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SMART SOLAR ELECTRIC FENCING

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Abstract*—The study highlights the significant impact of human-wildlife conflict on the livelihoods of people, including the loss of crops, animals, and human lives. The poor are found to be more vulnerable to such conflicts due to their reliance on the natural ecosystem. To address this issue, a portable solar electric fence system has been developed using IoT technologies. The system includes a solar panel, charge controller, energizer, battery, and relay. The solar energy from the sun is transformed into unregulated DC voltage, which is then converted to AC voltage by an energizer. A regulator is used to regulate the unregulated DC voltage. Unlike traditional methods that keep the energy flowing continuously, this system is designed to detect the presence of a person or animal through a motion detection sensor, allowing the current to flow only when needed.

***Keywords*— (Fence, Energizer, Charge controller)**

I. INTRODUCTION

The main aim of the project is to build a solar fence that will protect farmers' crops from animal damage while also protecting them from theft and trespassers. The shock-generating circuitry on the fence is fueled by solar energy. There is a lot of room for using renewable energy sources these days because nonrenewable ones come from resources that are depleted or destroyed quickly. Bamboo sticks were once utilized for protection as compound walls for security purposes. Nevertheless, as technology advanced, we now employ solar electric fence systems for agricultural and anti-trespassing, which is the most effective and cutting-edge method available. The usage of an electric fence system is a contemporary improvement over traditional fencing techniques for the protection of crops and property. It also effectively reduces animal-related loss. Its use in isolated places offers a cost-effective and practical way to provide the highest level of field protection. An electric fence typically consists of a fence energizer that is linked to a power source and whenever an animal or a person comes into touch with the electrically charged fence wires, electric fencing delivers an electrical shock. All animals including humans, pets, and bears are safe when an electric fence is built properly. A system must have a full and closed circuit for electricity to flow, such as in an electric fence. The circuit must be completed for the electrical current to return to its source from where it came from. The fence's charged wire must first become grounded before this flow can start. Regularly 1 occurring electrical pulses produced by the energizer are transmitted through the fence's charged wires to create an incomplete or open circuit, which is how an electric fence operates

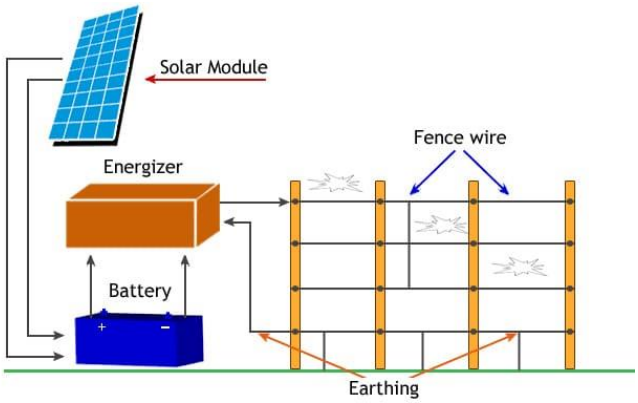


Fig.1.solar security fencing

II. LITERATURE SURVEY

With the help of solar cells, the light energy is converted to electrical energy and it converts high voltage to the required amount of energy using the charge controller and it is powered to battery. It consists of IR sensor when it senses any animal or human it gives signal to the micro controller.

The importance of solar charge controller is studied. Charge controller will control the charge of the battery without getting overcharged. There are two types of charge controllers they are PWM and MPPT. Charge controller provides highest state of charge. PWM is used when constant voltage is required when it reaches set point it disconnects the load. Energizer circuit consists of a reservoir capacitor which is connected to the 555 timer. This capacitor charges & discharges accordingly. The pulses are produced every 0.3sec and the mosfet acts as switch which gives supply to the ignition coil which is primarily used as transformer converts DC to AC.

III. PROBLEM FACED

Manual Security

To safeguard the crops, farmers either hire workers during the day and at night or if the fields are small, they do it themselves. For the purpose of frightening away monkeys and other wild creatures, farmers employ crackers and gunfire. Due to a labour scarcity in the State, labour costs are quite expensive. Due to human limits in ability to function in tough terrain, poor weather, and night hours, labour deployment to defend field crops cannot always ensure 100% protection of crops.

The Human-Elephant conflict

Elephants in Assam used to enter into the fields and ate all the crops. So, people decided to get rid of these elephants. For the purpose of fencing the intended area, they unlawfully pull electricity from high-tension wires or household lines; when elephants come into touch with these, they are shocked to death. When individuals have unintentionally run into these barriers, there have even been cases of human fatalities.

IV. SOLUTIONS

Despite the numerous measures taken by farmers and the government to protect crops from wild animals such as monkeys, none of them can ensure complete crop safety. The most effective solution seems to be the installation of a new type of Electric power fencing. This solar-powered fence uses a pulsing current to electrify the barrier, which gives an electric shock to any animal that touches it. Unlike a regular fence, the electric fence serves as a psychological deterrent, teaching the animals or persons to respect it.

V.COMPONENTS

SOLAR PANEL

A photovoltaic module, also known as a solar panel, is made up of multiple solar cells working together to convert solar energy into electrical energy. To generate the required current and voltage, several PV modules are connected to form a large PV array. Solar panels capture sunlight as a clean and renewable energy source and convert it into electricity to power various electrical loads. These panels are composed of silicon layers with phosphorus and boron, which create a negative and positive charge respectively. When photons are absorbed by these layers, an electric current is generated. The absorption of photons initiates an electric current in the solar panels. The specifications of a typical solar panel include a power wattage of 20W, dimensions of 330mm x 290mm x 25mm (length x width x thickness), poly-crystalline solar module type, an open circuit voltage of 22.3V, a voltage maximum power of 17.5V, a short circuit current of 1.44A, and a maximum power current of 1.03A.

SOLAR CHARGE CONTROLLER

A charge controller, also known as a charge regulator, is designed to regulate the voltage and/or current to prevent batteries from being overcharged. It acts as a regulator for the voltage and current flowing from the solar panels to the battery, ensuring that the battery is not damaged due to overcharging. Generally, in this model the panel is producing 12-16v of voltage so if there is no charge controller the battery gets damaged. At its core, the main purpose of a charge controller is to preserve the battery's maximum state of charge. This is achieved by safeguarding the battery against overcharging and disconnecting the load to avoid excessive discharge. An effective charge controller directly regulates the state of the battery, continuously checking its charge level between pulses and making appropriate adjustments as necessary. This ensures that the battery remains healthy and prolongs its lifespan. Maximum Input voltage 30v, Maximum Output current 5A, Charging voltage 14.4v (Bulk), 13.8v (Float) Maximum operating temperature 45C.

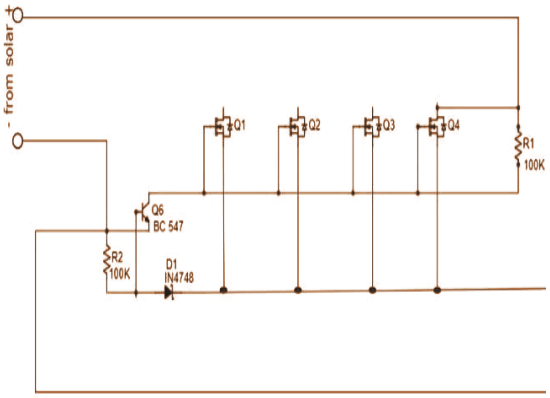


Fig.2.Circuit diagram of charge controller

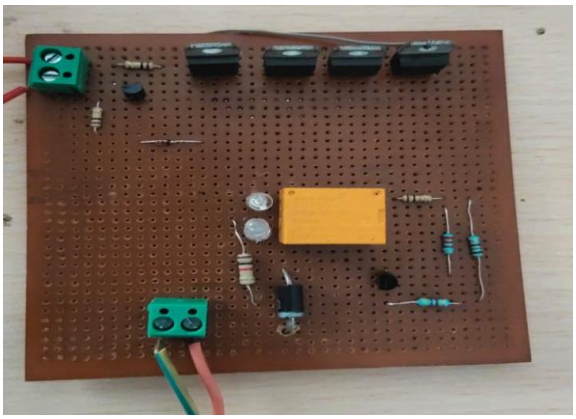


Fig.3. Real Circuit of Charge controller

CUT OFF CIRCUIT

A cutoff circuit is an electronic circuit designed to protect a device or system from damage due to excessive voltage or current. It works by monitoring the voltage or current and cutting off the power supply when it exceeds a preset

threshold. The purpose of a cutoff circuit is to prevent damage to the device or system, which could be caused by overvoltage, overcurrent, or short circuits. In our charge controller, cut off circuit is also included to prevent the battery from discharging beyond the manufacturer recommended value. It will protect battery during overcharging and it limits the current value upto battery requirement.

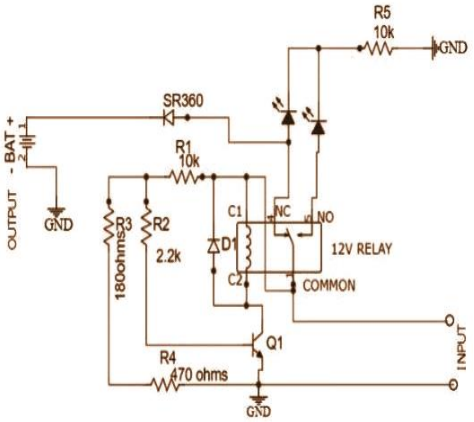


Fig.4.cutoff circuit

IGNITION COIL

The battery voltage is converted to considerably greater levels using an ignition coil. Two copper wire coils are wrapped around an iron core to form an ignition coil. Whereas the secondary winding contains thousands of turns of thinner wire and is protected from the high voltage by enamel on the wires and layers of oiled paper insulation, the main winding only hasa limited number of turns of heavy wire.

ENERGIZER CIRCUIT

An energizer is a Circuit which converts alternating current into direct current with high voltage pulses. You can use either mains power or 12 Volt batteries as power sources. We used a 12v battery, or a rechargeable battery may all be used to power the fence energizer. The circuit is not closed, energy cannot flow, and the fence sits idle waiting to be used when the device is earthed and linked to a fence. At this point, if an animal touches the barrier, it breaks the electric circuit: The energy forms the basic electrical circuit as it passes via the fence, the animal, the earth, and finally the ground rod system and back to the energizer.

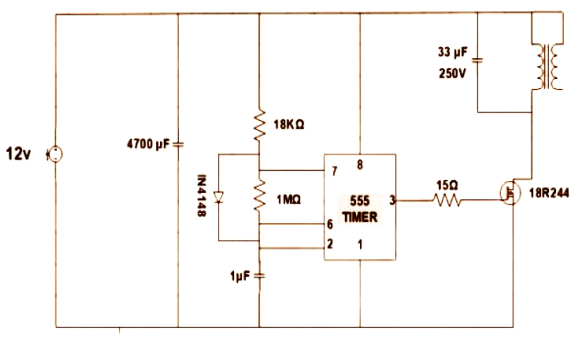


Fig.5.Energizer circuit

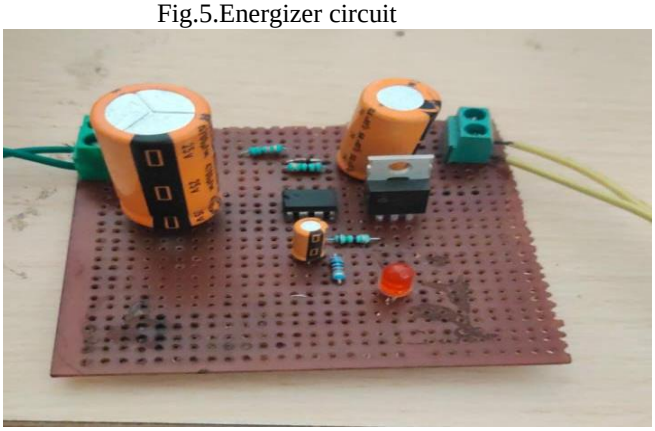


Fig.6.Real Energizer circuit

NODE MCU

The NodeMCU module is a small, compact board that is programmable and capable of wireless connectivity to networks. It can be classified as a System on Chip (SOC) that integrates a TCP/IP protocol. The NodeMCU board can operate as either a server or a client, or even both, within a network. When operating as a server, it acts as a host, while as a client, it can send requests to the server. Additionally, the NodeMCU module is equipped with input/output pins that can be connected to sensors or actuators. This allows for the transmission of sensor data to the server and the activation of actuators based on the received data.

BATTERY

A 12V,7Ah batteries are very popular deep cycle and general-purpose batteries, commonly used for powering medical equipment, security systems, UPS and other emergency systems, toys, scooters, fish finders, etc. For a long 3 time, 12V 7Ah batteries were built only as Sealed Lead Acid (SLA) batteries

RELAY MODULE

A relay module is an electronic device used to control the flow of electricity in a circuit. It consists of a relay, a switch, and a set of contacts. When the switch is activated, the relay energizes the contacts, allowing electricity to flow. Relay modules are commonly used in applications such as motor control, lighting control, and home automation. They are typically used to switch large amounts of power on and off, and can be used to control both AC and DC circuits.

PIR MOTION SENSOR

A motion detection mechanism that employs a PIR sensor is used to detect the motion of people, animals, or other objects. All things with a temperature above absolute zero emit heat energy in the form of electromagnetic radiation. In general, this radiation is not perceptible to the human eye as it emits infrared wavelengths, but it can be detected by electronic devices specifically designed for this task. A PIR sensor has the ability to perceive alterations in the quantity of infrared radiation that falls upon it, and this change is contingent upon the temperature and surface properties of the objects located in front of the sensor. As an object, such as a person, moves across the field of view of the sensor, for example in front of a background like a wall, the temperature at that particular point will increase from the ambient room temperature to the body temperature of the object, and then return to the room temperature. Alternatively, when an object, such as a person, crosses in front of the sensor's field of view, which may include a

background like a wall, the temperature at that specific location will increase from the ambient space temperature to the body temperature of the object, and then the sensor translates the observed alteration in the incoming infrared radiation into a corresponding change in the output voltage, which then triggers the detection process. Operating voltage -5v to 10v, Current Consumption-65mA, Output voltage goes high at 3.3v, operating temperature=-15 to+70 degrees.

V. METHODOLOGY

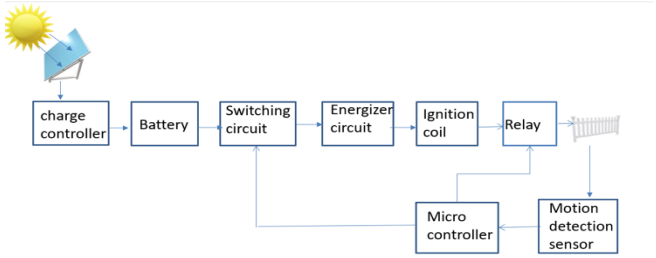
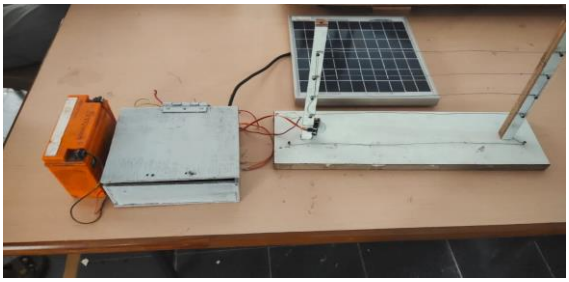
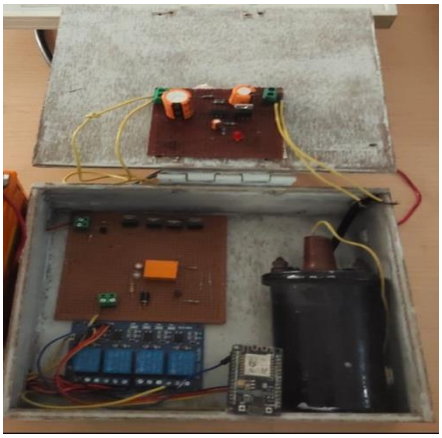


Fig.7.BLOCK DIAGRAM

The block diagram above illustrates that many photovoltaic cells linked in sequence make up a solar panel. These cells create electricity. These cells can generate enough electricity when assembled into a solar panel to refuel a typical 12-volt battery. When the solar module of a solar fence system transforms sunlight into direct current and replenishes the system's battery, the system is prepared to operate. The system's battery can often operate for up to 24 hours a day, depending on sunshine hours and capacity. The charger, energizer, fencer, or controller receives the output of the charged battery. This system is designed mainly to save energy so when a PIR sensor senses any person or animal it gives signal to the micro controller and this micro controller sends message to the owner as well as to the relay then this relay gets closed and a brief yet sharp voltage is produced by the energizer when it is energized. The energizer's main job is to generate sharp, brief voltage bursts of almost 8000 volts. Assuring that no physical harm is done to the trespasser who attempts to come into touch with the electric fence, these pulses are sent through the wires of the fencing system at a rate of around 1 pulse every 1-1.5 seconds with each pulse lasting for almost 3ms.





VI. CONCLUSION

Our project 'Smart Solar Electric Fencing' is based on the energy consumption. Solar energy is a great advantage where there is no access to power cables. This system can be easily constructed and installed. It also has long life and reliable. This system is very useful to the farmers to protect their crop from trespassers. The existing fencing system has a drawback of causing harm to living beings due to continuous power flow. Additionally, obtaining government approval for delivering electric shocks through the fence is required. To address these issues, we propose a new system that utilizes solar energy with backup power for uninterrupted operation during nights and cloudy days. The advantages of our proposed system include the use of renewable solar energy, ease of fence control and maintenance, and reduced time consumption. Moreover, our system eliminates the problem of electric power loss by utilizing a sensor-based approach instead of continuous power supply. So, it's a more eco-friendly, efficient, and convenient solution for fencing.

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