



## A REVIEW ON SOLAR POWER FENCING BASED ON GSM TECHNOLOGY FOR AGRICULTURE

Sonal D. Khandare<sup>1</sup>, Ankush S. Alone<sup>2</sup>, P. V. Raut<sup>3</sup>

<sup>1</sup>Student, Electrical (E&P) Engg., DES'sCOET Dmn Rly., Maharashtra, INDIA, [sonalkhandare96@gmail.com](mailto:sonalkhandare96@gmail.com)

<sup>2</sup>Student, Electrical (E&P) Engg., DES'sCOET Dmn Rly., Maharashtra, INDIA, [ankushalone1996@gmail.com](mailto:ankushalone1996@gmail.com)

<sup>3</sup>Assistant Professor, Electrical (E&P) Engg., DES'sCOET Dmn Rly., Maharashtra, INDIA, [priyankaraut1106@gmail.com](mailto:priyankaraut1106@gmail.com)

---

**Abstract**

*Farmers are always exposed to various external risks like weather dependence, damage to crops by stray or wild animals. This system basically works on solar energy. Agricultural solar fencing is one of the best methods for the protection of crops from wild animal damages. This agricultural solar fencing supply a low amount of electric current which gives an electric current to those entering the fenced area. It also enhances good safety to the agricultural land and crops. Solar power fencing system provides controlling for all type of animals. Its application suits remote areas and provides an economical and practical solution to achieve maximum protection of field or particular areas. When any object is sensed by PIR or IR sensor, immediately controller sends the message to the authorized person through the GSM modem, and it is interfaced with the controller and at the same time buzzer and light will on.*

*.Index Terms: Battery, Fence, GSM Modem, Sensor, Solar Photovoltaic Cell, Sunshine Hour.*

----- \*\*\* -----

**1. INTRODUCTION**

In india, agriculture is the broadest economic sector and plays a vital role in the overall socio-economic factor of India. The increasing news articles in television and newspaper on wild animals raiding agricultural crops during harvest season shows that these animals can destroy a farmer's livelihood. In such areas electric fencing system can be employed in which the animals experience a high voltage low current shock for a very short time. Because of the small magnitude of current there is no threat to the animal's life at the same time the large magnitude voltage scares away the animals. Usually, PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared" and "IR motion" sensors. A photoelectric sensor, or photo eye, is a device used to detect the distance, absence or presence of an object by using a light transmitter often infrared and a photoelectric receiver. They are used extensively in industrial manufacturing. There are three different functional types opposed (through beam), R-reflective, and proximity-sensing (diffused). India has about 95

percent clear sunny days with average daily incidence of solar.

The solar photovoltaic system has certain disadvantages as relatively high initial investment, requires storage devices. Solar energy available at a place is not a constant local weather conditions affect on its reception, it is not in concentrated form hence collection and concentrating surfaces are required. The solar photovoltaic (SPV) system converts the sunlight directly into DC voltage. The SPV technology is now a day's being efficiently used for electric fencing purpose. Man-animal conflicts have reached alarming proportions today. Much of these conflicts can be alleviated with proper management of areas set aside both for wild animals and man. The solar power fencing system provides both an economical and a practical solution to achieve maximum protection through effective control of animal trespass and browsing. Solar-powered fencing-system enables the control of animals by giving them a short, sharp but safe shock which is sufficiently memorable that they never forget it. The present study was taken for the study and performance of solar photovoltaic fencing system.

**PROPOSED SYSTEM**

Choice of proper methods is always important in the field of agriculture. In this era of sensors and technological development there is an urgent need to create strategies based on science and technology for sustainable use of agriculture. In this system there is interfacing is done with microcontroller through sensor and GSM modem. This GSM based system may offer the flexibility to the user for regulation and controlling of the operations.



**Fig. (a): GSM Modem**

## 2.1 GSM Modem

GSM networks operate in a number of different carrier frequency ranges with most 2G GSM networks operating in the 900 MHz or 1800 MHz bands. A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective a GSM modem looks just like a mobile phone. When a GSM modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity many of them can also be used for sending and receiving SMS and MMS messages. A GSM modem can be a dedicated modem device with a serial USB or Bluetooth connection or it can be a mobile phone that provides GSM modem capabilities. For the purpose of this document the term GSM modem is used as a generic term to refer to any modem that supports one or more of the protocols.

2G networks developed as a replacement for first generation (1G) analog cellular networks and the GSM standard originally described a digital circuit-switched network optimized for full duplex voice telephony. GSM is a cellular network, which means that cell phones connect to it by searching for cells in the immediate vicinity. There are five different cell sizes in a GSM network micro, Pico. The coverage area of each cell varies according to the implementation environment. Macro cells can be regarded as cells where the base station antenna is installed on a mast or a building above average rooftop level. Micro cells are cells whose antenna height is under average rooftop level, they are typically used in urban areas.

Cell horizontal radius varies depending on antenna height, antenna gain and propagation conditions from a couple of hundred meters to several tens of kilometers. The longest distance the GSM specification supports in practical use is 35 kilometers. There are also several implementations of the concept of an extended cell, where the cell radius could be double or even more, depending on the antenna system, the type of terrain and the timing advance. The GSM modem is shown in fig. (a) below.

## 2.2 Solar Panel

Solar panels absorb the sunlight as a source of energy to generate electricity or heat. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions (STC), and typically ranges from 100 to 365 Watts (W). A photovoltaic system typically includes an array of photovoltaic modules, an inverter, a battery pack for storage, interconnection wiring, and optionally a solar mechanism.

### a) Electricity Production

Solar power is the conversion of sunlight into electricity either directly using photovoltaic's (PV) or indirectly using concentrated solar power (CSP). CSP systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. PV converts light into electric current using the photoelectric effect. Solar power is anticipated to become the world's largest source of electricity by 2050 with solar photovoltaic's and concentrated solar power contributing 16 and 11 percent to the global overall consumption respectively.

### b) Concentrated Solar Power

Concentrating Solar Power (CSP) systems use lenses or mirrors and tracking systems focus a large area of sunlight into a small beam. The concentrated heat is then used as a heat source for a conventional power plant. A wide range of concentrating technologies exists; the most developed are the parabolic trough the concentrating linear fresnel reflector the Sterling dish and the solar power tower. Various techniques are used to track the Sun and focus light. In all of these systems a working fluid is heated by the concentrated sunlight, and is then used for power generation or energy storage.

## 2.3 Microcontroller

A microcontroller (or MCU for microcontroller unit) is a small computer on a single integrated circuit. In modern terminology, it is a system on a chip. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals. Program

memory in the form of Ferroelectric RAM and ROM is also often included on chip, as well as a small amount of RAM. The ATmega16 microcontroller is used in this system which is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega16 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

### 3. EXPECTED IMPLIMENTATION OF A SYSTEM

The block diagram for the proposed system is given below in fig. (b).

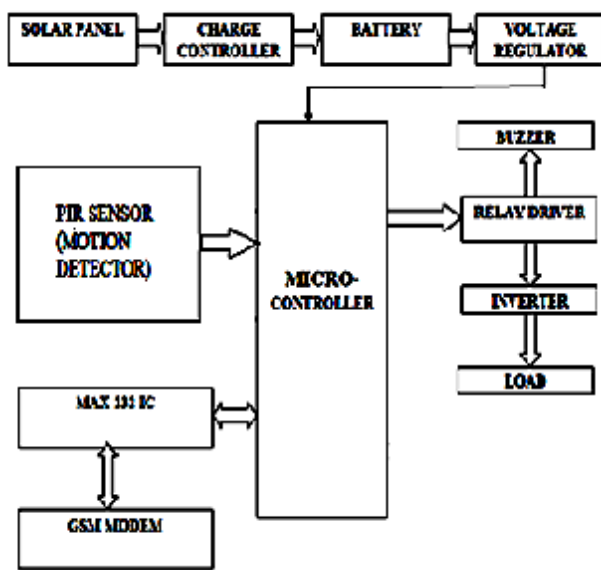


Fig. (b): Proposed System

#### 3.1. PIR-Based Motion Detector

A PIR-based motion detector is used to sense movement of people, animals or other objects. They are commonly used in burglar alarms and automatically activated lighting systems. They are commonly called simply "PIR". Pairs of sensor elements may be wired as opposite inputs to a differential amplifier. In such a configuration, the PIR measurements cancel each other so that the average temperature of the field of view is removed from the electrical signal; an increase of IR energy across the entire sensor is self-cancelling and will not trigger the device. This allows the device to resist false indications of change in the event of being exposed to brief flashes of light or field-wide illumination. (Continuous high energy exposure may still be able to saturate the sensor materials and render the sensor unable to register further information).

#### 3.2: Voltage Regulator

The voltage regulator IC maintains the output voltage at a constant value and provides +5V regulated supply which is required for the microcontroller. It may be use to regulate one or more AC or DC voltages.

#### 3.3: MAX232 IC

The MAX232 is a dual driver or receiver. It is an integrated circuit which converts the signals from RS232 serial port to the proper signal which are use in TTL compatible digital logic circuit. The drive increases the output voltage level from 5V supply to 7.5V by using external capacitor. It is mostly used in voltage level signal problems. This is use as a hardware layer converter like to communicate two systems simultaneously. It is helpful to understand what occurred to the voltage levels.

#### 3.4: Battery

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smart phones and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device. When a battery is connected to an external circuit, electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the external circuit.

#### 3.5: Relay Driver

Relays are electromechanical devices which are used as a switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The main advantages of using relay as a switch is that, they provide electrical isolation between inputs with the help of magnetic coupling and also we can handle a large power using a relay.

#### 3.6: Buzzer

Buzzer is used in the system for indication purpose. It indicates its alert when the unwanted person comes in contact with the fence area.

### 4. WORKING PRINCIPLE

The energizer has to be set up with its earth (ground) terminal coupled to an adequate earthing (grounding) system. The terminal is coupled to the live insulated wires of the fence. A correctly installed energizer sends an electric current along an insulated steel wire. As animal touches this live wire creates a path for the electric current through its body to the ground and back to the energizer via the earth (ground) system, thus complete the circuit. The greater the

shock the animal receives more lasting the memory will be and more the fence will be avoided in the future. The shock felt is a combination of fence voltage and pulse time (energy). The higher the joule rating of the energizer the greater the shock and the greater the fence performance provided the installation is correct.

### Calculation for Efficiency of Solar Panel

From the recorded data Input, output array and conversion efficiency calculation for the system is give by following formulae,

$$1) \text{ Array output (AO), Watts} = \text{Voltage(V)} * \text{Current(A)}$$

$$2) \text{ Input to arrays (IA), Watt} = G(W/m^2) * A(m^2)$$

Where, G - Incident solar radiation (W/m<sup>2</sup>)  
A - Panel Area (m<sup>2</sup>)

$$3) \text{ Conversion efficiency, \%} = \text{AO(Watts)} / \text{AI(Watts)} * 100$$

### Fence System Evaluation

The solar energy is converted into D.C. electricity by using the solar panel, which is further stored in the rechargeable battery dug time. This stored energy is then utilized for electrifying the fencing line at the night time and during cloudy weather. The voltage and current in fence line is measured by using the digital voltmeter and ammeter respectively. While measurement of voltage in fence wire with Digital Volt Meter (DVM) the one terminal or knob of DVM is connected to live wire and another terminal (earth terminal) is connected to earth fence wire or any post or touch to ground. The current in the fence line, it is always connected in series with fence live wire. It is observed that the voltage in fence line drops, when battery is not fully charged or discharge due to cloudy weather condition. The observations of fence voltage are recorded when battery is ¼ discharged, ½ discharged, ¾ discharged and fully discharged.

### 5. CONCLUSION

This paper shows that the proposed system is simple and efficient one. In order to implement this system for security purpose as well as less time consumption, it has low cost. In this the authorized person get message from GSM when any unwanted animal or person is detected by PIR or IR sensor. It sends command to the controller by IC 7805 regulator. Through relay driver the buzzer will on and light will glow. By using these techniques we can save small birds as well as the things which are placed inside the fencing areas. This is the solution to the protection of agriculture areas from robberies, interruption. In this system, the fencing is operated by passing continuous electric power supply through fence line for protection of agriculture.

### ACKNOWLEDGEMENT

The author extended their gratitude towards the guide from electrical engineering (E&P) department at DES'sCOET, Dhamangaon rly, for their guidance and also expressing gratitude towards the department and parents for their continuous support.

### REFERENCES

- [1] A. Gandhimathi, P. Madhumitha, T. Kalaiivani, "Solar Power Fencing System for Agriculture Protection using GSM," *An ISO 3297: 2007 Certified Organization*, vol.4, no.12, December 2016.
- [2] Chunjuan Wei, Junjie Yang, Wu Zhu and Jian Lv, "A design of Alarm system for substation perimeter based on Laser Fence and Wireless Communication," *IEEE conference on Computer Application and System Modeling (ICASM)*, vol.3, pp.543-546, 2010.
- [3] D. M. Kadam, Atul R. Dange and V. P. Khambalkar, "Performance of solar power fencing system for agriculture," *Journal of Agricultural Technology*, vol.7, no.5, pp.1199-1209, ISSN 1686-91411, 2011.
- [4] G. Alex, Dr. M. Janakiranimathi, "Solar Based Plant Irrigation System," *International Conference on Advances in Electrical, Electronics, Information, Communication and Bio-Informatics (AEEICB16)*, *IEEE*, 2016.
- [5] Lanka Wijesinghe, Prasanga B. Siriwardena, Shamali Dahanayake, Dharshana Kasthuriratne, "Electric Fence Intrusion Alert System," *IEEE*, 2014.
- [6] M. Anantha kumar, "Design of Solar Powered Energizer and On-line Monitoring of Electric Fencing system," *IEEE*, 2014.
- [7] Neeraj Khera, Amit Verma, "Development of an Intelligent System for Bank security," *IEEE*, 2014.
- [8] Shobhit Kumar Nagpal, "Hardware Implementation of Intruder Recognition in a Farm through Wireless Sensor Network," *IEEE*, 2016.
- [9] Thrimawithana, D. Madawala, U.K, "Pulse propagation along multi wire electric fences," *IEEE journals and Magazines on Science, Measurement & Technology*, vol.2, no.5, pp.349-358, September 2008.