Solar Based Electric Fencing for Deterring Cattles

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Abstract- This paper is based on Solar based electric fencing
for deterring cattle. The project is nothing but a solution for
protection of farm-field. In this farmer friendly project,
whenever any kind of animal touches the electrical fencing
they will subject to a short and safe shock of small duration
that will teaches them to stay away from the farm. The shock
is not harmful for any individual as the current passing
through fencing is in discontinuous form. As there is some
delay between two pulses of current it avoids the current flow
for long duration and also the prolonged shocking to the
animal.

Keywords- Solar Panel, Fencing

I. INTRODUCTION

The solar photovoltaic technology is now a days being
efficiently used for electric fencing purpose. The solar power
fencing system provides the maximum protection by effective
control of animal trespass & browsing. The solar powered
electric fencing enables the control of animals by giving them
a short and safe shock which teaches them not to cross the
fencing. Normally, people are not aware about electric fencing
& they are afraid that shock will injure and damage or kill an
individual or any living species. But if the electric fencing is
properly constructed then it is really safe to animals and
people also. For the flow of current in the fencing, there must
be a closed & complete circuit. The flow of current must be
bidirectional i.e. the current must travel from its source
through the system & will again back to the source. It is
possible only when the current gets the closed path or the
charged fence wire becomes grounded. Under normal
conditions, the circuit is open or incomplete. But whenever
any animal or any individual tries to touch the fence, it
grounds the fence and circuit get closed. An electric pulse will
travels through animal & back to the energizer, delivering a
safe shock to that animal.

II. WORKING PRINCIPLE

The basic operation of the solar based electric fencing is
following: Firstly, the solar rays falls on the solar panel after
that it converts the sunlight directly into the DC current. Then
the battery is used for the energy storage purpose. The battery
stores the electricity generated by the solar panel which will
allows the energizer to operate in day time and also in absence
of sun i.e. during night time or cloudy wheather. The battery
supplies a MOSFET based inverter and a step up transformer

that will produce a 50 Hz 230 V AC supply from the DC
output of PV Solar panel. This AC supply is then allowed to
pass through the fencing which will give slightly short and
safe shock to the cattle that tries to enter the farmfield for
grazing purpose. The fence will protect the crops in the farm
from getting damage.

III. COMPONENTS

A) Solar cell

The Solar panel acts simply as a battery charger. The solar cell
is composed of the semiconductors of the P-N junctions. It can
convert light into electric energy. Therefore we can assume
that electricity produced using sunlight shining on the solar
cell can be used like common electricity.

Fig. 1: Solar Panel

B) Fence energizer

The Electric Fence Energizer converts the electrical energy,
which normally comes from the electrical utility, batteries or
solar PVs in an electric impulse with limited energy associated
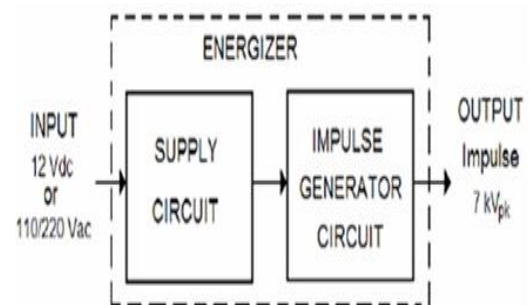according to safety limits.

Fig. 2: Electric Fence Energizer

C) AVR Microcontroller
The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. ATmega16 is a powerful microcontroller, which provides a highly flexible and cost-effective solution to many, embedded control applications.
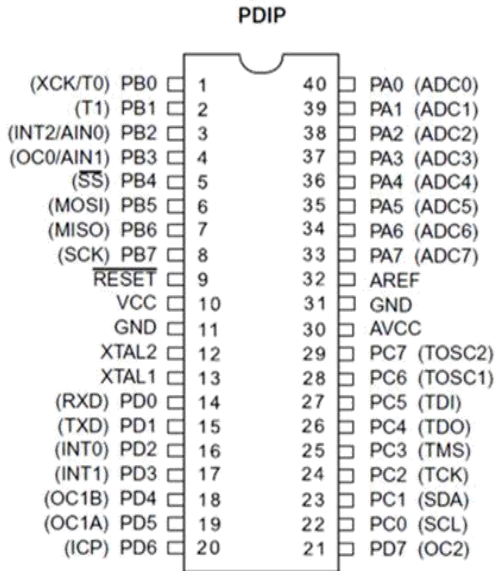

Fig. 3: ATmega16

D) MOSFET
This N-channel enhancement mode power MOSFET is produced using Fairchild semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduced on-state resistance and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies (SMPS), active power factor correction (PFC), and electronic lamp ballasts.

Fig. 4: Mosfet- TIP3055

E) Regulator IC
It is a three pin IC used as a voltage regulator. It converts unregulated DC current into regulated DC current. First pin is used for input, second for ground and third pin gives the rectified and filtered output. It has an inbuilt filtering circuit

which removes the ripples present in the rectified DC obtained from full bridge rectifier circuit.
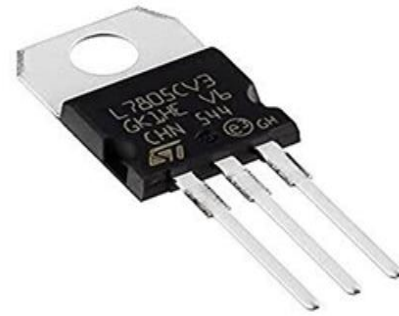

Fig. 5: IC 7805

F) Capacitive Filter
This is a 470uF/25V Radial Aluminium Electrolytic capacitor with ±15% Tolerance. It is used for the purpose of storage, regulation and/or filtration of energy and current flow in various types of circuits such as power supply.

Fig. 6: Capacitor 470µF, 25V

G) Transistor
BC547 is mainly used for amplification and switching purpose. It has maximum current gain of 800. For amplification applications, the transistor is biased such that it is partly on for all input conditions. BC547 is used in common emitter configuration for amplifiers. For switching applications, transistor is biased so that it remains fully on if there is a signal at its base. In the absence of base signal, it gets completely off.
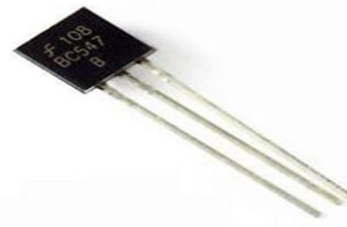

Fig. 7: BC-547 NPN Transistor
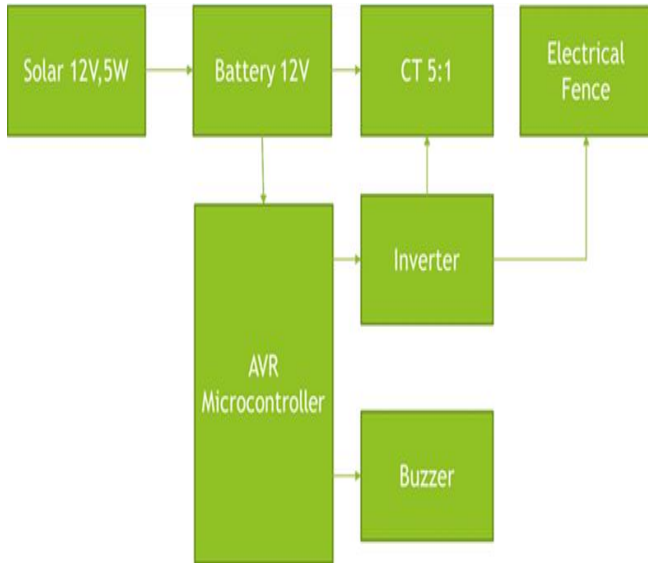
IV. BLOCK DIAGRAM

Fig. 8: Block diagram of solar based electric fencing

The solar based electric fencing mainly involves Solar panel, DC battery, Inverter & Microcontroller assembly. An inverter is an electrical device that converts direct current (DC) to alternating current (AC); the converted AC can be at any required voltage and frequency with the use of appropriate transformers, switching, and control circuits.

IV.CALCULATION OF MAXIMUM OUTPUT VOLTAGE THAT CAN BE RECEIVED FROM PV MODULES OF A SOLAR PANEL

It is known that the output voltage of a PV module is influenced by the ambient temperature. The range of the voltage output due to the extreme temperature should be within the specification of the charge controller. The temperature data from ASHRAE handbook is normally used along with open-circuit voltage (Voc) and the temperature coefficient of Voc (TCVoc) to calculate the range of the output voltage from the PV module.

(a)The range of DC output voltage from PV modules
From the electrical specifications of Solar World Sun module Plus SW 265 mono at STC (Standard Test Conditions):
Open-circuit voltage Voc = 39.0 V Temperature coefficient of Voc = − 0.30% / ℃

The low temperature history at Hill AFB, Ogden : ASHRAE Extreme Annual Mean Minimum Design Dry Bulb Temperature = − 16 ℃
Tmin = − 16 ℃ − 25 ℃ = − 41 ℃
V1 = Voc x {1 + [(− 41 ℃) x (− 0.30% / ℃)]}
= 39 x 1.1312 = 43.8 V

(b)The maximum output current from PV modules
Short-circuit current Isc = 9.31A Temperature coefficient of Isc = 0.04 % / ℃ ASHRAE 2% High Temperature = 34 ℃
Tmax = 34 ℃ − 25 ℃ = 9 ℃
Imax = I1 = Isc x {1 + [(9 ℃) x (0.04% / ℃)]}
= 9.31 A x 1.0036 = 9.34 A

V.   CONCLUSION

Our project 'Solar powered electrical fencing for deterring cattle' is based upon the concept of renewable solar energy. It uses solar energy to power the fencing around our fields so that cattles are not able to enter and destroy our crops. Solar energy is a resource that is not only sustainable for energy consumption, it is indefinitely renewable (at least until the sun runs out in billions of years). The main benefit of solar energy is that it can be easily deployed by both home and business users as it does not require any huge set up like in case of wind or geothermal power.

VI.   REFERENCES

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