not require fuel because the vehicle is operated with solar energy as primary source of supply and more importantly vehicle can be operated by farmers. Vehicle is eco-friendly, no fuel emission and low labor wages are added advantages of this proposed vehicle

1.Introduction

The history of agriculture in India goes back to the civilization of the Indus Valley Period and in some parts of Southern India even before that. Today India ranks second in farm production worldwide. Agriculture is playing important part in our economy [1]. Our farmers are tirelessly working in agriculture field. Most of our food what we eat today are from agriculture sector [2]. There are many processes involves in harvesting any useful thinks from agriculture field. Any food from agriculture not come immediately, it takes at least few days, few weeks, few months or even few years to yield. Farmers of our nation mainly depending on agriculture sector, they don't have second source of income. Before the development of industrial era, our farmers have used bullock cart to leveling, seed sowing and harvesting the plants. Farmers are themselves involving 95% of cultivation process and only remaining percentage they have used machinery [3]. After 1990, the cost of fuel had been reduced and the development of machinery related to agriculture sector was improved rapidly. After then 75% farmers have been using machinery for cultivation by owning themselves or rending it from other farmers [4]. Remaining 25% of farmers are depending themselves or labors for cultivating their own land. In recent days percentage level of farmers involving in cultivation land is decaying due to increasing the cost of agriculture vehicle, cost of labors and cost of seed.

Our government has initiated various schemes [5] for farmers which are listed in table 1.

S.NO	NAME OF THE SCHEMES
1.	Rainfed Area Development
2.	Soil Health Management (SHM)
3.	Sub Mission on Agro Forestry (SMAF)
4.	Paramparagat Krishi Vikas Yojana (PKVY)
5.	Soil and Land Use Survey of India (SLUSI)
6.	National Rainfed Area Authority (NRAA)
7.	Mission Organic Value Chain Development in North Eastern Region (MOVCDNER)
8.	National Centre of Organic Farming (NCOF)
9.	Central Fertilizer Quality Control and Training Institute (CFQC&TI)
10.	Paramparagat Krishi Vikas Yojana (PKVY)
11.	Soil and Land Use Survey of India (SLUSI)
12.	National Rainfed Area Authority (NRAA)
13.	Mission Organic Value Chain Development in North Eastern Region (MOVCDNER)

TABLE1. Various schemes for Farmers

Even though our government has provided sufficient scheme to famers, are they reached to the farmers 100%? It is debatable topics with leaders of farmers and our responsible government officers. Vehicles play an important role in different areas, such as commercial, medical, military applications etc. The special purpose vehicle especially Electric Vehicles (EV) are increasing productivity in agricultural sector [6]. Rising production costs, the availability of skilled labor, the lack of water supplies and crop monitoring are some of the major problems faced by Indian agriculture. After the industrial revolution, the ongoing integration of machinery has enabled agriculture to become much less labor-intensive, modern mechanized agriculture requires the use of tractors, trucks, combine harvesters and other vehicles. Inorder to reduce the labor shortage, cost of increasing fuel price and cultivation vehicle, in this paper we have proposed solar powered electric vehicle. The proposed vehicle will perform multiple tasks to mitigate the difficulties faced by our poor farmers. The vehicle is powered by solar energy [7] so the fuel usage is completely eliminated and 100% eco friendly. The proposed vehicle will do multiple functions such as leveling, seed sowing and harvesting the plants. The intention of the project is to investigate the feasibility of a small electric farming vehicle fixed with different tools working on the field without stopping for a shift to a different purpose and to minimize the cost of operating time on the ground in an attempt to increase the returns of farming in an environmentally appropriate way.

2. Block diagram of proposed method

The various components present in the proposed system are shown in the figure1. The proposed system consists of solar panel, charge controller, battery, battery sate sensor, microcontroller, voltage regulator, controller switch and dc motors. The solar panel converts the solar energy into electricity. The charge controller [8] provides enough voltage to the battery. The battery stores the energy from the solar panel via charge controller. The state of the battery is being measure by

battery state sensor. The controlling operation of the charge controller is controlled by microcontroller [9]. The controller will continuously measure the state of battery by mean of battery sensor and provides necessary control signal to charge controller. The output of the battery is connected to DC motor in order to perform various functions such as levelling, digging, seed sowing, spraying and harvesting.

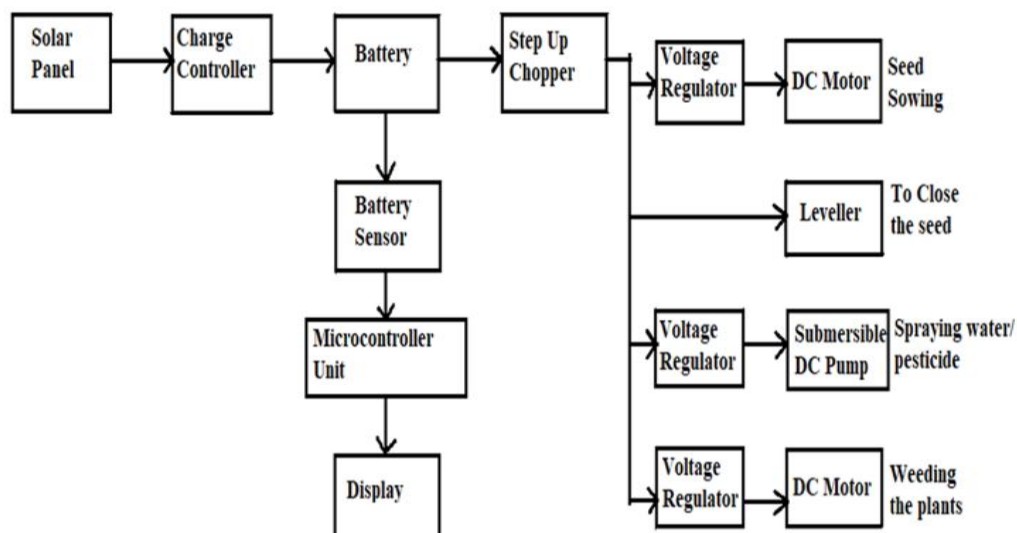


Figure.1block diagram of proposed method

3. Role of individual blocks of proposed method:

- Battery sensor is used to measure the percentage of battery and it will be displayed.
- Seed sowing is done through the funnel and the seeds are dropped in the soil with the distance of 1 inch.
- The seeds are stored in the hopper.
- Digging the soil is done through the rod.
- Leveler is used to close the seeds to the soil.
- Sprayer is used to spray the water or the pesticides can be sprayed.
- The weeding is done where the unwanted plants are killed in this weeding process.
- The whole machine is operated through the 12V battery.

4. Working operation of the circuit diagram:

The solar panel in our proposed method is used [10] to charge the battery and the charge controller is used to prevent the overcharging of the battery [11]. For the protection of battery, the zener diode of 22V and 11V is used. The zener diode will cut off the supply when the voltage increases above 22 V or less than 11 V. So the reversal of voltage can be prevented. The 12 V is converted to 5V through the voltage regulator which is connected to the microprocessor. The battery sensor is used to calculate the remaining charge in the battery and it is displayed through the liquid crystal display. The modes of four operations are done through the toggle switch and the switches are connected to the microprocessor. When the first switch is pressed, the vehicle starts to run. For the rotation of the wheel the wiper motor is used. The second switch is used for water spraying or pesticide spraying. The third switch is used for weeding and the fourth switch

is used for seed sowing in the soil. For digging and leveling process the rods are fixed in the vehicle. When this process is needed we can pull the rod for digging and leveling the soil. The soil will be dig at the distance of 1.5 mm. The seed sowing process is done through the DC motor and it is fitted inside the pipe to fall the seeds inside the soil at a distance of 1 feet. This pipe is used to store the seeds and through the hole the seed will be fallen into the soil. The pesticide sprayer is used to spray the pesticides or we can also spray the water. The sprayer can be run through the DC motor. The submersible motor is used to spray the pesticides. The weeder is run through the DC motor. The weeding of the plant is done through the blades. The blades will be rotated in the clockwise direction and the weed will be removed.

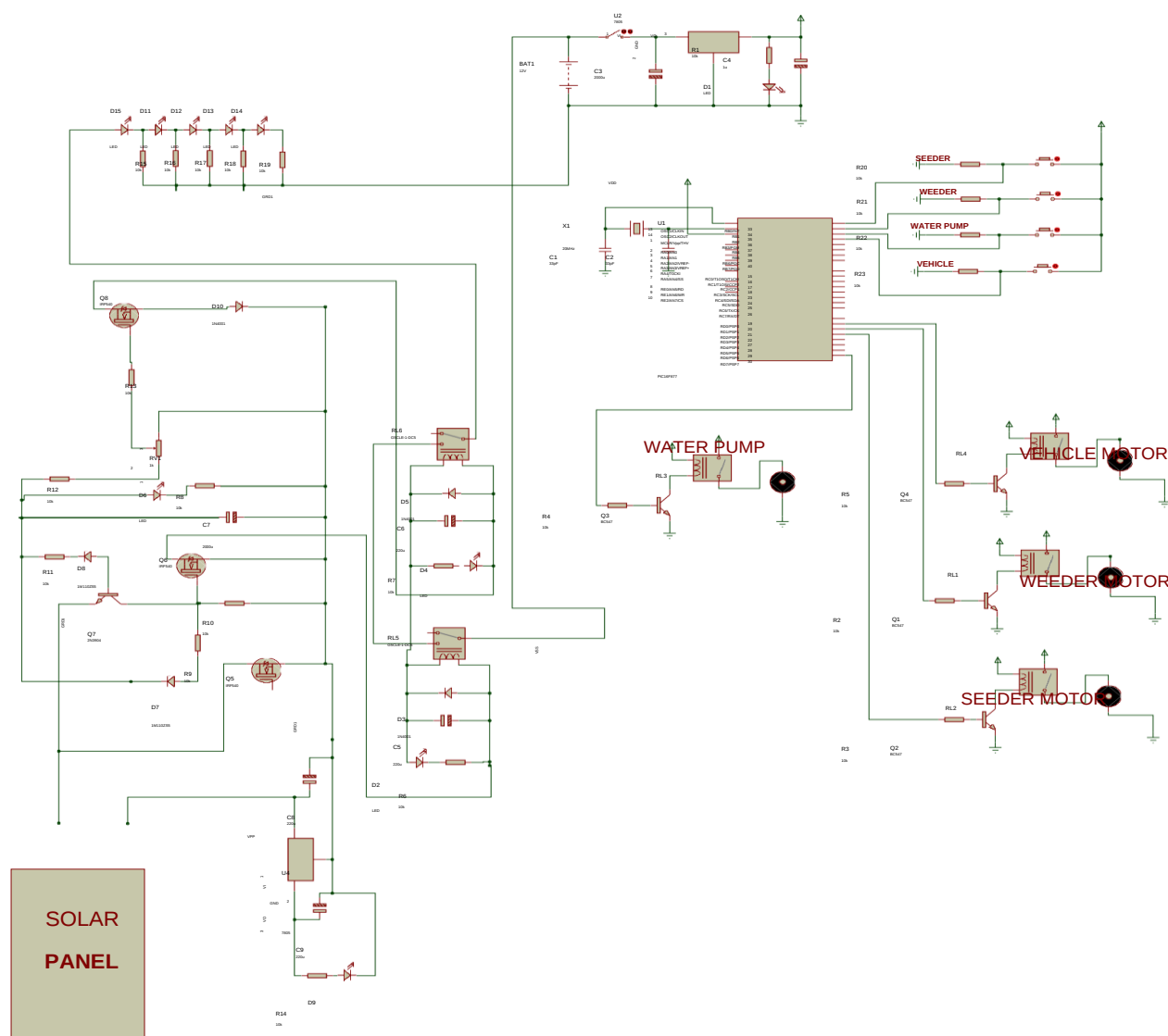


Figure.2 circuit diagram of the proposed method

5. Working of Hardware setup:

The solar panel is connected to the charge controller. The DC motor is connected from battery for each application. The solar vehicle is operated by solar energy. The photovoltaic cells are directly converting the sunlight into electricity. A single solar cell could be the size of a compact disk that

can produce about 3-4.5 watts. A typical solar module may generate about 100-300 watts from an array of about 40 cells. Multiple solar panels, each made of about 3-4 modules could therefore generate an absolute maximum of several kilowatts. The approximately 75W solar panel is used to charge the battery with lead acid. The panel is mounted on the vehicle's roof. It is connected via a charging controller to the battery. It provides enough voltage to be stored in the 12v battery. In order to prevent batteries from overcharging, a charge controller or charge regulator is used that is simply a current or voltage regulator. The voltage and current from the solar panel to the battery is continuously monitored. The MPPT solar charge controller [12-17] measures the voltage of the panel and then converts the PV voltage to battery. The charge controller also monitors the battery to prevent the overheating from the battery. Some of the charge controller also displays the data and transmit the data to remote displays.

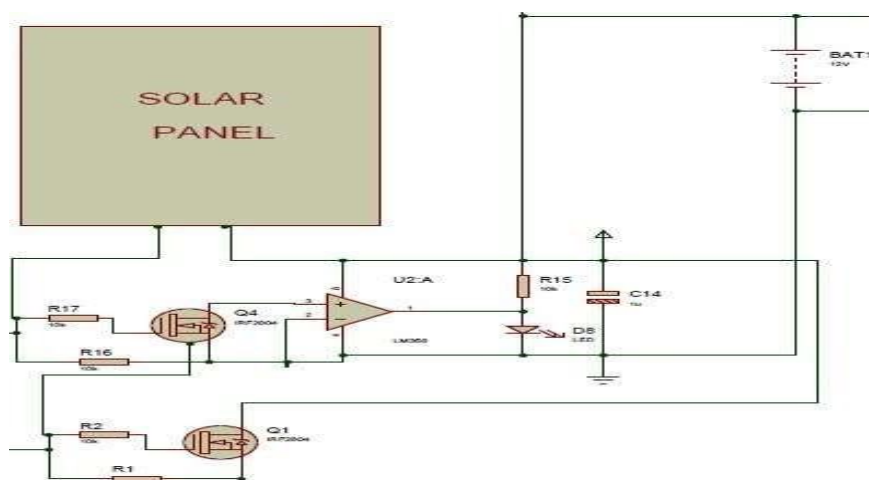


Figure.3 circuit diagram of charge controller

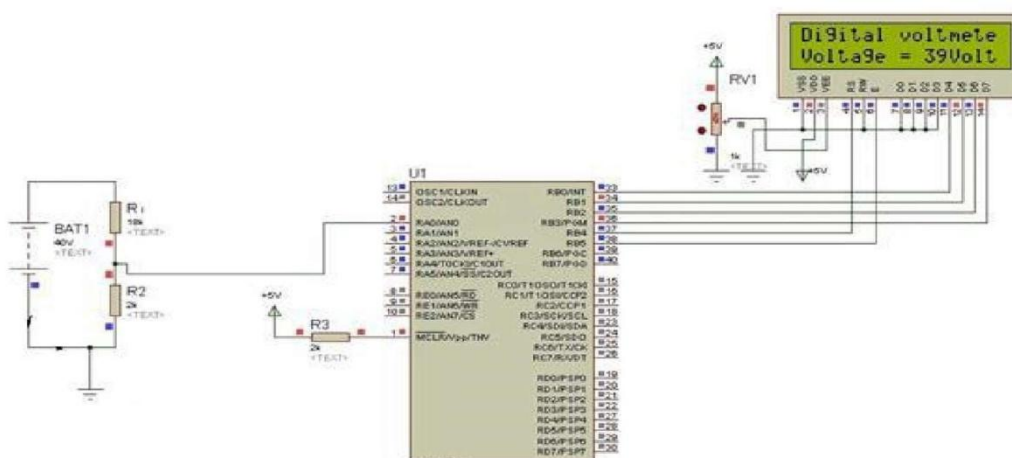




Figure.5top view of mechanical setup

The solar panel is fitted on the top of the vehicle and the charge controller is to prevent the overcharging from solar panel. The battery sensor is used to calculate the remaining charge in the battery and it is displayed through the liquid crystal display. From the battery 12V is converted to 5V through voltage regulator and this is connected to the microprocessor. The step up chopper is connected to the wiper motor. For the rotation of the wheel the wiper motor is used.

		
FIGURE.6(A) WIPERMOTOR SETUP	FIGURE.6(B) TOGGLE SWITCH	FIGURE.6(C) HARDWARE SETUP OF SEED SOWING AND DIGGING OPERATION

These five operations are done individually through the toggle switch. The first switch is used to start the motor, the second switch indicates the seed sowing, the third switch indicates the pesticide spraying and the fourth switch indicates the weeding the plants. The operator should stand behind to operate the vehicle. The rod is used to dig the soil. The soil will be digged at the distance of 1.5mm. The pipe is used to store the seeds and the DC motor is fitted inside the pipe to fall the seed in the soil at the distance of 1 feet. Through the hole the seeds will be fallen into the soil. The leveler is used to close the seed and the container is used for the storage. The pesticide sprayer is used to spray the pesticides or spray the water also. The pesticide flows to the sprayer through a pipe. A submersible DC pump is used for pumping the pesticides. The weeding of the plant is done through the blades. The blades will be rotated in the clockwise direction and the weed will be removed.



Figure.7hardware setup of proposed system

6. Significance of proposed methods:

- The proposed vehicle will increase the efficiency and reduce the production cost and also useful for small scale farmers and is made affordable to them
- The fuel required for the proposed vehicle is solar energy. So it is very quiet and zero percentage of noise emitted by the vehicle
- Solar panels may seem quite expensive when you first purchase it, but in the long run farmers will find themselves saving quite a great deal of money
- Since there is no internal combustion engine presented in proposed vehicle and no combustion takes place, there are no emissions
- Time consumption is very less when compared to the conventional vehicle

7. Conclusion

The economical development of any country is depending on various sectors, one important sector is agricultural. Recently many farmers have facing various kinds of problem in cultivation field such as lack of labors, increasing the cost of fuel and vehicle for cultivation. Considering these three problems in our mind, the proposed method has been developed. In this method, solar powered electric vehicle is completely eradicating the burden of farmers at cultivation field. The solar power acted as source of supply for vehicle so the famers need not depend on fuels such as petrol and diesel. The proposed vehicle can also perform multitask which includes leveling, seed sowing, watering or pesticide spraying and harvesting plant. There is no an internal combustion engine is presented in this vehicle so it emits zero percentage of pollution to the environment. It is eco friendly vehicle and the cost of vehicle is affordable. Any famers can easily afford this proposed vehicle. This paper mainly addresses the problems faced by poor farmers and provides alternative ways to cultivate their lands

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