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IoT BASED ELECTRONIC RODENT MOTION DETECTION

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Abstract: In this paper, we will learn about IoT Based Electronic Rodent Motion Detection system using Arduino & GSM module SIM800A. In our country every year, rodents cause a big economic harm. Hidden and normal herd of rodent's attacks plants and field gradually but it causes huge harm in agriculture area and snakes like dangerous animal harms the farmers and local community too. Ancient strategies are being followed by farmers aren't much effective and it's not being feasible to hire guards to keep an eye fixed on the crops and forestall the animals. So here, in this paper we have used the design of an IoT based electronic rodent motion detection that comprises of a motion-sensor, a GSM module, an Arduino Uno board and a Buzzer. This detects the rodent by using a motion sensor. Once presence of rodent confirmed the Arduino Uno board starts the Buzzer which produces ultrasonic sound waves by which the animal or insect goes away from that area and a memorandum will be sent by using GSM module and then farmer get ready for protecting. This approach will drastically reduce the use of pesticides, rodenticides in the agriculture and reduces the exposure of crops from these harmful chemicals and eventually we will be producing healthy and fresh goods. The Indian economy accepts security in terms like protection from attacks of rodents in fields. Hence, this work focuses on raising a smart agriculture using IoT technologies.

Index Terms - Arduino UNO, PIR Sensor, GSM module SIM800A, Buzzer.

I. INTRODUCTION

Agriculture sector plays key role for India's gross domestic product (GDP). Risk Factors such as economic conditions, bad weather conditions, human resources, animals, labor cost are the barriers for growth of agriculture sector. But, Due to population explosion it is necessary to increase the crop yield. To improve the yield, soil quality must be better. IoT based electronic rodent motion detection in backyard farming helps people in detecting rodents using PIR (Passive Infrared) motion sensor and repelling them by producing Ultrasonic sound waves. Ultrasonic wave defines a frequency band with a frequency range more than 20 kHz. Humans are not capable to hear this ultrasonic audio. Because the eardrum of human will not vibrate rapid but insects can listen this ultrasonic sound effectively. Ultrasonic sound creates repellent and noisy climate which repels animal and insects. It also alerts the farmer through message, thus helps him in protecting the plants and increases overall yield.

II. PROBLEM STATEMENT

In today's world, the process of controlling rodents and other animals from destroying the crops has been a great challenge to the farmers. Due to population explosion, it is necessary to increase the crop yield and decrease the loss of crops. Many systems have used different sensors to detect the rodents and have tried many ways to eradicate them but was not able to achieve it completely. In this system we have an IoT module that uses a PIR sensor which detects the rodents entering the farm and repels them by producing Ultrasonic sound waves and alerts the farmer by sending a message to his phone.

III. SCOPE OF THE PROJECT

- The Animal is detected using PIR sensor.
- Buzzer produces ultrasonic waves to make them uncomfortable and scare them away.
- An alert is sent to the farmer via text message to notify the intrusion.

IV. LITERATURE SURVEY

[1]. Sensor based Crop Protection System with IOT monitored Automatic Irrigation. Authors: Damini Kalra, Praveen Kumar, K Singh and Apurva Soni, International Conference on Advances in Computing, Communication Control and Networking (ICACCCN), 2020. In this system, the automatic irrigation is done with the help of 2 soil moisture sensors which calculates the moisture percentage in the soil in real time. This information is then transmitted to the microcontroller in voltage form where the code starts executing and finds average of the moisture level detected by the 2 sensors. The temperature, humidity and the soil moisture data are sent to the microcontroller from where it is transferred to NodeMCU via serial communication. NodeMCU is a Wi-Fi module which allows the user to monitor the physical parameters through mobile phones. The system also protects the crops with a two-mode protection system

for day and night along with automated irrigation with IoT monitoring. The movement detection system and the sound detection system ensure the crop protection with the help of high frequency sound emitted on the algorithm basis. In the night, along with the movement and sound detection, a lower frequency sound emitter for small insects is activated to protect the crops from pests and insects which come out in the night.

[2]. Smart Crop Protection System from Animals. Authors: M. Jaya Prabha, R. Ramprabha, V. Vasu Brindha and C. Asha Beaula, International Journal of Engineering and Advanced Technology (IJEAT), 2020. In this system, they designed an animal detection system to detect the presence of animals and give alert to the farmer as well scare away the animal without any harm. they monitor crops by placing appropriate sensors in the field. They used ultrasonic sensor, IR and GSM. The sensor is used to detect the animals. Once the animal gets detected, this signal is then to the microcontroller for further processing and the system gets activated immediately on the APR board, and then the sound is played to scare away the animal, and to alert the farmer, the system automatically gives call to the farmer. The ultrasonic sensor is placed on the motor so that it rotates 360 degrees, to sense the presence of animals and birds on all directions. Microcontroller is the main component in this system, as it reads all the inputs from different sensors and components and then based on those inputs, gives signal to other components to get desired result. The GSM module as a mobile device to make call to the farmer. It alerts the farmer that some animals or birds try to enter into the farm. Thus, this system ensures the protection of the field by using various sensors and components.

[3]. IOT Based Smart Rodent Detection and Fire Alert System in Farmland. Authors: T. Sowmika, L. Rohith Paul and G. Malathi of Computer Science and Engineering, Vellore Institute of Technology. International Research Journal of Multidisciplinary Technovation (IRJMT), 2020. In this paper, they designed a smart and safe agriculture system that would notify the farmer about the lack of moisture in the soil, animals and others trespassing in their field at odd times using IOT. They used flame sensor to detect fires in the farm and soil moisture sensor to find the moisture content in the soil and then send the data to the farmer. They used PIR and ultrasonic sensor to detect animals and other living beings which are trespassing in the field. All these sensors are controlled with the help of raspberry pi module. They used Wi-Fi module is to send the data received from the sensor to a cloud service platform which analyze the data and perform the required operations like turning on the motor and buzzer. This approach that can be used to solve this problem is using IOT based sensor networks to assist the current traditional methods that are used by the farmers in order to improve their efficiency. The Indian economy accepts security in terms like protection from attacks of rodents in fields. Hence, this work focuses on raising a smart agriculture using automation and IOT technologies.

[4]. Low-Cost Wireless Sensor Network for Rodents Detection. Authors: Carlos Cambra, Sandra Sendra, Laura Garcia and Jaime Lloret, International Conference on Advanced Computation and Telecommunication (ICACAT), 2017. In this paper, they designed a system with less energy consumption and used low-cost microcontrollers They deployed multiple devices which works in real time and are used to monitor the rodent. They collect the data of rodent motion detection and the trapping estimations for further analysis. This data is collected periodically, like weekly or monthly and sent to multimedia platforms like mobile or computers. This paper also uses PIR sensor to detect the rodents. The main aim of this system is to use the micro-RF transceivers which costs less than 5\$ and also to reduce power consumption. This system is a WSN that combines many commercial hardware and software components that integrate several smart implementation algorithms for network routing. This paper also shows how IoT, with network algorithm routing, can be used in large and smart rodent-detection network systems which are expensive in the current market and which should be scalable and easily configurable. On a mesh network, it integrates intelligent frameworks, low energy consumption and the implementation of sensors using the new communication chips based on 2.4 GHz.

[5]. Smart Ultrasonic Insects & Pest Repeller for Farms & Inventories Purpose. Authors: Prafful Silakari, Purna Silakari, Litesh Bopche and Aparna Gupta, International Conference on Advanced Computation and Telecommunication (ICACAT), 2017. This paper proposes an agriculture monitoring system, main goal is to protect the farm and notify it to the farmer. They use ultrasonic sensor and motion sensor to detect the sound and motion of trespassing animals which ensures the presence of the animal in that range. They used Arduino Uno board to control all these sensors and make it work as per the needs. After confirming the presence of the animal, it sends signal to the Arduino board, which sends an alert to the farmer. this alert is sent via GSM Module, which acts as a mobile device. At the same time, it triggers a repeller which emits ultrasonic. This causes irritations to the animals, and they are forced to leave the farm, hence protecting the crops from the animals. As a result, this system serves as a cost-effective and efficient system for monitoring and protecting agricultural farms without any human interventions required.

[6]. Animal Detection System in Farm Areas. Authors: Vikhram B , Revathi B , Shanmugapriya R , Sowmiya S and Pragadeeswaran G, International Journal of Advanced Research in Computer and Communication Engineering, 2017. In this paper, they proposed an animal detection system, which detects the presence of animal using sensors and notify the farmer about the intrusion. To detect the presence of the animal in the farm, they used PIR and Ultrasonic sensors, which detects the motions and as well as sound, hence ensures the presence of the animal. Once the presence of animal is confirmed, the signal is sent to the APR board, which plays sound to divert the animal from the farm. They used Light dependent resistors (LDRs) to find whether it is day or night, if night then the flash light is switched on for visibility at night. they have 2 types of power source, Solar panel and regulated power supply for this system. An LCD display is also used in this system which displays the presence of the animal and as well as the LDR readings. to alert the farmer, a SMS is sent the farmer to notify about the intruder. Overall, this system is designed to protect the farm the farm from intruders without causing any harm to the ecosystem.

[7]. Design of Birds Detector and Repellent Using Frequency Based Arduino Uno with Android System. Authors: Yahot Siahaan, Bheta Agus Wardijono and Yulisdin Mukhlis, International Conferences on Information Technology, Information Systems and Electrical Engineering (ICITISEE), 2017. In this paper, they created a bird and pest repellent system using ultrasonic sound. It consists of PIR sensor, which acts as a detector and detects the presence of bird. They use LC oscillator type Colpitts and Piezo Ultrasonic sensor used as repeller to cause irritations to the bird and scare them away. The working range of the detection is 0cm - 500 cm, and they set the ultrasonic frequency to 60kHz. The frequency used by the author is in range 20 kHz - 29 kHz. This frequency is chosen because the ultrasonic frequency that can be heard by the bird senses reaches only 29 kHz. This desired frequency is derived by changing the capacitor capacitance value. This whole prototype is controlled by an Arduino Uno board, which receives and sends signals to all the sensors and other components. This prototype is integrated with an android app. So, all the events are recorded in the android app which can be used to monitor by the farmer and get notifications.

[8]. Solar Powered Smart Ultrasonic Insects Repellent with DTMF and Manual Control for Agriculture. Authors: Humayun Rashid , Iftekhar Uddin Ahmed , S M Taslim Reza and M. A. Islam, IEEE International Conference on Imaging, Vision & Pattern Recognition (icIVPR), 2017. This system is designed for agricultural purpose, but can be used for other domestic purpose also. two

modes are provided in this system namely, auto mode and manual mode, which can be switched as per their requirements. Using ultrasonic sound-based system is better than other conventional chemicals pesticides, which cause harm to the environment and to the economy. The frequency can be varied as per requirements in this system, so that we can manipulate the frequency to repel many kinds of insects. this system can be controlled from any distance using DTMF (Dual Tone Multi Frequency) technology. DTMF is a technology that can be used to control devices from any distance by using GSM mobiles. It also has night mode with manual control using Light Dependent Resistor (LDR). Power supply is provided with the help of solar panel which is cost effective and good for environment. All these components are controlled using an Arduino Uno board, where it has been coded to perform certain operations on the components.

[9]. Solar Energy Driven Arduino based Smart Mosquito Repeller System. Authors: Simarjit Singh Saini, Divya Bansal, Gurnoor Singh Brar and Ekambir Sidhu, IEEE WiSPNET 2016 conference, 2016. Ultrasonic waves whose frequencies are higher than 20kHz are not audible to humans. But these waves affect other insects since they are sensitive to these waves. Mosquitos contain special hair called sensilla which is present on the antennae which gets affected due to these waves. This affects their nervous system and eventually they are forced to leave that area. 38-44 kHz is the frequency range that can be used to divert these mosquitoes and flies. The proposed ultrasonic mosquito repeller system operates by harvesting the solar energy from sun during daytime and storing it in rechargeable lead acid battery and utilizing the harvested energy to turn on and operate the ultrasonic mosquito repeller system during evening and night time. The relay act as switch which turn repeller on and off based on Arduino instructions. When repeller is turned on by relay and Arduino, it generates ultrasonic sound waves which can be efficiently used to repel the mosquitos from specified area. The range of this proposed system is around an area of 125 square meters.

[10]. Ultrasonic Sensor Animal Safety System. Authors: Vijayaraghavan Sundararaman, Vijayalakshmi T G and Swathi Venkatadri, IEEE International Conference on Recent Advances and Innovations in Engineering, 2014. This module is designed to protect and prevent animals (especially dogs) from the road accidents. Many people get injured when their vehicle comes in contact with domestic or wild animals on the road. Research shows that these animals have been responsible for most of the read-end collisions. The mail goal of this system is to design an ultrasonic sound wave generator, that can be used to divert the animals from the roads. The ultrasonic sound cannot be heard by humans but dogs and other animals have the ability to hear these sound. So, we design an ultrasonic wave generator to generate waves that can divert the animals. This system is powered by solar panels, to enhance the efficiency of the system. The ultrasound generator is basically a transmitter that transmits the ultrasound in the surrounding using air as medium and also this ultrasonic generator acts as the repeller for dogs. This will generate a frequency of 40kHz which is irritating frequency for the dogs that humans cannot hear. This high-pitched sound when heard by the animals, the y get irritated and leave that area, eventually preventing the accidents. This system can be used in forest areas, where the movement of animals in roads are more frequent and thus reducing the accidents.

V. PROPOSED SYSTEM

The sensors used in this system is PIR (Passive Infrared) sensor. This sensor is attached with Arduino uno and GSM module SIM800A. In this System, we can detect the rodents and other animals whenever they try to enter the field. We can stop the rodents and other animals from destroying the crops by repelling them. Meaningful research documented that ultrasonic-wave achieve rodent repeller impact and also decrease in the combine as well as an imitation of numerous pests. We can alert the farmer in real time via text message whenever the rodents and other animals enter the farm. Previously, the farmer had to monitor his field frequently for pests and animals which can destroy his crop which is a loss of time and can incur lot of financial loss to the farmer, but with this project the farmer can monitor his crop and in case any pest enters his crop, he will be alerted instantly so that he can take proper action saving him lot of time and the money that he invested in the crop. This research work not only support the farmers but also provide benefits in the productivity.

5.1 CIRCUIT DIAGRAM

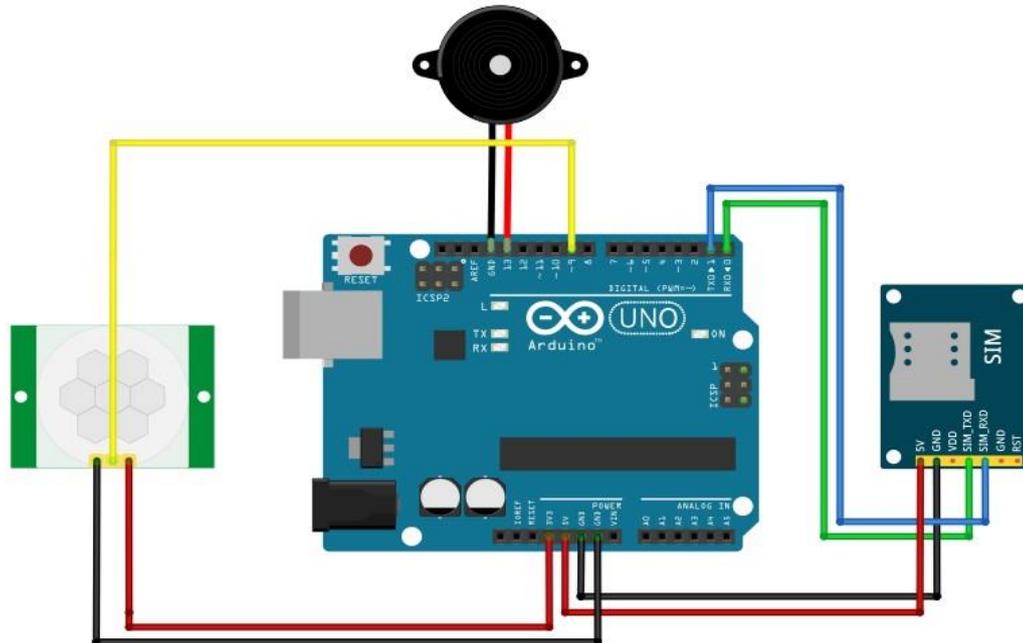


Fig 5.1 Circuit diagram

VI. CIRCUIT DIAGRAM DESCRIPTION

This Rodent Motion Detection system consists of an Arduino UNO Board, a PIR (Passive Infrared) Sensor, a GSM (Global System for Mobiles) module and a Buzzer.

6.1 Arduino board

The Arduino Uno is used to control all sensors and components of our system. It is the main component of our system, that controls the working of all the other components. We have written the code using the Arduino IDE and embedded the code into this board to control these components as desired. PIR sensor, GSM Module, Buzzer are all connected to this board. Whenever the PIR sends a high voltage to the Arduino board, the buzzer is switched on to produce ultrasonic wave of 25kHz frequency. This frequency is already set in the code. At the same time, it also sends the pre-written alert message to the GSM module, and then that message is sent to the desired mobile device. The message and receiver's mobile number are set in the code itself.



Fig 6.1 Arduino UNO

6.2 PIR Sensor

PIR is used to detect any warm, Infrared radiating object in its range. It consists of a pyroelectric sensor at its center, which generates high voltage with the help of the infrared radiation. The sensor is covered by Fresnel lens, which concentrates the radiations to the sensor for better sensing purpose. It also consists of 2 potentiometers, 1 which is used to control the sensitivity of the sensor, range can go up to 6 meters, and another potentiometer is used to control the output delay time, which ranges from 0.3 seconds to 5 minutes. It also has 2 trigger modes, one is repeatable trigger, which keeps the output voltage high until the radiation is present in the sensor's range. Second mode is non-repeatable trigger, which will keep the output voltage high until the delay time is over. We are using repeatable mode here for our prototype, and setting the delay time to minimum.



Fig 6.2: PIR Sensor

6.3 GSM module

We use GSM module to establish communication between our prototype and the farmer's mobile device. We use 9V battery as a power supply to this circuit. A SIM is inserted into the circuit, which acts as a mobile device. It is connected to the Arduino board via Transmitter and receiver pins, and controlled by the Arduino board, where we have written code to send SMS to alert the farmer whenever the PIR sensor detects a rodent or any animal in its limited range.



Fig 6.3: GSM module

6.4 Buzzer

Using PIR Sensor, the rodents are detected. Whenever, any impediment comes ahead of the PIR sensor the buzzer produces ultrasonic sound waves of 25kHz frequency which causes an irritation to the rodents and forces them to stop moving towards the crops and protects the crops.



Fig 6.4: Buzzer

VII. EXPERIMENTAL RESULTS

fig 7.1 Shows the prototype of IoT Based electronic rodent motion detection. The red LED glows whenever any infrared radiating object (rodent and other animals) is detected in its area.

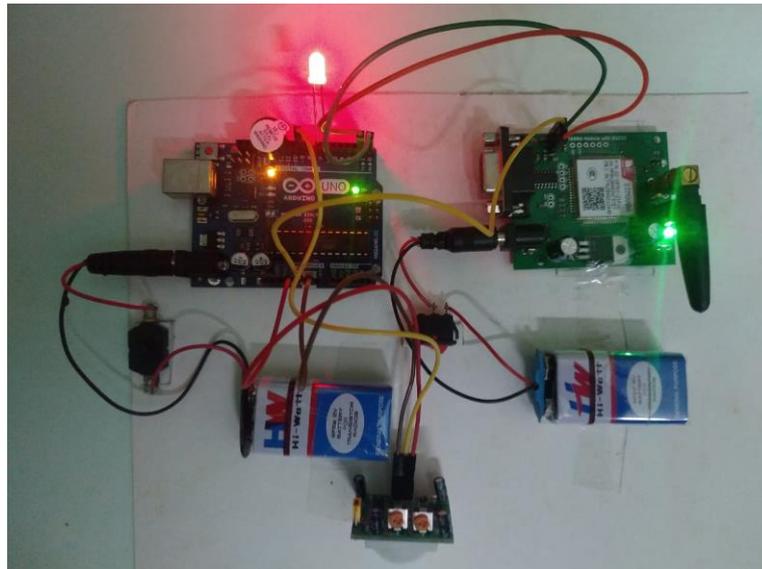


Fig 7.1: prototype of IoT Based electronic rodent motion detection.

As shown in below fig 7.2 shows the measurement of frequency produced by the buzzer when the animal is detected by the PIR sensor.



Fig 7.2: Ultrasonic sound frequency measurement

VIII. CONCLUSION AND FUTURE WORK

Proposed system detects rodents and emits ultrasonic sound waves that repels them. So that wild animals will not enter into the farm. It will run away. GSM module sends message to the farmer to alert him. Here we use a PIR sensor as a detector with a movement distance that can be captured from a rodent is 6m, according to the characteristics of the sensor. When rodents are detected then the rodents will automatically be given with ultrasonic waves. From this it is concluded that the design system is very useful and affordable to the farmer. IoT Based Electronic Rodent Motion Detection serves as a reliable and efficient system for monitoring agricultural losses. The corrective action can be taken. The design system will not be dangerous to animal and human being, and it protects farm. Wireless monitoring of field not only allows farmer to reduce the man power, but it also allows user to see efficient and accurate changes in it and by the data government and farmers welfare, MNC's make good policies. It is cheaper in cost and consumes less power. The GDP per capita in agriculture sector can be increased. This project can be extended for cattle monitoring also.

In the future, there will be very large scope, this project can be made based on wireless networks. Wireless sensor network and sensors of different types can be used to collect the information of crop conditions and environmental changes and this information can be transmitted through network to the farmer that initiates corrective actions. Farmers are connected and aware of the conditions of the agricultural field at anytime and anywhere in the world.

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