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Farmer Friendly Solar based Virtual Fencing for Rural Agriculture with Battery Reverse Charge Protection

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Abstract: ***Solar-based virtual fences use the principle of converting solar energy into electrical energy and giving electric shock while touching the fences. Electronic fence systems are used at many places such as forest areas, farms, etc. To protect those places against animals and thefts solar energy is converted to electrical energy to provide the necessary voltage for electrical fences As the Unregulated DC voltage from the solar energy is converted to regulated DC voltage and further converted to AC voltage using an inverter. And this electrical energy is used to give short but sharp shocks to the animals or anyone who touches the fence, But there is life threat through electrical shocks, as even though it is a short time shock it will be dangerous to life as it electrical energy and there will be chances of death, So we proposed a model of VIRTUAL FENCING technique which protects the farmland by scaring away the animals which tries to enter the fence protected land and at the same time it alerts the owner about the intrusion and lets the owner choose the type of defense to use remotely which is made possible in our model through a GSM module.***

Keywords: Virtual Fence, Safe Fence, Safe Defence, Farmer Friendly.

I. INTRODUCTION

In the world, the economy of many countries is dependent upon agriculture. In envy of economic development, agriculture is the main source for the daily life of many people in India. Agriculture is the mainstay of the economy.

It contributes to the gross domestic product. Agriculture meets the food requirements of the people and produces several raw materials for industries. But because of animal interference in agricultural lands, there will be a huge loss to the farmer. To avoid these financial losses, it is very important to protect agricultural fields or farms from animals.

To overcome this problem of farm destruction by animals and theft by Humans, we have proposed a working model of VIRTUAL FENCING technique which will be portable, safe to life and efficiently working to help a farmer save his crop from being destroyed by any animals or any person through entering into the land, These prohibitive fencing techniques protect the crop from being destroyed and indirectly helps in increased crop yield. Theme of the project is to design a intelligent security system by using Embedded system while the electric fences damages some percent of crop directly and even creates loss to farmer as the fencing system he used have to be implanted in his own land ,for this setup he will lose out on his land space which he used for crops before so indirectly he will get loss due to the electrical fences and even there's a chance of crops near to the electrical fences getting burned or damaged due to the contact of crop to electric fence and whenever a green plant has a contact to electrical power it is damaged definitely ,There is a chance of short circuit near fences which could cause fire in his land and lead to burn down his entire crop, So to overcome all of these issues our proposed work defines safe fencing technique using a RENESAS microcontroller as a main controller of the project and IR sensors used to detect any kind of intrusion into the land and a GSM module connected to the micro controller which enables sending SMS alerts to the user when a breach happens at the fence and lets the user choose type of defence through a SMS replied back to the GSM module with a particular predefined code.

II. RELATED WORKS

A.D Dias in the international conference for Guilherme explains the fundamental concepts of electric fence technology, presents a new method for a livestock electric fence energizer circuit and impulse transformer as well mathematic analysis of the circuit. a new expression for design single impulse transformers for this kind of application is presented who has different project criteria from conventional transformer applications. An electric circuit prototype of electric fence energizer equipment for livestock use was implemented and the results are showed [1].

Chunjuan Wei explains the security of power equipment and electric power lines is presented. Many alert systems based on AC high voltage grid, electronic pulse fence, or infrared electronic fence have been installed in substations. In this paper, they proposed an intelligent anti-theft alarm system based on the laser fence and wireless communication network.

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Moreover, the onsite searchlights could be remotely controlled by SMS with GPRS network [2]. Caroline Lee explains majorly about virtual fence for animal management in rangelands. Here they present a virtual fence based on an electromagnetic coupling principle. The fence is an insulated wire in a loop unrolled on the ground around the animals. When the fence signal is detected by the collar, a behavior algorithm decides the action to apply to the animal to prevent it from crossing the wire. Bringing more flexibility in fencing this new technology could lead to more precise management of grazing in protected zones [3]. Chang, P-F., L-Y. Chu, and Y-K. Wu explains a non-lethal high-voltage intelligent instruction detection sensor for perimeter alarm systems. The sensor looks like a standard high voltage electric net barrier. It is a kind of outdoor detection system and functions not only as a fearful obstacle but also as an intrusion detection sensor. The alarm detection algorithm, which classifies the sensor readings in three levels: alarm, uncertain and secure, avoids a lot of false alarms by detecting logically unreasonable data and analyzing weather-related disturbance. This system makes a significant improvement in reducing the false alarm rate [4]. Jun-Horng Chen, Teng-Hui Tseng, Chin-Lun Lai, Sheng-Ta Hsieh, This work proposes an intelligent and interactive virtual fence system for security management in a danger-or accident-prone area. The proposed work is designed to be realized in an outdoor and wide-area park. With the proposed system, users can visually and arbitrarily define the Polygonic alert area for the sake of security. [5]. Wesley Huang, Chia-Sui Wang, Yih-Feng Chang, Chia-Mao Yeh, Jason Lin, explains how to provide a safe environment and convenient services is a topic of great concern to the government, police units, and the public. In the past, in the management of intrusion detection on the periphery of the plant area, approaches with constructing infrared sensing and embedding wire to sense the passage of objects have been adopted. Apart from the problem of high construction cost, hardly distinguishing people, animals or objects often happens.[6]. Emilee Klaas, Mehdi Roopaei, explains Immersive Analytics (IA) is potentially the most impactful new technology to be used in recent years. This technology can integrate data analytics techniques, multisensory input, and output along the reality-virtuality continuum into immersive environments that allow the operator to have more interaction with complex data. IA is a disruptive mechanism for behavior research and treatment in a controlled environment. Animal's behavioral interactions with its environment, and other organisms, disclose significant information about the ecosystem.

III. METHODOLOGY

An exemplar module will be developed for the project. It contains individual PCB boards for all interfaces according to the block diagram. Every PCB will be inter-connected with jumper wires Designing of Diagram for proposed the model

A. Hardware testing as per project
B. Test Code preparation for peripherals
C. Logic Development as per project
D. Final Testing of the project as per project conditions:

1) Designing of the diagram for the proposed model includes gathering all the components required for the design and connecting it to the microcontroller.
2) Here we will be using a solar panel to make our project be environmentally friendly and utilize solar power instead of depending on Electricity.
3) Along with the solar power there will be a battery for backup power which will be charged from solar power during day time and this battery power will be used in night times until morning.
4) A LED display will be used to denote the power status and condition of the fences
5) IR sensors will be used to detect any kind of obstacles or any contact near to the fences if anything is found by the IR sensors it will generate a sound or a warning to the user through GSM relay and preinstalled sounds.
6) All these mechanisms will be connected to a micro-controller which will be controlling all these activities.
7) A GSM relay mechanism installed to activate/Deactivate (or) Use these virtual fences functionality with ease without any hassle or manual work.
8) A Booster circuit (Energizer) will be used here to control the voltage from solar panel (or) battery to fences.
9) Previous type of electric fences used to shock the animals when they touch the fence which would harm animals but this project is focused to prevent hurting animals from electric shock and warm the user with a preinstalled sound when the IR sensor detects any obstacle near sensors or any animals crosses the virtual formed fence.

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IV. BLOCK DIAGRAM

Many embedded systems have significantly different designs according to their functions and utilities. In this work, a structured modular design concept is adopted and the system is mainly composed of a single microcontroller. The microcontroller located at the center of the block diagram as shown in **fig.1** forms the control unit of the entire project. Embedded within the microcontroller is a program that helps the microcontroller to take action based on the inputs provided by the output of the GSM. The main objective is to protect from the entry of the unauthorized person. Here we have used an Mp3 player, it will produce obstructive sounds when birds entering to forms. We use to store respective warning sounds, whenever IR obstacle detects any unauthorized entry, then stored Mp3 content will be played. We are implementing virtual fence concept also here, by using mobile we can activate this and make it function, whatever the mobile input that will be received by GSM which is attached to the
Controller

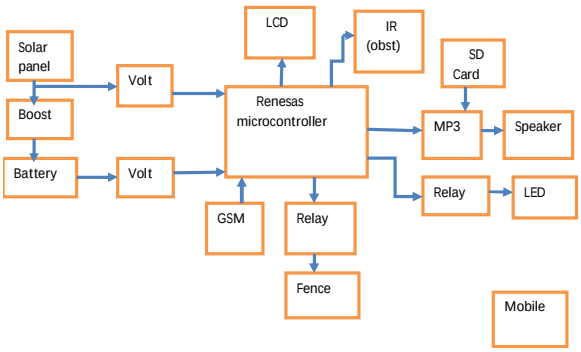

Fig. 1. Block diagram of the proposed system

From the point of power conservation, we are using solar panel as an alternative supply in place of a battery. And internal operations will be displayed on LCD, which is attached to the main controller unit. And GSM will be responsible for sending and receiving messages. The relay unit acts as a switch for the LED, and it will be turned on and off based on situations. The booster circuit will be responsible for maintaining the Battery and Solar voltage. via input from the mobile device, the controller operations will be decided. Virtual fencing will be used above the ground level where no electric fencing is possible to make possible of security in all situations, while on ground electric fencing is installed above those to protect from birds and other possible situations, we would install virtual fencing which would alert audio when an IR sensor detects something passing into the are secured area.

V. FLOW CHART

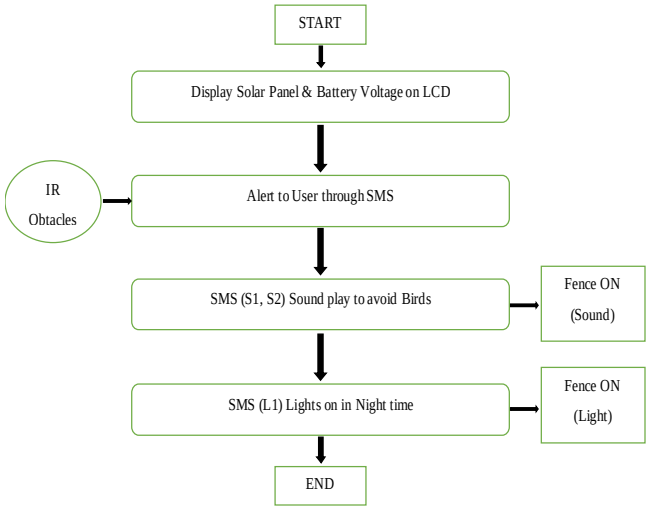

Fig.2: Working flow of proposed model

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This Flow chart above in **Fig.2** explains the working flow of the designed model from Supply of the required voltage to turn on The device and displays the voltage being supplied to the model and input voltage from the solar panel to charge the battery, on the LCD and checks the components working by turning on and off, Once all the components are working and ready the IR obstacles are used as detecting mechanism where if anything is detected by the IR sensors it will alert the user through an SMS and then next phase of the model is playing preloaded sounds from an mp3 module, Sounds to be played can be selected by the user with an SMS command predefined to scare away anything entering the fenced area there's an additional feature of sharp lighting to create a temporary uneasy moment/ blind anything entering the secured area.

VI. EXPERIMENTAL RESULTS

Previous designs used electrical fences which were risky for one's life, but this design of our work is completely safe from any harm to life. We have tested this proposed model **fig.3** with various conditions by calibrating sensors values to adjust specific conditions, obtained results from testing the proposed model with GSM module testing using AT commands to check user interaction remotely, FN-M 16 module which is used to store all the audios we used here for sound defense and monitor ongoing information for a very long period, the sensors used in our work has low sensitivity and calibration to different senses in not automatically adjusted as of now and it will be implemented in our future work for real-time application with higher range. The project is designed using structured modeling and can obtain desired results.

Fig.3 shown below is the design for the model proposed in this paper **Fig.4** shows the input from solar panel and output for fence used, also displays the fence condition as ON or OFF

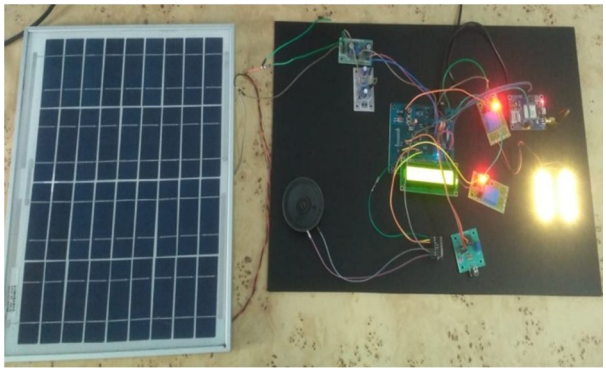

Fig.3: Model design for proposed system

Fig.4: Display used to show status of fence

VII. CONCLUSION

The use of Electrical fencing by farmers in order to safeguard crop from animals or other reasons can also create a loss to them by some methods, So as the farming is the only occupation half of the Indian population is depending on for there daily earning. without farming we might face crisis in food as decrease in farming in seen due to the losses occurred in such situations, Our work stated above in this paper explains certain methods to overcome all these problems and practice safe and easy portable methods for safeguarding there crop as well as to reduce loss. All these methods are designed using structured modelling and is able to provide desired results. This project can be implemented successfully in Real time with certain modifications. To make this system applicable for real time purposes, components with great range needs to be used.

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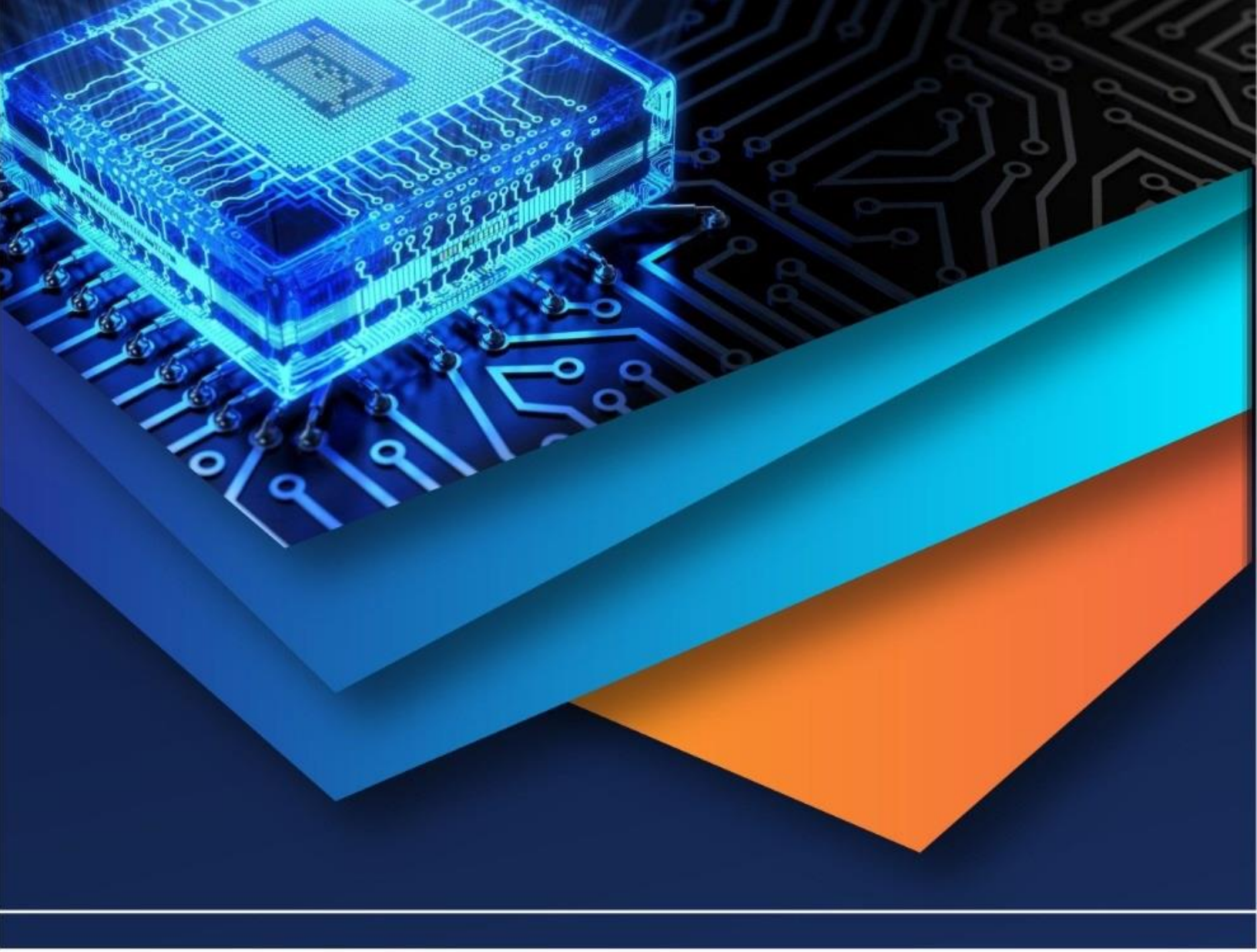

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