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International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

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Smart Crop Protection System

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ABSTRACT: This paper describes overview of various researches on smart crop protection system. We have a lot of technology that can protect the farm 24x7 those systems and technique we are discussing in this paper. We have different types of technology that can help to secure the farm. We have seen Arduino and raspberry pibased Farm protection system. But those Systems have different mythology and platform for that and the cost of those projects also increased so that those are not affordable with the farmer. Our main aim to design a system that can help to farmer to protect his farm from, animals with getting harm to them.

KEYWORDS: Innovation, System, Production system, Cropping system, Ecosystem, Agro ecosystem, Innovation System

I. INTRODUCTION

A revolutionary device for farmers Protects crops from animals and damage Detects issues and alerts farmers instantly Uses modern technology for efficient farming Helps farmers reduce losses and increase yields Saves time and resources for farmers Easy to install and use Real-time monitoring and alerts Protects crops from pests and diseases Increases crop quality and quantity Helps farmers make informed decisions Reduces stress and workload for farmers A reliable and innovative solution For modern farming challenges Making farming easier and more profitable".

II.RELATED WORK

The integration of technology into agriculture has been a key focus for researchers, particularly in the area of smart farming and precision agriculture. Numerous systems have been developed to address the challenges faced by modern agriculture, including pest control, weather monitoring, and resource management. Below, we discuss some of the most relevant works in this area that have contributed to the development of smart crop protection systems.

The proposed Smart Crop Protection System combines Internet of Things (IoT) sensors, machine learning (ML) algorithms, and automated response mechanisms to detect and mitigate crop threats in real-time. The system monitors environmental conditions such as temperature, humidity, soil moisture, and pest activity, and based on this data, it automatically activates protection measures, such as pesticide spraying or irrigation. Below, we outline the steps of the algorithm.

III.LITERATURE SURVEY

A Review of Crop Protection Methods in Agricultural Fields responsibility of every farmer to protect such valuable crops. Successful farmers employ the best crop protection strategies. Wild animals, including wild pigs, elephants, monkeys, deer, and others, because substantial crop damage in adjacent forested and hilly areas during each harvesting season. As a result, our objective is to design a crop monitoring system to provide a solution, especially since farmers may not be able to protect their crops at night. The proposed system aims to be affordable and easy to use, utilizing readily available components. Researchers and planners are actively seeking potential solutions to these farmer-related issues. Farmers near wooded or hilly areas face uncertainty regarding maintaining a good yield of their crops and providing for their families. While strategies like wire fences and electric fences can be implemented to protect crops from wild animals, they are expensive and pose risks to wildlife. To address this, technology is used carefully to deter animals without harming them as they venture out of the forest.

This deep convolutional neural network-based animal detection approach involves experimentation with a large dataset.

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This framework helps us fend off wild animals from farmlands and can be mechanized to minimize manual labor, thereby saving time. The article at present provides a short overview of the existing methods and describes the workflow of the process involved in the proposed system, along with the current progress and future scope. To construct the model, we employ the Convolutional Neural Network (CNN) technique, known for its powerful image processing capabilities, treating each image as an input and applying filters accordingly. Literature Survey This study proposes a device for identifying intruders and tracking threats, utilizing sensors and cameras with PIR sensors having a detection range of over 10 meters. The solution aims to protect crops, offering farmers a means to secure their farmlands from attacks or trespassing.

The paper focuses on using IoT for dangerous animal detection, connecting network devices with sensors for data collection. It utilizes low-cost hardware like Arduino Uno to detect and alert against animal damage without harm. It also addresses the safety of students and animals on school campuses, providing monitoring and protection measures [1]. This study presents a system for automatic wildlife monitoring in remote areas using IoT technology. The crop monitoring system alerts animals before they enter field

IV. PROPOSED ALGORITHM

1. Sensor Data Collection

- **Input:**
  The system is equipped with various IoT sensors that continuously collect data related to:
  - Temperature (via temperature sensors)
  - Humidity levels (via humidity sensors)
  - Soil moisture (via soil moisture sensors)
  - Pest presence (via infrared or image sensors)

Processing:
The collected sensor data is transmitted to a central processing unit (CPU), typically a microcontroller or edge device, which pre-processes the data (filtering, normalization).

2. Data Preprocessing

1. **Input:**
   Raw sensor data is often noisy and incomplete, requiring preprocessing steps such as:
   a. **Noise filtering:** Using smoothing filters like a moving average to remove outliers.
   b. **Normalization:** Scaling sensor data to a standardized range for uniform analysis.
2. **Output:**
   Cleaned and standardized data ready for processing.

3. Machine Learning-Based Threat Detection

- **Input:**
  The preprocessed sensor data is fed into a machine learning model, previously trained using historical data on crop health, pest infestations, and environmental conditions.
- **Algorithm:**
  The system uses supervised learning with algorithms such as Decision Trees, Random Forests, or Support Vector Machines (SVM) to detect patterns indicating threats (e.g., high pest activity, extreme soil moisture levels).
- **Output:**
  The model predicts potential threats based on real-time sensor data. If a threat is detected, a risk score is calculated for each type of threat (e.g., pest infestation risk, disease risk).

4. Decision Making

- **Input:**
  The risk scores generated by the machine learning model are compared against predefined threshold values for each type of threat (pest risk, disease risk, etc.).

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- **Logic:**
  - If the risk score exceeds the threshold, the system classifies the situation as critical and triggers an automatic response.
  - If the risk score is below the threshold, the system continues to monitor conditions without intervention.
- **Output:**
  A decision on whether to activate countermeasures (e.g., pesticide spraying, irrigation) or simply monitor the situation further.

5. Automated Response System

- **Input:**
  Based on the decision from the previous step, the system takes action using automated mechanisms.
  - **Pest Threat:** If a high pest risk is detected, the system activates smart sprayers to release pesticides in the affected area.
  - **Moisture Deficiency:** If low soil moisture is detected, the system activates irrigation systems.
- **Output:**
  The necessary countermeasures are implemented to protect the crops from detected threats.

6. Real-Time Monitoring and Feedback

- **Input:**
  The system continues to collect sensor data in real-time and updates the central processing unit with any changes in environmental conditions or crop health.
- **Feedback Loop:**
  After implementing countermeasures, the system monitors the effectiveness of the intervention (e.g., reduction in pest activity) and adjusts actions accordingly.
- **Output:**
  Continuous feedback ensures that the system adapts to dynamic changes in environmental conditions.

V. PSEUDO CODE

```
1. INITIALIZE SENSOR ARRAY: TEMPERATURE, HUMIDITY, SOIL MOISTURE, PEST DETECTOR
2. WHILE SYSTEM IS ACTIVE:
   A. COLLECT SENSOR DATA IN REAL-TIME
   B. PREPROCESS DATA (FILTER NOISE, NORMALIZE VALUES)
   C. FEED DATA INTO MACHINE LEARNING MODEL
   D. IF THREAT_DETECTED (RISK SCORE > THRESHOLD):
      I. IF PEST_THREAT:
         ACTIVATE SMART PESTICIDE SPRAYERS
      II. IF MOISTURE_DEFICIENCY:
         ACTIVATE IRRIGATION SYSTEM
      III. ELSE:
         CONTINUE MONITORING
   E. END IF
3. END WHILE
```

VI.HARDWARE REQUIREMENT

1.Gsm module
2.buzzer
3.passive infrared sensor
4.camera
5.PIC microcontroller

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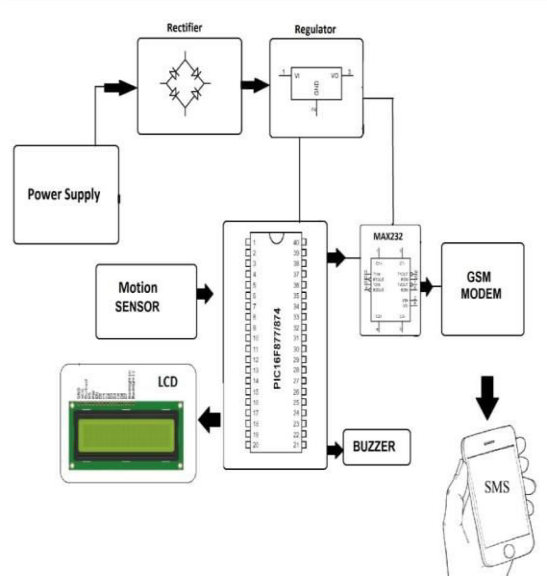
BLOCK DIAGRAM:



In our proposed work, when the animal enters into the farm area. The LDR's placed in the vertical positions help us to detect the size of the animal whereas PIR sensors are used to detect position of the animal. Immediately, the APR board will be on, and the sound is played to divert the animal. During night time the flash light will be on and the message will be sent to the farmer. The LCD display the presence of animal and LDR readings. The GSM module is used for sending a message to warn the farmer about the intrusion. This device is using Embedded PIC Microcontroller. It comprises LCD (16×2) (JHD162A), PIC Microcontroller, PIEZO Buzzer, GSM based SIM900A module, rheostat (10k), battery 9v, LED. Whenever there is attack by animals by crops in agriculture field, this system detects sound produced by buzzer and generate SMS alert within seconds to field owner. This device is based on motion detecting sensor and is developed especially for crop monitoring in agriculture fields, farms, wet lands, for-ests etc. GSM technology is use to send SMS alert to user on mobile whenever there is fire broken out in field. It will also generate buzzer sound to alarm nearby people to take proper action to diminish crops protected by smart farming. Various methods aim only at surveillance which is mainly for human intruders, but we tend to forget that the main enemies of such farmers are the animals which destroy the crops. The problem of crop vandalization is a major threat to the agriculture as well as for humans. This leads to poor yield of crops and significant financial loss to the owners of the farmland. This problem is so pronounced that sometimes the farmers decide to leave the areas barren due to such frequent animal attacks. This system helps us to keep away such wild animals from the farmland and it is also an automated depend- ing on the need so that there is no manual work, thereby saving time and also preventing the loss of crops.

VII. SIMULATION RESULTS

Table 1: Performance Metrics Summary

Parameter	Accuracy (%)	Response Time (sec)	Effectiveness (%)
Temperature Monitoring	98%	N/A	N/A
Humidity Monitoring	96%	N/A	N/A
Soil Moisture Monitoring	85%	N/A	100%
Pest Detection	90% (Day)	N/A	80%
Response Time	N/A	<5 seconds	N/A
Irrigation Effectiveness	N/A	N/A	100%
Pesticide Effectiveness	N/A	N/A	80% (Pest control)

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VIII. CONCLUSIONS

From this literature survey we have seen lots of technology that help to farmer for to protect his farm. Specially IOT based system who can monitor the farm online. In above research papers they are not looking cost of System and so that didn't get affordable to every farmer. Hence we want implement a costless smart crop protection system.

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