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IMPLEMENTATION OF IOT BASED ANIMAL DETECTION SYSTEM

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ABSTRACT

The main aim of our research paper is to protect the crops from damage caused by animal as well as divert the animal without any harm. Animal detection system is designed to detect the presence of animal and offer a warning. In this research, we used PIR and ultrasonic sensors to detect the movement of the animal and send signal to the controller. It diverts the animal by producing sound and signal further, this signal is transmitted to GSM and which gives an alert to farmers and forest department immediately.

1.INTRODUCTION

Rapid increasing of population it occurs deforestation, this results in shortage of food, water and shelter in forest areas. So, animals' interference in residential areas is increasing day by day which affects human life and property causes human animal conflict but as per nature's rule every living creature on this earth has important role in eco-system. Agriculture is the backbone of the economy but because of animal interference in agricultural lands, there will be huge loss of crops. Elephants and other animals coming in to contact with humans, impact negatively in various means such as by depredation of crops, damaging grain stores, water supplies, houses and other assets, injuring and death of humans. Farmers in India face serious threats from pests, natural calamities and damage by animals resulting in lower yields Traditional methods followed by farmers are not that effective and it is not feasible to hire guards to keep an eye on crops and prevent wild animals. Since safety of both human and animal is equally vital. So, animal detection system is necessary in farm areas. Now days, several methods of detecting animals from the certain distance close to the paddy fields and farms include the use of human eyes to witness animal movements. It is not possible for human beings to monitor animal movements continuously throughout the day. So there is a need for specialized detection of animals particularly which enter the paddy fields and farm land of human beings. Due to the unavailability of any detection system these attacks kill villagers and also destroy their crops. The methods used for the recognition of the animals include Image Processing technique. Animal attacks are a common stories in nowadays. Due to the unavailability of any detection system these attacks kill villagers and also destroy their crops. Therefore a proper detection system could help save their lives and also to the preservation of crops. Also the crops of villagers are destroyed due to frequent interference of animals. By using Image Processing we can protect the field and the lives of people. This project is also used in tourist places. Its main objective is to detect the presence of the animal using sensors. It compares the image with the pre – stored image using image processing techniques. It send alerts to the authorized person about their entry and in addition it starts a sound buzzer to deny their entry. In this system the animals are composed of automotive electric fence using light sensor and Thermal sensor. The light sensor will activate the fence when the sun goes down and the thermal sensor will detect the elephant and activate the fence during the daytime. When the elephant breaks the fence and enter, laser sensor will activate the siren.

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By geo point location system (GPS) technology, control room officer can view the exact place where the fence was breached. The electric fence was not controlled by any external factor so a high voltage of electric current is passed in the electric fence it may lead wild animals to dead. The farm fields are protected from elephants only. The electric current passed in the fence makes the animals drive to the unconscious state. The farm fields are protected from all kinds of wild animals. It consumes less power compared to other systems. It provides Security to the farm with the safety of animal. It does not harm the animal in any ways.

2.SYSTEM DESIGN

2.1. EXISTING SYSTEM

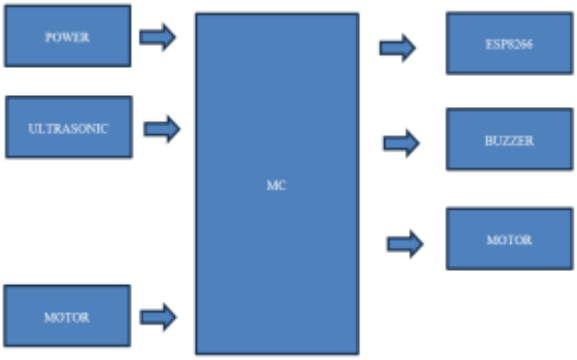
N. Ananya, et. al. demonstrated a model primarily with the use of ultra-low power, mixed signal microcontroller [13]. The system connects PIR sensor, ultrasonic sensors and GSM modules to bring out an alert system for undomesticated animals. It also makes use of speakers to produce alert sound in case of animal detection. Billi Bharghav, presented a work in which the ultrasonic sensor detects animal movements, and the animal gets identified using an infrared camera and a deep learning algorithm that is previously coded and programmed into the system [14]. When an animal gets detected, a diversion is introduced by playing a certain frequency of sound through a speaker at various higher frequencies which disturbs the animal enough to cause it to leave the area. Also, that signal would be sent to a gateway for the Internet of Things, which quickly alerts the forest department and farmers.

2.2. PROPOSED SYSTEM

In the proposed system, the Arduino UNO microcontroller is primarily used for system monitoring and management which is shown in Fig. 1. It acts as a hub for all inter-device communication. In the farm field, the animal is detected using an ultrasonic sensor. An ultrasonic sensor is an instrument that employs sound waves to find objects nearby and in their immediate vicinity. High-frequency sound waves are emitted, bounce off of things, and the time it takes for the sound waves to return is then evaluated. This principle is in relation with the Doppler effect, which is the apparent change in the wave's frequency in response to an observer moving in relation to the incident wave. Sound waves have specific frequencies or number of oscillations per second. The frequency range normally employed in ultrasonic detection is 100 KHz to 50MHz. The proposed system utilizes GSM modules, which forwards an alert message notification, the speakers to generate high pitched animal voices to repel the animal away. The system also has an IoT application platform developed using NodeMCU, in order to facilitate the hardware components in the form of software. Name of the personal hotspot network and password are given along with the Authentication token in the code to connect to the adafruit platform. When the code gets dumped into the hardware, the information regarding the last arrival of the animal along with date and time will be displayed on the adafruit platform, once connected to the personal hotspot. Light Emitting Diodes (LED) is also deployed, that can be controlled by the farmer from his home, in case of emergency lighting purposes for the land to repel the animal.

3.IMPLEMENTATION

3.1. BLOCK DIAGRAM



3.2. DESCRIPTION

REGULATED POWER SUPPLY:

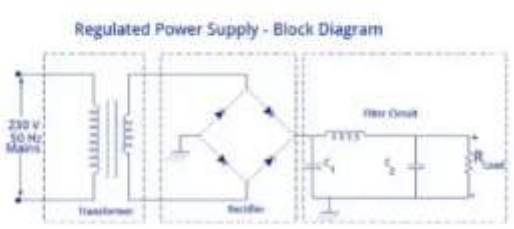


Fig: Regulated Power Supply Diagram

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- **Regulated Power Supply Definition**: A regulated power supply ensures a consistent DC output by converting fluctuating AC input.
- **Component Overview**: The primary components of a regulated power supply include a transformer, rectifier, filter, and regulator, each crucial for maintaining steady DC output.
- **Rectification Explained**: The process involves diodes converting AC to DC, typically using full wave rectification to enhance efficiency.
- **Filter Function**: Filters, such as capacitor and LC types, smooth the DC output to reduce ripple and provide a stable voltage.
- **Regulation Mechanism**: Regulators adjust and stabilize output voltage to protect against input changes or load variations, essential for reliable power supply

ARDUINO

The Arduino is a family of microcontroller boards to simplify electronic design, prototyping and experimenting for artists, hackers, hobbyists, but also many professionals. People use it as brains for their robots, to build new digital music instruments, or to build a system that lets your house plants tweet you when they're dry. Arduinos (we use the standard Arduino Uno) are built around an ATmega microcontroller — essentially a complete computer with CPU, RAM, Flash memory, and input/output pins, all on a single chip. Unlike, say, a Raspberry Pi, it's designed to attach all kinds of sensors, LEDs, small motors and speakers, servos, etc. directly to these pins, which can read in or output digital or analog voltages between 0 and 5 volts. The Arduino connects to your computer via USB, where you program it in a simple language (C/C++, similar to Java) from inside the free Arduino IDE by uploading your compiled code to the board. Once programmed, the Arduino can run with the USB link back to your computer, or stand-alone without it — no keyboard or screen needed, just power.

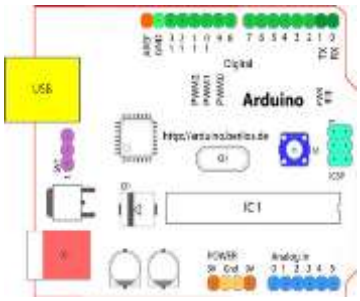

Fig: Structure of Arduino Board

SENSOR

A sensor is a device that detects and responds to some type of input from the physical environment. The input can be light, heat, motion, moisture, pressure or any number of other environmental phenomena. The output is generally a signal that is converted to a human-readable display at the sensor location or transmitted electronically over a network for reading or further processing

HC-SR04 Ultrasonic Sensor:

The HC-SR04 ultrasonic sensor includes a transmitter & a receiver. This sensor is used to find out the distance from the objective. Here the amount of time taken to transmit and receive the waves will decide the distance between the sensor and an object. This sensor uses sound waves by using non-contact technology. By using this sensor the distance which is required for the target can be measured without damage and provides accurate details. The range of this sensor available between 2cms to 400cms. The HC-SR04 is a type of ultrasonic sensor which uses sonar to find out the distance of the object from the sensor. It provides an outstanding range of non-contact detection with high accuracy & stable readings. It includes two modules like ultrasonic transmitter & receiver. This sensor is used in a variety of applications like measurement of direction and speed, burglar alarms, medical, sonar, humidifiers, wireless charging, non-destructive testing, and ultrasonography.

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Fig: HCSR04-ultrasonic-sensor

BUZZERS

In common parlance a Buzzer is a signaling device that is not a loudspeaker. It can be mechanical, electromechanical, or electronic (a piezo transducer). BeStar produces Buzzers in every available configuration for a wide variety of applications. A Piezo transducer can produce the sound for panel mount buzzers, household goods, medical devices and even very loud sirens. When a lower frequency is required an electromagnetic buzzer can fill the need. These are very common in automotive chimes and higher end clinical diagnostic devices. The BeStar buzzer range includes self drive units with their own drive circuitry (indicators), or external drive units, which allow the designer the flexibility to create their own sound patterns

ESP8266 WI-FI MODULE:

In 2014, an ESP8266 Wi-Fi module was introduced and developed by third-party manufacturers like AI thinkers, which is mainly utilized for IoT-based embedded applications development. It is capable of handling various functions of the Wi-Fi network from another application processor.

It is a SOC (System On-chip) integrated with a TCP/IP protocol stack, which can provide microcontroller access to any type of Wi-Fi network. This article deals with the pin configuration, specifications, circuit diagram, applications, and alternatives of the ESP8266 Wi-Fi module.

What is the ESP8266 Wi-Fi Module?

An ESP8266 Wi-Fi module is a SOC microchip mainly used for the development of end-point IoT (Internet of things) applications. It is referred to as a standalone wireless transceiver, available at a very low price. It is used to enable the internet connection to various applications of embedded systems.

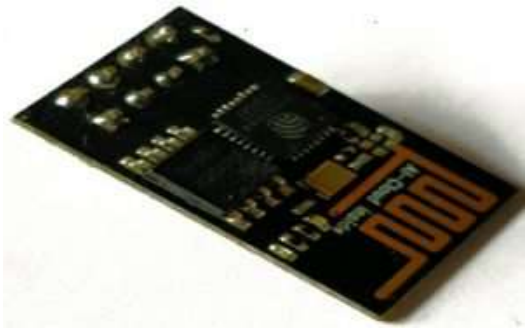

Fig ESP8266 Wi-Fi Module

RELAY

A **single-channel relay** is an electronic switch that can be controlled by a low-power electrical signal, such as the output from an Arduino microcontroller. By using an **Arduino Uno** and a single-channel relay module, you can control high-voltage or high-power devices, such as lights, motors, and appliances, from your computer or mobile device. In this blog, we will explore how a relay works, how to interface a **single-channel relay with an Arduino Uno**, and demonstrate a simple example of how to use the **5v relay module** to control a lamp.

Single Channel Relay Module Pinout

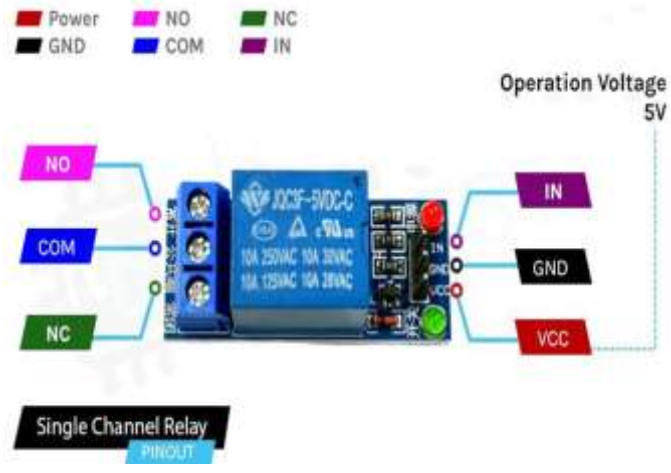

Fig: Relay Board

VCC - this pin provides power to the module

GND - this is the common ground

IN - This pin is also called the control pin because it is used to control the output of the relay.

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COM - is connected to the device you intend to connect.

NC - terminal is connected to the COM terminal by default unless you activate the relay which breaks the connection

NO is normally open unless you activate the relay which then connects it to the COM terminal

4.LITERATURE REVIEW

1. IoT-Based Animal Detection Systems in Agriculture

The integration of the Internet of Things (IoT) in agricultural practices has gained significant attention due to its potential to improve productivity and reduce losses. A study by Patel et al. (2020) explored the use of IoT-based systems for detecting and monitoring animal activity in farm fields. The authors demonstrated that various sensor technologies, such as infrared cameras, motion detectors, and acoustic sensors, could be employed to detect animals in real-time. These sensors collect environmental data, which is processed through an IoT platform, providing farmers with immediate alerts about the presence of animals. The system's effectiveness was evaluated in several pilot farms, where it showed promising results in reducing crop and livestock damage by providing early warning signals. However, the study noted that sensor placement and environmental factors such as weather conditions impacted system accuracy, indicating the need for further optimization. This research highlights the growing relevance of IoT in creating automated systems that enhance farm security and reduce manual intervention.

2. Remote Monitoring and Animal Deterrent Systems

In the context of preventing animal intrusions, several studies have combined IoT-based monitoring systems with automated deterrent devices. A paper by Liu et al. (2019) discussed the use of IoT systems integrated with automated deterrent mechanisms, such as motion-activated sprinklers, loudspeakers, and lights. The system used sensors to detect animals' presence and immediately activated deterrents to drive them away, preventing damage to crops and livestock. The study showed that this approach significantly improved farm protection compared to manual monitoring and traditional deterrent systems. The system's advantages included real-time alerts, reducing human intervention, and allowing for more efficient resource use. The research also examined the reliability of IoT communication networks in remote rural areas, where connectivity could be a challenge. Despite these concerns, the combination of monitoring and deterrence provided a scalable, efficient solution to protecting agricultural assets. The findings suggest that IoT can be a game-changer in managing wildlife threats in agricultural environments, offering a more sustainable and automated approach.

3. Environmental Sensing for Livestock Protection Using IoT

A study by Zhang et al. (2021) focused on the use of environmental sensing technologies for livestock protection, which can also be applied to detecting wild animals in farm fields. The research explored the application of various environmental sensors like temperature, humidity, and motion sensors to detect abnormal activity around livestock areas. The study demonstrated that integrating these sensors into an IoT framework allowed farmers to monitor changes in the environment that could signal potential animal intrusion. Furthermore, the system could send alerts to farmers' mobile devices, enabling them to respond quickly. The research highlighted the importance of integrating machine learning algorithms for more accurate animal detection by analyzing patterns in environmental data. While the system proved effective in reducing livestock loss, the study emphasized that the challenge lies Sin differentiating between animals and other environmental factors. This research reinforces the potential of IoT-based systems in livestock protection and animal detection but also suggests that more refined algorithms and sensor technologies are necessary for further optimization.

5.WORKING

The IoT-based animal detection and alert system for farm fields uses sensors and cameras to detect the presence of animals entering the area. The system processes real-time data and sends alerts to farmers through their smartphones or other devices. It utilizes machine learning to distinguish between animals and humans, reducing false alarms. Additionally, it can trigger sound or light deterrents to prevent animals from damaging crops. This

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innovative solution enhances farm security and minimizes crop losses efficiently.

The IoT-based animal detection and alert system is designed to safeguard farm fields by employing advanced technologies like motion sensors, infrared cameras, and machine learning algorithms. These sensors monitor the farm's perimeter continuously and detect the presence of animals intruding into the protected zone. The system processes this data in real time and identifies the type of animal, ensuring accurate classification. Once an intrusion is detected, alerts are sent to the farmer via a mobile application, SMS, or email, enabling timely intervention.

6.RESULTS

CONCLUSION

The IoT-based Animal Detection and Alert System for farm fields offers a promising solution to the challenges faced by farmers in protecting crops and livestock from wildlife and stray animals. By utilizing a combination of sensors such as motion detectors, infrared cameras, and acoustic sensors, this system enables real-time monitoring and detection of animal presence across large agricultural areas. The integration of IoT technology allows for continuous and autonomous operation, significantly reducing the need for manual intervention and ensuring timely alerts to farmers about potential intrusions. This system enhances the overall efficiency of farm management by providing accurate, instant notifications, allowing farmers to take immediate action to prevent damage, whether through manual or automated deterrents. The combination of IoT sensors and automated deterrent devices, such as motion-activated sprinklers, lights, or sound systems, ensures that animals are deterred without direct human involvement, further reducing the need for constant monitoring. This not only improves operational efficiency but also helps lower costs associated with farm security. Additionally, the scalability of the system makes it suitable for farms of various sizes and types, ranging from small farms to large commercial agricultural operations. Despite the system's advantages, challenges remain in terms of sensor placement, environmental factors that can affect sensor accuracy, and the need for reliable communication networks, particularly in rural areas. Moreover, enhancing the system's ability to differentiate between different types of animals and environmental disturbances remains a critical area for further research and development. In conclusion, the IoT-based Animal Detection and Alert System holds great potential to revolutionize farm security by reducing wildlife-related damage and promoting more efficient, sustainable farming practices. With ongoing advancements in sensor technology, data analytics, and communication networks, this system will continue to improve, offering farmers a robust, automated solution to protect their agricultural assets and increase productivity

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