Automated Bird Detection and Repeller System Using IOT Devices: An Insight from Indian Agriculture Perspective

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Abstract: Agriculture plays a vital role in contributing to one-third of India's Gross Domestic Product and a significant part of the country is relying upon it for their survival. The annual income of farmers is largely dependent upon the yield of crops that they produce, which is continuously decreasing due to a number of factors and one such factor that we are focusing on is the damage caused by birds. By taking into consideration the statistical survey of farmers on the percentage damage of crops due to birds, we would like to propose the model and prototype of an automated bird detection and repeller system using IoT devices. This model consists of two main functionality one is the motion detection using PIR(Passive Infrared) based motion detectors and the other part that is repeller that will generate sounds of the predator which will drift the birds away from the field, using an MP3 module and megaphone. This model aims to maximize the yield output and shows how IoT devices can help achieve this.

Keywords: IoT devices, motion detection, repeller, MP3 module

1. Introduction

In India, nearly 70 percent of rural households are dependent on agriculture for their livelihood. India is an agricultural country as it is completely dependent on the agricultural sector. The low productivity of crops depends on various factors and one of the factors is the intervention of birds population. Birds feed on grains, fruits, vegetables, insects and bugs which are available in extent in a crop field. While most cases these birds are not a threat to crops as they mostly feed on pests and insects that feed on crops and help in the process of pollination that encourages a higher yield but they can also cause damage by disrupting the seeds while searching for worms and insects or in case of the unavailability of insects.[5] Crops are at threat by birds in all stages of cultivation right from crop implementation to crop harvest. Damage caused by birds depends on several factors which are the local population of birds, cropping patterns and the area of the field.[6] ’63 bird species of birds, 1,364, from 19 families that caused damage to several crops. A whopping 52 bird species attacked cereals, pulses got attacked by 14 bird species, while oilseeds faced damage risk by 15 species, and fruits by 23 species. They also caused damage to the crops of smaller grains such as pearl millet and sorghum as well as maize,” stated the inter-ministerial report of the Committee on Doubling Farmers Income (DFI) - Volume X titled "Risk Management in Agriculture", released by the Ministry of Agriculture. Mustard, pulses, peas, wheat and rice productions are largely affected by crows, sparrows, pigeons and doves. Many traditional ways are used by farmers like white cloth banging, erection of scarecrows, noise-making devices like crackers and carbide guns with polythene bags, killing and catching birds. Many bird repellent chemicals like Trimethacarb, Methiocarb and Curb and poisonous chemicals are also used. A survey was conducted to understand the damage caused by birds and how effective the current techniques are to stop this damage. The survey includes questions about the damage pattern. The analysis shows that 73% of the farmers considered damage produced by birds a serious problem and 85% agree to the need for modern and eco-friendly bird scaring techniques. More than 90% of the farmers expressed that the damage percentage depends upon the crops and the season.[3]

2. Literary Survey

We all are aware of the fact that no survival is possible without the
agricultural sector and to fulfill each and everyone’s health and growth in a country like India, which can only be done if our crops are harvested well and are not destroyed for any reason. Many projects and researches have already been done to conquer the problem, one of the major problems caused to the crops by birds. The research work done by Azamjon, Yun Chan, Daeyoung Na, Cheolwon Lee and Heung Seok Jeon [4] was on the topic to keep away the birds from destroying crops and out of many solutions, the solution used by them was the solar-powered bird repeller system with the effective bird scarer sound which utilizes the solar energy to generate loud noises to shock the birds and other species and cause them to flee away from that area. It is very eco-friendly and a great idea but solar power is not long-lasting and requires daily solar recharges, while the area which lags good sunny weather would not be benefitted from this method. So, as we know research are never perfect and hence there is always a scope for improvement, therefore we have tried to cover the above con of the research and used IoT in our research as IoT makes things technologically easier and more long-lasting. The research work done by P. Rama Rao and GugulothuDevilal proposed that food is the most important requirement for living beings. The main products of our food comes directly or indirectly from agriculture. Nowadays, the security of the agricultural field is very important. Crop damage by birds is a severe problem in most of the areas all over India. Field surveys showed that on an average 36% of the crop were damaged by wild birds. Birds are falling on crop and eating it. Every animal or group of animals have a specific range of hearing frequencies. Their irritating frequency is estimated by a specific logic. For developing this project they used Arduino, APR900, IR, and buzzer which came up to be a good idea and further this can be developed on large scale and specifically focusing on birds to get rid of the 36% problem causing reasons.[1]

2. **PIR Motion Detector Sensor:** It detects any living being within approximately 10m from the sensor. This is an average value, as the actual detection range is between 5m to 12m. It consists of a pyroelectric sensor that generates energy when exposed to heat means when a human or animal body will get in the range of the sensor it will detect the movement because the human or the animal body emits heat energy in the form of infrared radiation. The second element of PIR sensor is Fresnel lens which provides a field view of less than 180 degrees. So, this will help us in detecting the entry of birds in the crop field.

3. **MicroSD Card:** It is a type of removable flash memory card used for storing information. This card will contain the recorded voices of predators like eagles, falcons, owls etc.

4. **MP3 Module:** It is a portable consumer electronic device that allows you to store and play audio files in MP3 format. The MicroSD card will be inserted into the MP3 module, the module will read the audio from it and it will help in controlling the volume of the sound produced.

5. **Audio Amplifier:** This device will help in amplifying the signals received from MP3 module to make it louder.

6. **Megaphone or any other sound-emitting device:** The amplified signals will be sent through this megaphone at 15W or more according to the field area if the agricultural tract is area wise large then we need to increase the watt and vice-versa.

7. **External Battery:** Required for charging up purposes

The prototype of the proposed model is as shown in Fig. 1.

As soon as the bird reaches into the radius of the PIR sensor, it generates a PIR activation and sends the signals to the MP3 module which in turn generates the sounds of predator and gets it amplified and produced by the connected megaphone.

3. **Proposed Model**

The main goal of this model is to drift away from the birds from damaging the crop yield of farmers during the harvesting season. Our model will be erected on the center of the field track on a raised platform and it can cover the birds entering the field within the radius of 12m approximately. So, if we use many PIR sensors in series then we can cover a large hectare of field. This model is based on the emerging technology of the Internet of Things (IoT) which has clearly been a breakthrough in providing solutions to cater to the needs of the people. It has clearly been able to connect real-life objects, humans and animals with the world of the Internet. This model performs two main functionality that is motion detection and sound emission to scare away the birds. The components of the model are:

1. **Wemos D1:** The Wemos D1 is a ESP8266 WiFi based board that uses the Arduino layout with an operating voltage of 3.3V. The program for detection and repeller actions will be loaded into this board.

![Fig 1 - Bird Detection and Repeller Diagram](image-url)
4. Conclusion

This proposed model is a cost-effective, reliable and simply understandable solution. This approach of using IoT devices believes that problems like protection of crops from birds and many such related problems can be solved under this area of interest, hence broadening the horizon of researchers to bring on effective implementable ideas or solutions for different problems similar to this. Lastly, we conclude by stating the advantages of our model, automated detection and repeller techniques, no man-force needed.

5. Future Scope

In our proposed model we are collecting the data of output of PIR sensors, we can use this data to further analyze and improve the model. Secondly, we can be set up this model on a large scale with the help of the interconnection of various such models. After more research in this field, we can install better sound variants that can scare the bird from entering the field. We have various scope of improvement in our model like using better motion detection sensors which specifically detect birds and usage of display image processing monitor that will show the pictures of predators and will be helpful in drifting away from the birds.

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