A Unique Solution for Security of Agriculture Produce Using Green IoT

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***Abstract*- Many technologies have been introduced to improve the production of agricultural produce. But very little is done to protect the produce from being eaten by rodents or other intruders. These challenges should also be taken into account. Security systems these days are not smart enough to provide real time notification after sensing the problem. The technologies like Internet of Things and Wireless Sensor Networks can lead to agricultural modernization. We have designed, tested and analyzed an 'Internet of Things' based device. Since, the devices in IoT have limited energy sources they often run on battery, the implementation of green communication and system design in IoT has been a core challenging issue. This paper addresses the energy efficiency issues across diverse IoT driven networks by proposing a system design for G-IoT for the IoT devices to extend the life expectancy of the whole IoT network.**

***Keywords*- Green IoT, Raspberry Pi, Sensor devices, Python, Agriculture Security.**

I. INTRODUCTION

In past few years information and communication technologies have been introduced in agriculture, improving food production and transportation [1]. However the integration of these technologies are not yet used for security purposes. The significant challenge facing the security in agriculture is the interaction between security devices to enhance security in various fields.

The lack of information transmission and data analyzing has been "solved" by integration of internet of things with present security systems in order to achieve efficient food preservation. Although the food crop loss and debilitation of diseases are due to various threats as rodents, pests, insects and grain pathogens. In the context of Smart Security and Monitoring System for Agriculture, we address the challenge of integrating Internet of Things with electronic security devices and systems to improve the efficiency of food preservation in grain stores [2].

II. LITERATURE SURVEY

Internet of Things is used with IoT frameworks in order to easily view, handle and interact with data and information. Within the system, users can register their sensors, create streams of data, and process them. In addition, the system has searching capabilities, helping the user with a full-text query language and phrase suggestions, allowing a user to use APIs to perform operations based on data points, streams and triggers. It is also applicable in various agricultural areas apart from security. Few areas are:

- Water quality monitoring
- Monitor soil constituent, soil humidity
- Intelligent greenhouses
- Water irrigation
- Scientific disease and pest monitoring

III. PROPOSED SYSTEM

Is to develop intelligent security systems with ability to analyze data and transmit information over network to the remote location. The system uses the concept of IoT to detect motion and record it, so that the data can be used to analyze and take useful decisions.

A. Internet of Things

Kevin Ashton in 1999 proposed the term"Internet of Things" to refer inter connected devices [3]. It's a major tech revolution in information and communication technology with updated infrastructure and networks where all the connected devices are able to identify and communicate with each other. The six elements in IoT are identification, sensing, communication technologies, computation, services and semantic. The communication protocols of IoT are: Wi-Fi, Bluetooth, LTE, NFC. Thus, agriculture can be a vast area to integrate Internet of Things with distributed autonomous sensors to monitor environmental condition of grain stores and to analyze data and pass the information to remote user [4].

B. Wireless Sensor Network

Wireless Sensor Network is a distributed collection of small devices. It is capable of wireless communication [6]. As the implementation of wireless communication technologies in industrial areas are necessary due to inaccessibility to remote location at every time, to transmit the information's generated by sensors along with controlling them. So, to

achieve interoperability between devices in industrial areas, design and implementation of wireless communication system is done.

C. *Green IoT*

According to Gartner, in near future, about 25 billion identifiable devices are expected to be a part of this computable network by year 2020[5]. These devices will produce a lot of electronic waste and will also consume a significant amount of energy in order to execute different tasks. This will eventually pose a challenge in near future to reduce the energy consumption and will also demand for new ways of developing a green communication across the network. The vision has become more sparse and promising since the promotion of green IoT(G-IoT). As a result, reduction in context of energy consumption and the deployment of green IoT, should be considered as the future challenges in IoT along with the current projected challenges. Besides energy consumption is acute in different heterogeneous IoT devices as it actively relates to cost and availability of the IoT network. Thus energy consumption has become a core issue in future.

IV. SYSTEM ARCHITECTURE

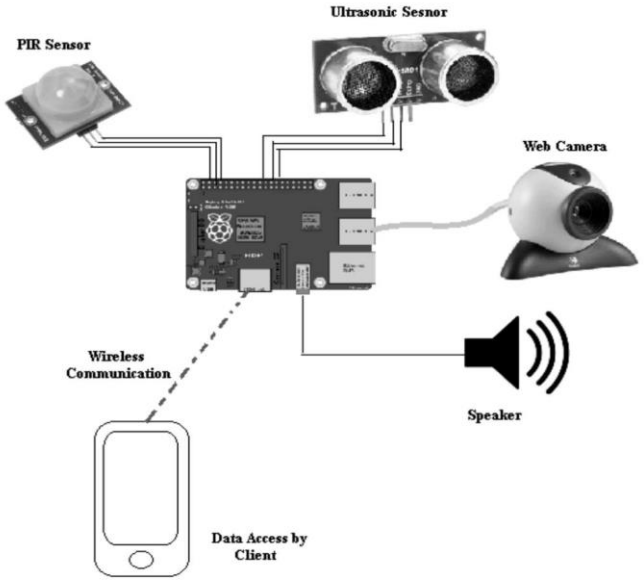


Figure.1 System Architecture

TABLE I

GPIO TO SENSOR CONECTION

Device	Port	GPIO Pin
URD Sensor	TRIG ECHO VCC GND	GPIO 23 GPIO 24 PIN 2 PIN 6
PIR Sensor	VCC GND OUT	PIN 2 GPIO 7 PIN 6
Buzzer	VCC GND	GPIO 4 PIN 6
Camera		USB

Unlike, other security systems which require continuous monitoring and image recording through CCTV's which result in more power consumption. This system is designed such that it should be energy efficient and result in less power consumption. So, only when PIR sensor detects any kind of motion in its range the URD sensor sends the ultrasonic waves and calculates the distance of rodents from the system. Then, the buzzer gets activated and image is captured through webcam which is stored in data base. This device can be controlled and monitored from remote location and it can be installed in agricultural fields, grain stores for security purpose. This paper is oriented to make more noticeable the methods to solve such problems like identification of rodents, threats to crops and sending real time notification and processing without human intervention.

A. *Raspberry Pi*

Raspberry Pi is a small credit-card sized minicomputer. It supports Python language. It has forty GPIO pins. It has onboard Bluetooth and Wi-Fi. It has 1Giga Bytes of RAM and has a memory slot.

Figure.2 Raspberry Pi

TABLE II

RASPBERRY PI PIN LAYOUT

PIN	GPIO	PIN	GPIO
1	3.3V	2	5V
3	GPIO2	4	5V
5	GPIO3	6	GND
7	GPIO4	8	GPIO14
9	GND	10	GPIO15
11	GPIO17	12	GPIO18
13	GPIO27	14	GND
15	GPIO22	16	GPIO23
17	3.3V	18	GPIO24

19	GPIO10	20	GND
21	GPIO9	22	GPIO25
23	GPIO11	24	GPIO8
25	GND	26	GPIO7
27	ID-SD EEPROM	28	ID-SC EEPROM
29	GPIO5	30	GND
31	GPIO6	32	GPIO12
33	GPIO13	34	GND
35	GPIO19	36	GPIO16
37	GPIO26	38	GPIO20
39	GND	40	GPIO21

B. Webcam

Figure.3 Webcam

A webcam is used to capture n record the images of the rodents that are detected and send it to the user web. It is connected to raspberry pi through USB.

C. Buzzer

A buzzer is an audio signaling device that may be mechanical or electromechanical. In this system we use an intermediate buzzer instead of repellent. It has two terminals VCC and GND.

Figure.4. Buzzer

D. Ultrasonic sensors

Figure.5 Ultrasonic sensors

Ultrasonic sensors transmit ultrasonic waves in cone shaped beam. It has four pins Trigger, Echo, VCC and GND. Ultrasonic waves transmitted have a frequency of about 30MHz.

E. PIR Sensor

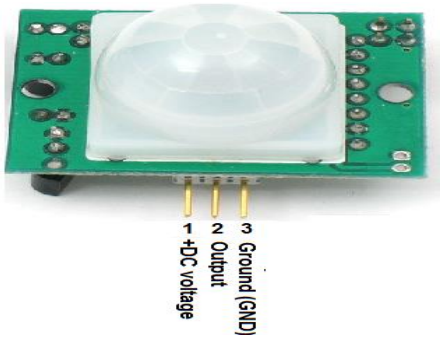


Figure.6 PIR Sensor

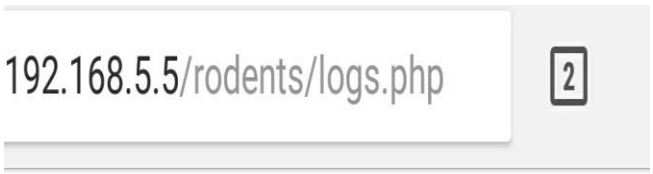
Passive Infrared Sensor (PIR) Sensor detects any kind of motion in its range. It has three pins GND, VCC and Output.

V. SOFTWARE REQUIREMENTS

- Language: Python and PHP
- Platform: Windows
- Data store: MySql Server
- Tools: PHP (hypertext pre processor)

VI. RESULTS

Figure.7 Result



Rodents Logged Data

Sl No	Distance	Time	Picture
1	3.62348556519	2017-06-21 14:33:26.042760	Jun-21-2017_143331.png
2	3.65591049194	2017-06-21 14:35:05.638700	Jun-21-2017_143510.png
3	45.8285808563	2017-06-21 14:35:14.861806	Jun-21-2017_143519.png
4	7.70092010498	2017-06-21 14:35:23.086705	Jun-21-2017_143528.png
5	201.058864594	2017-06-21 14:35:46.429979	Jun-21-2017_143551.png

Figure.8 Result displayed on webpage

This represents the value transmitted by security system to mysql database. Distance Measured is in centimeters and Time is in"dd/mm/yy: hh:mm:ss" format. After configuring web link *i.e. 192.168.5.5* for prototype, the API template is modified later to provide webcam access link within the body of user notification text. In the represented sample data, time periods are shown to denote the test object's distance after each detection. As the object is detected, electronic pest repeller or buzzer is activated for few seconds and an image is captured and stored in the data base which can further be displayed on web page through php and it is accessed by users through IoT.

VII. CONCLUSION

The proposed IoT system model promotes G-IoT by incorporating with the proposed energy efficient scheme which ensures less power consumptions with well defined stages of devices within an IoT network. The system is designed for identification of rodents in grain stores. After collecting and analyzing the data, algorithm is designed to provide accuracy in notifying user and activation of buzzer. All the results are calculated by taking several readings. The testing is done in an area of 10 sq.m., with device placed at the corner. Once IR sensor identifies heat it starts URD sensor and webcam, along with it, device sends random number of notifications (based upon timestamp) to user.

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