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Security Measures for Crops and Domestic Animals Using Virtual Fence

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Abstract:- India is mainly an agriculture-based country. Security of agricultural farm is of utmost importance for protecting the produce. Not being able to make the grown crops to the market is another side of the problem. Valuable investments and efforts can be ruined in minutes intentionally or unintentionally by persons or by animals. The threat posed by birds to economic crops in the farms and effect in health or at storage facilities requires the deployment of an effective bird deterrent in such locations. Many attempts have been made to develop successful bird deterrent systems with only a made progress in this topic. The ultrasonic frequency range sound (15-25 kHz) is irritating to birds and they scare away. The result shows that the system is 80-95% accurate and 100% consistent for detecting any suspicious movement and to act accordingly.

Keywords:- *Ultrasonic sensor, Arduino nano, Bird Repellent, 555 timer, PIR sensor etc.*

I. INTRODUCTION

Agriculture is the backbone of our country. It plays very important role in the growth of country's economy. The true purpose of education is served only when the products of education (we the students) are able to address the problem of the nation through their specialization stream. Hence as we are from the Electronics and Instrumentation branch, we have tried to tackle the problem faced by the farmers (confined to areas near the forests) through the little knowledge we have.

Ever since humanity started farming and taming animals, the concept of perimeter protection has always been the use of hazardous objects placed as physical fencing apparatus to protect the interiors. These mainly serve as "hindrance" objects which do not act/communicate intelligently in cases of perimeter breach. Over the years, many advanced surveillance technologies have aided in monitoring regions of concern. But these are deployed primarily for high end security purposes in critical areas. And majority of the time farmers are not as skilled as it requires to operate these things. Hence, we aim to come up with a user friendly and simple yet an effective system to monitor farmlands and protect them from animal intrusions. Crop is not the only thing in danger, but domestic animals too. The model that we have proposed also makes sure that domestic animals are safe too. Because in many areas, domestic animals like sheep, goat, hen etc. are eaten away by the wild animals that trespass the boundary and even other domestic animals that are higher in the hierarchy.

II. LITERATURE SURVEY

To build an intelligent security system using IoT and sensor networks are the foundation.

Most of the existing solutions to this problem primarily involve using CCTV footages to alert the owner about the intrusion. Researchers have developed various IoT-based security devices, but very little work relating to agricultural land security is reported. The methods defined in the papers referred have methods such as detection of vibration when the fence is touched, ultrasonic sensors for sensing movement or the use of simple cameras with automated algorithms to detect a change in image and hence the intrusion of the person. In Ronnel Kylon A et.al, (2016), a smart security system built using image processing and Arduino microcontroller is described. The system captures the image when any motion is detected in the farm and then the image is sent to a server for processing using MATLAB which is again sent back to the Arduino for appropriate action to be taken. There is no provision for processing the image the source and hence this process is very much time consuming. In V Jenitha, et.al, (2021), a system is proposed. In Vinita Tyagi et.al, (2017), a survey is presented with applications of image processing techniques applied to the field of agriculture for detecting weeds and grading fruit. This method was less time-consuming and precise than many conventional approaches used. Image processing helps enhance decision making for vegetation measurement, crop sorting and irrigation. We can also classify the different types of weeds using image processing techniques. In Zhanjie Wang, et.al, (2010), a system is described in which crop destroying animal or intruder is

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identified. The farm is monitored closely using Closed- circuit television (CCTV) which also provides the recorded video for security. Motion is detected using Arduino microcontroller and a snapshot of the video is taken and displayed on the Graphical User Interface (GUI) which is programmed. It is further processed to identify the intruder and alarm system is turnedon through an opto-isolator. Thisalarm can be turned off by the respondents. These methods are usually effective during the day, and ineffective at night. Moreover, mere alerts about intrusions do not solve the problem of animals destroying crops. The reaction towards the intrusion by humans might be delayed by several minutes which is at most times useless. One more solution is we can deploy electric fences. But the problem that lies with deploying electric fences is that they aredangerous to animals as well.

III. PROPOSED SYSTEM

The need for smart solutions leads us to design this solution which uses an efficient system to alert the owner in real-time indicating "what" has breached the perimeter. The system also tries to intimidate the intruder by producing "customized" sounds of desired frequency. This would decrease the damage caused by the breach and would alert and enable the owner to take immediate action. Even if the owner couldn't make it to his farmland due to some unavoidable reasons, the produced sound is enoughto protect the crops on its own. We are doing sensor networks from which we going to detect the animal or bird intrusion. Detection is the first and most important step. A microcontroller serves as the primary controller of the system. In addition to the microcontroller, we will design the hardware and software around it. Detection and sound systems make up the hardware. For the software, the code will be written in the C language. We are also using PIR sensor to trigger the sound when there are birds flying in the range of PIR sensor. When the animal or bird is sensed by the circuit, we will send the notification to the user saying that bird is detected and the system in on.

From the research we have made we got to know that the birds or animal will be triggered at a specific frequency of sound . So, we are going to take this as advantage and we are generating those sound from our device to scary away the animals without causing any physical harm. From the research we have done we got to know that for repelling the using "ultrasonic radiation" in which we going to use the frequency range (17-24 kHz) which disturbs the birds and repels away.

IV. SYSTEM DESIGN

For the detection part, we are going to use an ultra-sonic sensor in four directions to detect the intrusion in all directions. Then we are going to use an Arduino nano microcontroller to trigger the sound when the intrusion is detected in any of the sensors. For the generation of the sound, we are going to use 555 timer circuit for the generation of desired frequency.Arduino Nano has 36 pins in which 22 pins are input/output pins , 6 analog pin and 14 digital pins. Flash memory in 32 KB

The ultrasonic sensor is connected through a 7405-voltage regulator. The detection range is set by the user and a 9v battery or a solar panel can be used to power the circuit. From the power supply a relay is connected for switching the tweeter on and off. The Arduino is also connected to a Node MCU. It is a Wi-Fi module from which we can send the messages if animal is detected on not.

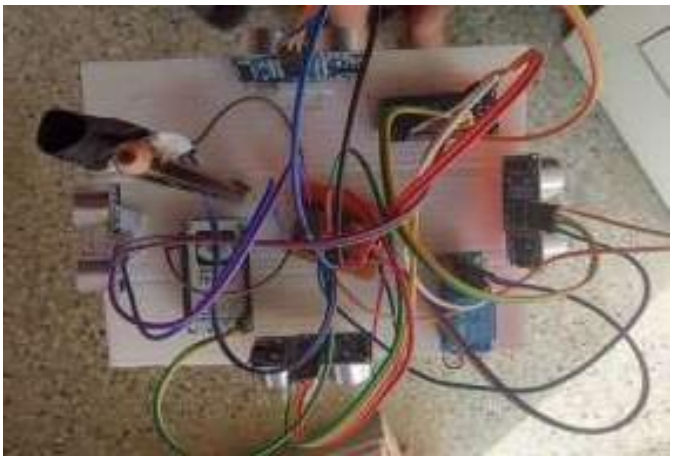

Fig 1:- Virtual Fence System

For the frequency generation circuit, we are going to use a 555-timer circuit in astable mode. Pin 2 and 6 are connected together for the circuit to re-trigger after completion every cycle and to run continually. For each cycle capacitor c charges through r1 and r2 but discharges through r2. The capacitor charges up to 2/3 vcc which is determined by the 0.693(r1+r2)c and discharges down to1/3 vcc.

Astable 555 Oscillator charge and discharge times are given by.

$t1 = 0.693(R1 + R2) \times C$

and

$t2 = 0.693 \times R2 \times C$

Where R is in Ω and C in Farads

555 Oscillator cycle time
$T = t1 + t2$

555 oscillator frequency Equation

V. IMPLEMENTATION

Algorithm: Crop Security using Virtual Fence Methodology.
Step 1: Start
Step 2: Activate Ultrasonic sensor.
Step 3: If motion detection=YES goto step 3 else, continue sensing
Step 4: Turn on the sound system
Step 5: Activate speaker and play the sound to scareaway the animal and go back to step 3

$$f = \frac{1}{T}$$

Duty Cycle can be found out by

$$Duty\ Cycle = \frac{R1 + R2}{(R1 + 2R2)}$$

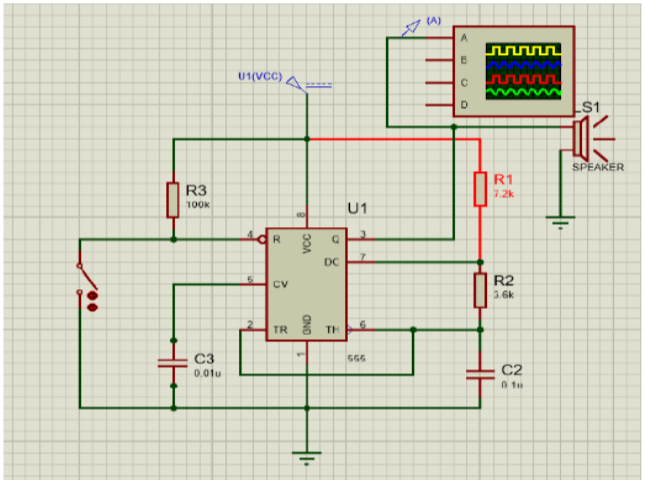

Fig 2:- Circuit Diagram in Proteus

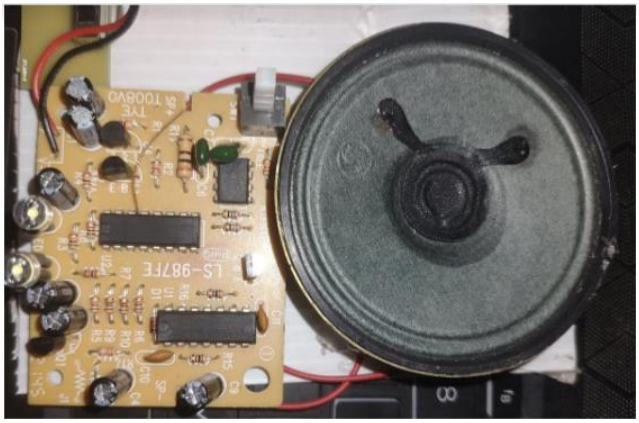
Fig 3:- Implementation of Timer Circuit

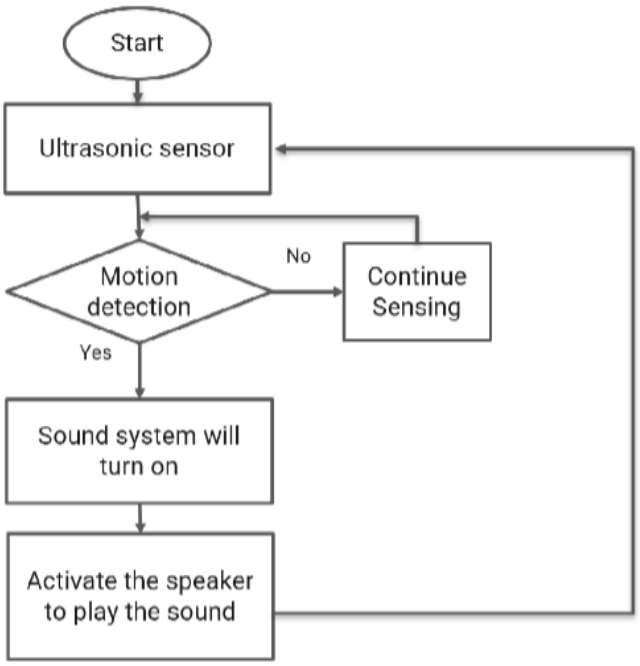

Fig 4: Flowchart of the Proposed Methodology

VI. RESULTS

Our model was able to successfully detect the intruded animal and trigger the ultrasonic sound from which they will flee away. It was able to detect the intrusion and measure the distance of the same and send notification and alert the owner.

VII. CONCLUSION

Smart agriculture is need of the hour. Virtual fence is widely needed technology nowadays. In order to achieve this vision based smart system is proposed and implemented using Arduino nano and sensor networks. The architecture comprises of Arduino nano, which is the heart of the processing unit that takes information from the sensors deployed in the farmland. where in, the animal responsible for the generated event is identified and corresponding allergic noise is produced to make the respective animals flee. This designed framework can be utilized in smart agricultural applications such as preventing the intrusion of wild animals into the field and detecting any malicious activities being carried out on the farmland.

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REFERENCES

[1]. Guguloth Devilal and P. Rana Rao (2018), Protecting Birds from Birds, Using Sound Technology in Agriculture
[2]. Sheela. S, Shiaram. K. R , Chaitra U, Kshama. P, Sneha K.G.,Supriya K.S (2016), Low-Cost Alert System for Monitoring the Wildlife from Entering the Human Populated Areas Using IoT Devices
[3]. P. Silakari, P. Silakari, L. Bopche and A. Gupta, "Smart Ultrasonic Insects & Pets Repeller for Farms & Inventories Purpose," 2018 International Conference on Advanced Computation and Telecommunication (ICACAT), 2018, pp. 1-3, doi:10.1109/ICACAT.2018.8933607.
[4]. R. K and S.R. Madkar, "Implementation & Design of Wireless Transceiver for Data Acquisition in Wireless Sensor Network", vol. 3, no. 7, July 2013.
[5]. H.M. Alabari, S.C. Mane and H. Evalad, "A Zigbee Based Smart Sensing Platform for Monitoring Environmental Parameters", *Proceedings of IEEE ICI&MT*, pp. 1-8, May 2011.
[6]. J. Hane and H. Yue, "Paprika Greenhouse Management System for Ubiquitous Agriculture", *Proceedings of IEEE ICI&CTC*, pp. 555-556,Nov 2010.