

National Institute of Technology, Karnataka

Project Proposal

Project Title

User-InteractiveSolar-PoweredElectric Grass Cutter (IS-GC)

Project Investigators

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Project Objective

We are attempting to convert the traditional grass cutter from a simple on-and-off device into an environment-friendly machine with more control, safety and interactive features.

Conventional Petrol-Run-Cutters (PRCs) lead to significant amounts of carbon emission resulting in atmospheric pollution. These machines lack proper preventive measures, and force the user to resort to unsafe solutions in the case of any malfunctions or emergencies. Our Electric Grass-Cutter updates the user through real-time readings about the current state of the machine and has control functions that allow the user to take preventive actions before any possible failures occur. The user is also given speed and power control of the machine to ensure efficient and flexible operation. The battery of the machine can be charged through solar or the AC mains, ensuring zero carbon emission.

The current mind set of most customers in India is that eco-friendly and green products cost a lot more than existing machines. This misconception makes the transition to environment-friendly products harder unless an example is made to help people overcome that misconception. In a situation like this, a Made-in-India product that fits the above criteria would be the best way to shift the one-sided monopoly of the market and give local companies more room to grow. Our product strives to be just that, an example from which other local producers will learn that ECs can be profit-making too and eventually push them to produce electric machines of their own. Once the customer-base slowly shifts towards electric machines, these local companies will again be strengthened.

We aim to be the spark that gives local producers a window to contribute to healthy competition in the market. The Make-in-India scheme was a result of the Government understanding the need to strengthen our markets, and we want our product to be the starting point to enable that transition. By providing a better alternative to existing machines we can aid the transition of a foreign-dominated market towards one with more number of Indian producers as well as increase popularity of Electric Cutters (ECs) in the country.

Key Deliverables

The innovations present in our project can be split into two aspects, the reduction in cost and the advancements in technology with respect to present-day grass cutters.

Technical Aspect

The technical innovations that differentiate our machine from existing machines are,

1. Solar-charging capability

The battery that powers our machine will be solar-powered we will also provide a charging dock from the mains. This ensures zero carbon emissions.

2. Electronic Control Board (ECB)

This makes the machine user-interactive and gives the user more control over machine parameters. Some of the controls given to the user are,

(i) Speed Control –the speed knob allows the user to control the RPM of the motor depending on the type of grass being cut. The control has been divided into Speed Modes and cutting of grass has been tested for each mode.

(ii) Braking mechanism–unlike traditional grass cutters, the IS-GC automatically detects faults and malfunctions and, if harm to the user is imminent, is able to de-energize the machine by isolating the motor from the supply.

(iii) Display Board - this provides real-time readings from various embedded sensors through an LCD panel for the user to analyse the current state of the machine. Parameters include voltage and current levels, motor temperature, rotor speed, charge status of the battery (during charge/discharge), obstacle detection, gyroscope and most importantly an alarm system that warns the user in case any malfunctions arise.

Regular Power Mode (RM)					High Power Mode (HM)				
Mode Voltage		Mode Duty Cycle			Mode Voltage		Mode Duty Cycle		
V(pm)	Unit	D(pm)			V(pm)	Unit	D(pm)		
21	V	0.43			25	V	0.52		
Modes		Speed Modes		Mode Duty Cycle	Modes		Speed Modes		Mode Duty Cycle
V(sp)	Unit	N	Unit	D(sp)	V(sp)	Unit	N	Unit	D(sp)
20.16	V	6300	RPM	0.96	24	V	7500	RPM	0.96
18.48	V	5775	RPM	0.88	22	V	6875	RPM	0.88
16.8	V	5250	RPM	0.8	20	V	6250	RPM	0.8

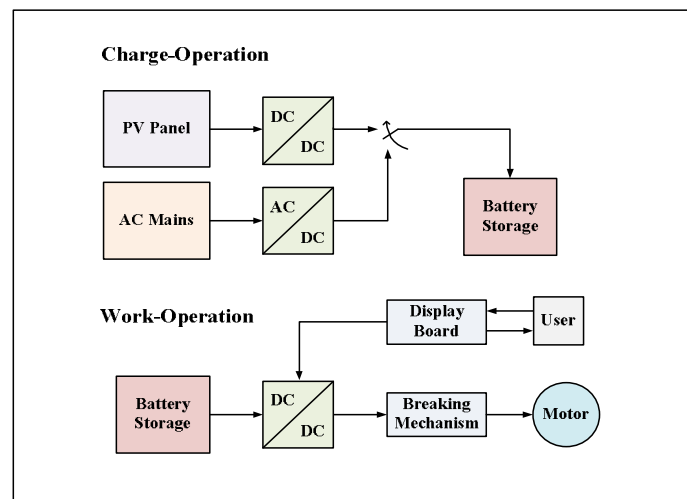
Table. 1. Mode Characteristics of the IS-GC

Cost Aspect

Modern day grass-cutters have had little to no development since they were first brought into the market. Any innovation that has occurred has been by foreign companies such as HITACHI, BOSCH and MAKITA, and due to their better quality and brand familiarity customers prefer their products over local-made machines. This makes it quite hard for a new product to enter the market in direct competition with these foreign brands. These foreign companies, who supply a large portion of grass cutters available in the market, will pose as our competition.

The market, as of now, largely deals in PRCs because of their higher power in comparison to existing ECs and lack of awareness about ECs in the community resulting in higher prices of ECs in the current market scenario. By delivering equivalent performance (as compared to PRCs) and by using cost-effective technology, our machine combines the advantages of both PRCs and ECs.

Proposed Design



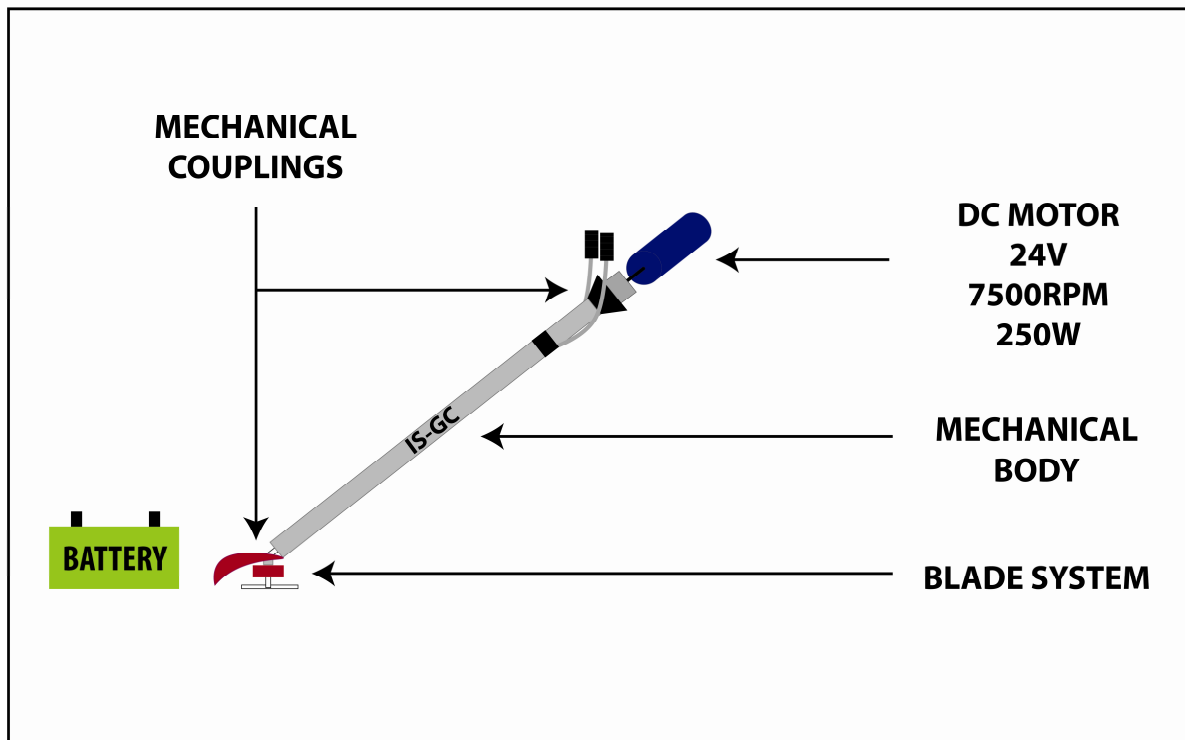


Fig. 2. IS-GC Machine Diagram

Project Outcome

Our project aims to bring about the following consequences through its successful completion,

1. Environmental Impact: Air pollution in India is quite a serious issue with the major sources being fuel wood and biomass burning, fuel adulteration, vehicle emission and traffic congestion. The Government of India is trying to make the country a more eco-friendly place to live in through policies and awareness programs. But in addition to the efforts made by the Government, there needs to be a driving force from the population itself. Our product will aim to be one of those forces that will not only make people aware of the serious environmental crisis we are in right now, but also give them the solution to try and solve it. By gradually shifting the community from PRCs that pollute the atmosphere towards greener and environment-friendly products, people will become more responsible about the vital part each person plays in making the future of India (and the world, eventually) a greener place to live in.
2. Health Impact: Existing machines contribute largely to noise pollution as well. These affect surrounding localities and have even proven to have adverse effects on the user. Adding on to this the strong vibrations from the engine affect nerve cells in the arms of users damaging them over time. Our product will have very low operating noise, have a comfortable mechanical design and at the same time be energy efficient. This will slowly allow more people in our community to be comfortable with grass cutters (and expand our consumer base as well).
3. Market Impact: As mentioned before, local companies have been severely affected since they do not possess the capital to compete with branded, high-quality but expensive foreign machines. By introducing an Indian-made, cost-effective, user-friendly and green grass-cutting machine the customers of the current market (dominated by foreign companies) will shift to our product. This will reduce the monopoly foreign companies have over local markets and will eventually boost local companies to manufacture electric-products of their own.

Project Budget

Our proposed budget is divided into various avenues based on our research development timeline. This timeline has been shown below

Budget Allocation		
Phase I	<ul style="list-style-type: none">• Review of present technologies• Brainstorming and Discussion	Done
Phase II	<ul style="list-style-type: none">• Circuit Design and Modelling• Enlisting required materials• Lab simulations	Rs. 50,000
Phase III	<ul style="list-style-type: none">• Checking if simulations satisfy required objectives• Procuring required hardware and software	Rs. 1,70,000 to Rs. 2,00,000
Phase IV	<ul style="list-style-type: none">• Hardware testing of procured parts• Machine assembly and testing• Machine optimization (economic and hardware)	Rs. 50,000 to Rs. 1,00,000
Phase V	<ul style="list-style-type: none">• Developing project into a market-feasible product• Documentation of work and research	-
Proposed Project Budget		Rs. 3.5 Lakhs (estimated)
Proposed Project Completion Time		1 Year
