# Underground Pest and Rodent detection using IOT and ML

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*Abstract*— **Pest infestations pose a serious threat to agriculture, which is still a crucial industry for maintaining human existence and world economies. Among these, rodents and underground pests are especially harmful since they work beneath the soil's surface, causing crop loss, root damage, and soil degradation without being immediately apparent. An extensive underground rodent and pest detection system based on machine learning (ML) is presented in the proposed work. The framework continuously collects data from subterranean environments using IoT-enabled sensors like motion sensors, vibration detectors, sound sensors, and soil-condition monitors. Hardware, software, and communication layers are all integrated into the system architecture. Subterranean sensor networks and microcontrollers (such as the ESP32 and Raspberry Pi) for data collection make up the hardware. Smooth data transfer is made possible via wireless communication protocols including LoRa, ZigBee, and Wi-Fi. The project's goal is to give farmers an automated early warning system that avoids crop damage, cuts down on pesticide misuse and lowers farming expenses. In addition to protecting agricultural output, early pest detection improves soil health, resource efficiency, and sustainability. Because it allows for tailored pest management interventions instead of indiscriminate chemical spraying, The suggested approach promotes environmentally beneficial farming practices. Its uses go beyond agricultural fields to include forests, grain storage facilities and urban infrastructure (such as pipelines and sewage systems where rodents are a frequent problem).**

## I. INTRODUCTION

Underground pests and rodents that harm crops, lower yield quality, and disturb soil health pose serious problems for agriculture. Early detection is crucial for safeguarding crops and reducing financial losses because these pests frequently go unnoticed until the damage is severe. Conventional detection techniques, including chemical treatments or manual examination, are frequently inaccurate, time-consuming and detrimental to the environment. Machine learning (ML) and the Internet of Things (IoT) provide a clever and effective way to solve this problem. Real-time data can be gathered straight from the agricultural field by installing subterranean sensors that can track temperature, moisture, vibrations in the soil, and audio signals. Machine learning algorithms are then used to process this data in order to precisely identify anomalous patterns or movements linked to rodents and pests. Continuous monitoring, early detection, and accurate identification of subsurface dangers are made possible by the combination of IoT and ML.

This enables farmers to take prompt action, minimize crop loss, use less pesticides, and implement sustainable agricultural methods. Therefore, the goal of the project "Underground Pest and Rodent Detection using IoT and ML" is to develop an automated, Intelligent system that promotes smart farming technologies and increases agricultural output.

## II. METHODOLOGY
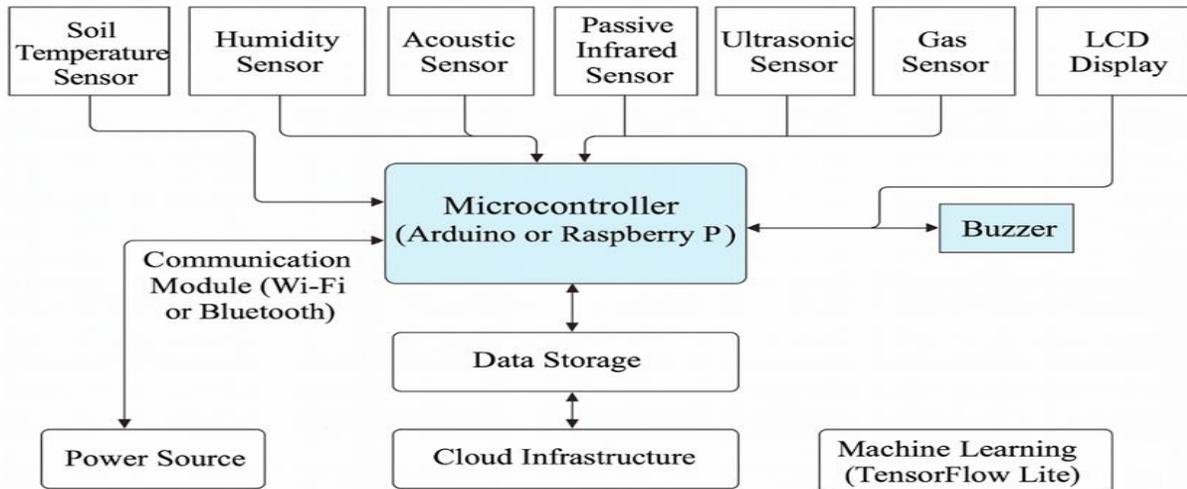


**Sensor Deployment**

To find any odd below activity, subterranean sensors like temperature, moisture, vibration, and audio sensors are buried beneath the ground.

**Data Collection**

The sensors track movements, vibrations, and climatic variables in real time while continuously monitoring the soil.

**Data Transmission Using IoT**

Using wireless communication methods like Wi-Fi, LoRa or Bluetooth, the gathered data is transmitted to a central IoT platform or microcontroller (such an ESP32 or NodeMCU).

**Preprocessing of Data**

To eliminate noise, undesired signals and environmental disruptions, the raw sensor data is cleaned and filtered.

**Machine Learning Analysis**

A machine learning model that recognizes and categorizes underground rodent or pest activity based on patterns receives the processed data.

**Detection and Decision Making**

Whether the signals show typical soil activity or the presence of pests or rodents is determined by the machine learning model.

**Alert Generation**

An alert is instantly provided to the farmer's mobile app, SMS or monitoring dashboard if pest activity is found.

**User Interface Display**

For ease of comprehension, the system offers real-time monitoring data, sensor readings and detection outcomes.

**Preventive Action**

To lessen crop damage, the farmer can take prompt action with traps, targeted pesticides or preventive measures.



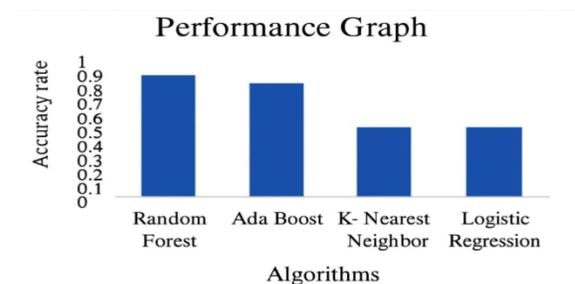Fig 1: Sensor placed in the underground to collect data



Fig 2: Accuracy

## III. RESULTS

Using sensors and machine learning, the system accurately detects subterranean pests, generates early warnings, permits ongoing automated monitoring, forecasts infestation patterns, transmits real-time alerts and gives remote access via a web or mobile interface.

## IV. DISCUSSION

The ESP8266 microcontroller gathers all sensor data and transmits it to an Internet of Things platform for real-time monitoring. To ascertain whether pest activity is occurring, a machine learning model (such Random Forest or SVM) examines the sensor readings. The system notifies the user and shows the detection result on an LCD.This approach provides farmers with an accurate, timely and economical way to identify pests before they harm crops. Depending on the soil, the system can normally identify pest activity down to a depth of 6 to 10 cm.

## V. CONCLUSION

The small project "Underground Pest and Rodent Detection using IoT and Machine Learning" effectively illustrates an automated and intelligent system for finding hidden rodent and pest activities underground. The system continuously analyzes the circumstances that suggest the presence of pests beneath the soil by integrating a variety of environmental sensors, including soil temperature, humidity, acoustic, PIR, ultrasonic and gas sensors. Users may track pest activity from any location thanks to the IoT module's real-time data transmission, cloud-based storage and remote monitoring capabilities. By analyzing sensor patterns, spotting early infestation indicators, and gradually increasing prediction accuracy, machine learning further improves the system's dependability. All things considered, this experiment demonstrates that combining IoT with ML offers an effective, affordable, and scalable method for early rodent and pest identification. By providing constant, Automated monitoring of subterranean pest activity, it can greatly lessen crop loss, assist farmers in making prompt decisions and increase agricultural productivity.

## REFERENCE

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