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Full Length Article

Intruder/Animal Alert System In Agriculture Field

Dr. Shaik Mahammad Rasool[1], Shaik Mohammad Umar Thoufeeq[2], Nashra Zain[3], Mohammad Abdul Rahman Shareef[4], Mohammad Yaser[5]
[1]HOD; Department of Electronics and Communication Engineering, Lords Institute of Engineering and Technology, Hyderabad, Telangana, India.
[2,3,4,5]B.E.Students; Department of Electronics and Communication Engineering, Lords Institute of Engineering and Technology, Hyderabad, Telangana, India.
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Abstract
Agriculture is the backbone of many countries and plays a vital role in providing food, employment, and economic stability. Farmers invest a great amount of time, money, and effort in cultivating crops, but they continuously face challenges that affect agricultural productivity. One of the major problems encountered in agricultural fields is the intrusion of wild animals and unauthorized humans into farmlands. Animals such as wild boars, monkeys, cows, elephants, and other stray animals often enter crop fields and damage the crops, resulting in severe financial losses to farmers. In addition, theft and unauthorized access to farmland also create security concerns. Traditional methods such as fencing, manual guarding, and scarecrows are not always effective and require continuous human effort. Therefore, there is a need for an efficient, automated, and cost-effective surveillance and protection system for agricultural fields.

Keywords
Intruder Detection, Animal Alert System, Agriculture Security, Smart Farming, IoT Technology, PIR Sensor, GSM Module, Embedded System, Wireless Monitoring

Introduction

Agriculture field and farm require a good developed protection to avoid intrusion of animals at inappropriate time. Already prevailing protection has little more high maintenance and complex structure. The farm lands are provided with fencing as of a coverage to promote or enhance the protection features of crops grown. Yet, the fencing made of thorns are not sufficient to block the entry of animals that cause greater damage to crops without any acknowledgement. The animal intrusion leads to enormous loops in financial gain over crop production. Animals indulges in the fields in accordance to needs and food availability. The prevention of animal entry could improve the crop production in abundant and improve the economic status of farmers or people who own large farms or lands that are susceptible to animal attack. The first half of the project help in finding the movement and triggers an alarm sound to inform the owner regarding the intrusion. The python coding is used in the proposed system with PyCharm IDE. In second half, voice assistant that react for the sound with particular keyword is built that sends the already fed message in terms of help is sent to the trustable person for help to make the safety measures in prior and to avoid most of damage to farm or fields. The process that is taken into consideration is to make a fence like structure with inbuilt options to monitor animal movements and once the movement is predicted, an alert sign has to be generated to acknowledge the farm field owners regarding the intrusion. The farmers or field owners has to be made available with direct considering the idea.

Literature Review

Gomathi et al. [1] proposed a voice recognition–based multi-robot system for blind people using a LiDAR sensor. Their work focused on improving mobility assistance for visually impaired individuals by combining voice commands with obstacle detection technology.

Jong et al. [2] developed a vision-based voice-controlled indoor assistant robot for visually impaired people. The system integrates computer vision and voice recognition to support indoor navigation and assist users in performing daily activities independently.

Eon et al. [3] presented an intelligent motion control system for a two-wheel driving robot based on voice recognition. Their research demonstrated how voice commands can be used to control robotic motion effectively, enhancing user interaction and

autonomous operation.

Anikt et al. [4] introduced a human–computer interaction system using hand gestures and voice commands. The study emphasized multimodal interaction techniques, allowing users to communicate with systems through both gesture recognition and speech input.

Perry and Zhiheng [5] designed a voice-controlled 6DoF robotic arm utilizing ultrasonic sensors, computer vision, and Alexa voice assistance. Their system enabled robotic arm manipulation through voice commands, providing greater flexibility in automation and assistive applications.

Emam et al. [6] proposed a digital personal assistant using Bangla voice command recognition and face detection. The system combined speech recognition and facial identification technologies to provide personalized and secure user interaction.

Sandar and Thin [7] developed a real-time human motion detection, tracking, and activity recognition system using a skeletal model. Their work focused on accurate human activity analysis for intelligent monitoring and interactive systems.

Daeho and Youngtae [8] presented a vision-based remote control system using motion detection and open figure counting techniques. Their research demonstrated how motion-based recognition can be applied to remote control systems for improved human–machine interaction.

These studies demonstrate the growing importance of voice recognition, computer vision, gesture recognition, and intelligent robotic control systems in assistive technology and human–computer interaction. The reviewed works provide a strong foundation for developing advanced voice-controlled and intelligent robotic systems.

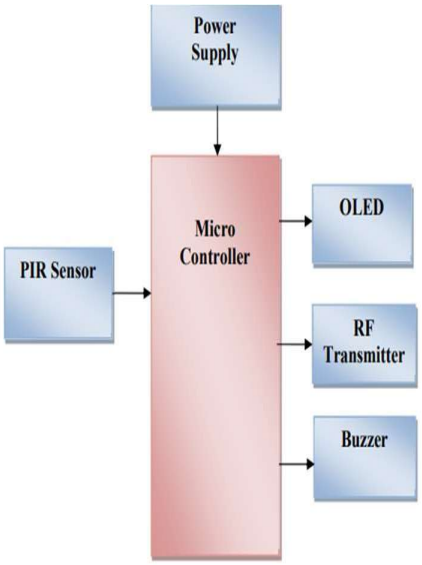
Existing System

The existing systems mainly provide the surveillance functionality. Also, these systems don't provide protection from wild animals, especially in such an application area. They also need to take actions based on the on the type of animal that tries to enter the area, as different methods are adopted to prevent different animals from entering such restricted areas. Also, the farmers resort to the other methods by erecting human puppets and effigies in their farms, which is ineffective in warding off the wild animals, though is useful to some extent to ward off birds. The other commonly used methods by the farmers in order to prevent the crop vandalization by animals include building physical barriers, use of electric fences and manual surveillance and various such exhaustive and dangerous methods.

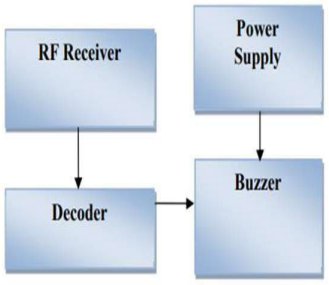
Proposed System

The proposed system uses a controller, which forms the main heart of the system; the different sensors and RF Module are interfaced to the puppet. As soon as the PIR sensors go High on detecting motion within a range of 10 meters, the RF will transmit information to receiver module wirelessly, which on the receiver side has a buzzer to indicate the motion of animals or any Intruder detected.

Block Diagram



3.4 MONITORING SECTION:



Working Principle :

monitoring/receiver section. Its primary objective is to detect the movement of animals or intruders in farmland and alert the farmer immediately. In the transmitter section, the PIR (Passive Infrared) sensor is used to detect the motion of humans or animals entering the protected agricultural area. The PIR sensor senses infrared radiation emitted by living beings and sends the detected signal to the microcontroller. The power supply unit provides the necessary electrical power for the entire circuit to operate properly. The microcontroller acts as the central processing unit of the system. It processes the signal received from the PIR sensor and controls the

output devices. When an intrusion is detected, the microcontroller activates the buzzer to generate a warning sound and also displays the status information on the OLED display. Simultaneously, the microcontroller sends the alert signal through the RF transmitter. In the monitoring section, the RF receiver receives the transmitted signal and sends it to the decoder. The decoder processes the received data and activates the buzzer to notify the farmer about the intrusion. Thus, the system provides real-time monitoring and protection for agricultural fields against animal attacks and unauthorized entry.

Hardware Implementation

The proposed system is implemented using various hardware components that work together to achieve efficient operation and communication. The major hardware modules used in the system are described below.

- **Power Supply:**

The power supply unit provides the required electrical energy to all hardware components in the system. It ensures stable and continuous operation by converting the input AC power into regulated DC power.

- **Transformer:**

The transformer is used to step down the high AC mains voltage to a lower AC voltage suitable for the circuit requirements.

- **Rectifier:**

The rectifier converts alternating current (AC) into direct current (DC), which is required for operating electronic components.

- **Bridge Rectifier:**

A bridge rectifier is employed for full-wave rectification. It efficiently converts both halves of the AC input signal into DC output, resulting in improved power conversion.

- **Voltage Regulators:**

Voltage regulators maintain a constant output voltage level and protect the circuit from voltage fluctuations. They ensure reliable operation of sensitive electronic components.

- **Arduino UNO:**

The Arduino UNO serves as the main controller of the system. It processes input signals, executes programmed instructions, and controls the operation of connected modules.

- **Memory & Communication:**

The memory and communication module is responsible for storing required data and enabling communication between different system components for data transfer and control.

- **OLED Display:**

The OLED display is used to present information such as system status, sensor readings, and output messages. It offers clear visibility with low power consumption.

- **PIR Sensor:**

The Passive Infrared (PIR) sensor is used for motion detection by sensing infrared radiation emitted by human bodies or moving objects.

Power Supply:

The power supply section is the section which provide +5V for the components to work. IC LM7805 is used for providing a constant power of +5V.The ac voltage, typically 220V, is connected to a transformer, which steps down that ac voltage down to the level of the desired dc output. This resulting dc voltage usually has some ripple or ac voltage variation.

Rectifier

There are several ways of connecting diodes to make a rectifier to convert AC to DC. The bridge rectifier is the most important and it produces full-wave varying DC. A full-wave rectifier can also be made from just two diodes if a centre-tap transformer is used, but this method is rarely used now that diodes are cheaper. A single diode can be used as a rectifier but it only uses the positive (+) parts of the AC wave to produce half-wave varying Dc

Bridge Rectifier:

When four diodes are connected as shown in figure, the circuit is called as bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners.

Let us assume that the transformer is working properly and there is a positive potential, at point A and a negative potential at point B the positive potential at point A will forward bias D3 and reverse bias D4.

MICROCONTROLLER:

Arduino/genuino uno is a microcontroller board based on the atmega328p (datasheet). It has 14 digital input/output pins (of which 6 can be used as pwm outputs), 6 analog inputs, a 16 MHz quartz crystal, a usb connection, a power jack, an icsp header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a usb cable or power it with a ac-to-dc adapter or battery to get started.. You can tinker with your uno without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in italian and was chosen to mark the release of arduino software (ide) 1.0. The uno board and version 1.0 of arduino software (ide) were the reference versions of arduino, now evolved to newer releases. The uno board is the first in a series of usb arduino

boards, and the reference model for the arduino platform; for 25 an extensive list of current, past or outdated boards see the arduino index of boards.

MEMORY

The atmega328 has 32 kb (with 0.5 kb occupied by the bootloader). It also has 2 kb of sram and 1 kb of eeprom (which can be read and written with the eeprom library). Input and output See the mapping between arduino pins and atmega328p ports. The mapping for the atmega8, 168, and 328 is identical.

COMMUNICATION

Arduino/genuino uno has a number of facilities for communicating with a computer, another arduino/genuino board, or other microcontrollers. The atmega328 provides uartttl (5v) serial communication, which is available on digital pins 0 (rx) and 1 (tx). An atmega16u2 on the board channels this serial communication over usb and appears as a virtual com port to software on the computer. The 16u2 firmware uses the standard usb com drivers, and no external driver is needed. However, on windows, a .inf file is required. The arduino software (ide) includes a serial monitor which allows simple textual data to be sent to and from the board. The rx and txleds on the board will flash when data is being transmitted via the usb-to-serial chip and usb connection to the computer (but not for serial communication on pins 0 and 1).

OLED (Organic Light Emitting Diodes) OLED is a flat light emitting technology, made by placing a series of organic thin films between two conductors. When electrical current is applied, a bright light is emitted. OLEDs are emissive displays that do not require a backlight and so are thinner and more efficient than LCD displays (which do require a white backlight). OLED displays are not just thin and efficient - they provide the best image quality ever 31 and they can also be made transparent, flexible, foldable and even rollable and stretchable in the future. OLEDs represent the future of display technology!

PIR Sensor

This PIR (Passive Infra-Red) Sensor is a pyroelectric device that detects motion by measuring changes in the infrared (heat) levels emitted by surrounding objects. This motion can be detected by checking for a sudden change in the surrounding IR patterns. When motion is detected the PIR sensor outputs a high signal on its output pin. This logic signal can be read by a microcontroller or used to drive a transistor to switch a higher current load.

Here is a clear and corrected rewritten version of your content:

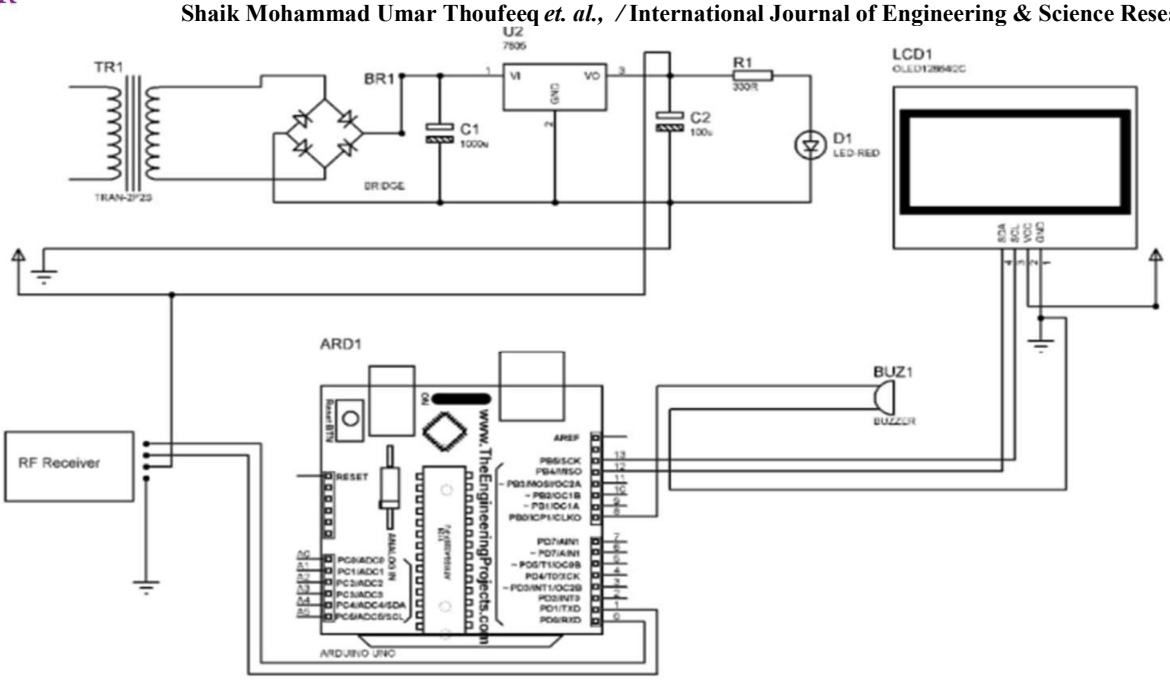
RF TRANSMITTER AND RECEIVER

The primary function of a Radio Frequency (RF) transmitter is to modulate, up-convert, and amplify signals for transmission through free space. An RF transmitter generally consists of a modulator that modulates the input signal with a carrier frequency signal. The amplified signal is then transmitted through an antenna.

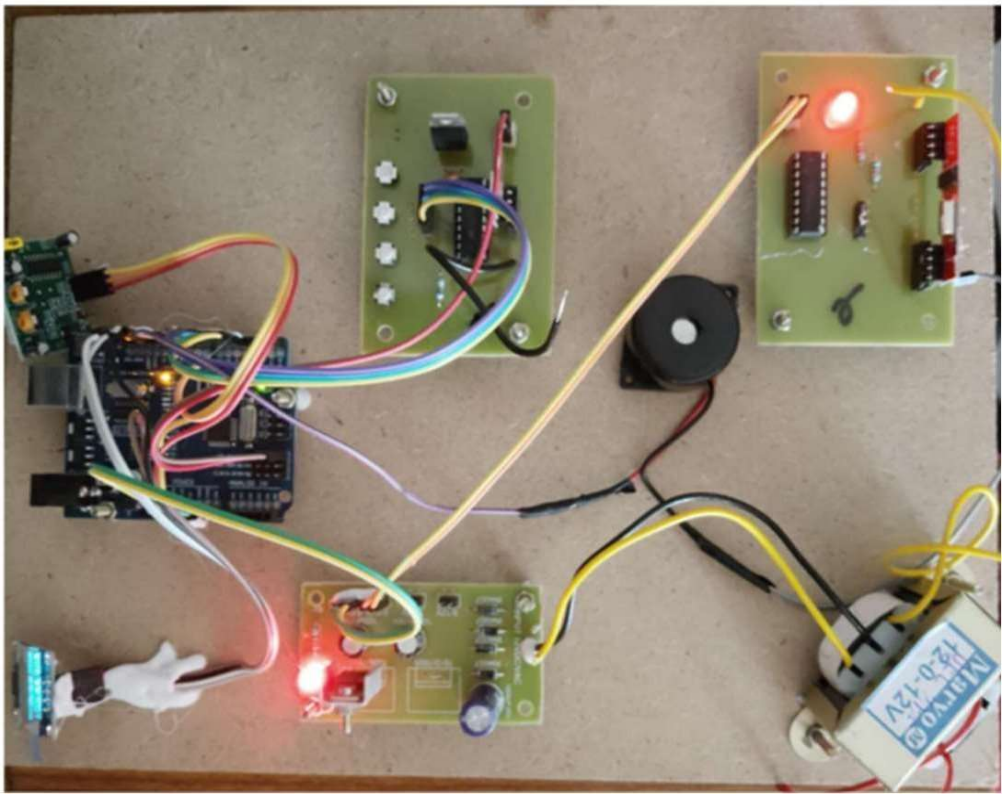
The RF transmitter used in this system is **TWS-434A**. It operates at a frequency of **433.92 MHz** and is designed for short-range wireless communication applications. The transmitter offers a communication range of approximately **400 feet in open outdoor areas** and about **200 feet indoors**, where it can penetrate most walls. The TWS-434A is compact in size, consumes low power (approximately **8 mW**), and operates within a voltage range of **1.5V to 12V DC**. Data transmission is achieved using **Amplitude Modulation (AM)** of the RF carrier signal.

The RF receiver used is **RWS-434**, which receives signals transmitted at **433.92 MHz**. The RF receiver is connected to an antenna and includes several stages such as a **low-noise amplifier**, **intermediate frequency stages**, **filtering stage**, and **data recovery stage**. The low-noise amplifier receives the incoming RF signal from the antenna and amplifies it while minimizing noise. Since RF communication channels are susceptible to interference and external noise, the receiver's filtering and data recovery stages help ensure accurate signal detection and reliable data communication.

SCHEMATIC DIAGRAM


TR1
TRAN-2P2S
BR1
BRIDGE
U2
7805
VI
VO
GND
C1
1000u
C2
100u
R1
330R
D1
LED-RED
LCD1
OLED128642C
SDA
SCL
VCC
GND
ARD1
ARDUINO UNO
www.TheEngineeringProjects.com
RESET
AREF
BUZ1
BUZZER
RF Receiver

RESULTS:


MERVO
7812-12V

OUTPUT:

CONCLUSION:

The proposed "Intruder Animal Alert System for Agriculture Fields" provides an effective and reliable solution for protecting farmlands from wild animals and unauthorized human intrusion. Crop damage caused by animals is one of the major problems faced by farmers, leading to reduced agricultural productivity and financial losses. The developed system helps in minimizing such losses by continuously monitoring the field and generating alerts whenever movement is detected within the protected area. The system uses a PIR sensor to detect the presence and movement of animals or intruders. Once motion is detected, the microcontroller processes the signal and activates warning devices such as buzzers and alert systems. The RF transmitter and receiver modules enable wireless communication between the field unit and the monitoring section, allowing farmers to receive alerts even from a distant location. The OLED display provides status information, making the system easy to monitor and operate. One of the major advantages of this project is its low cost, simple design, and ease of installation. The system reduces the need for continuous manual surveillance and provides better security during both daytime and nighttime. The automatic alert mechanism helps farmers respond quickly to intrusion events and prevents severe crop destruction.

FUTURE SCOPE :

The future scope of the Intruder Animal Alert System in Agriculture Field is very wide due to the increasing need for smart farming and crop protection technologies. This system can be further improved by integrating advanced sensors, wireless communication, and artificial intelligence techniques for better efficiency and reliability. In future, the project can be enhanced by using IoT technology to monitor agricultural fields remotely through mobile applications or web platforms. Farmers can receive realtime alerts and notifications about animal intrusion directly on their smartphones, enabling faster response and better crop safety. The system can also be integrated with solar power technology to reduce electricity consumption and allow continuous operation in remote agricultural areas where power supply is limited. This will make the system more economical and environmentally friendly.

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