GRANARY MANAGEMENT SYSTEM USING IOT

[1]Ranjitha A S, [2]Priyanka H Wadeyar, [3]Ragini D C, [4]Ranjitha M N, [5]Chetan B V

[1, 2, 3, 4] Final Year B.E Students, [5]Assistant Professor
Department of Electronics and Communication Engineering,
GM Institute of Technology, Davanagere, Karnataka, India.

***Abstract*— India is one of the largest agricultural lands in the world with approximately 179.9 million hectares under cultivation. Still in India, food grains are stored at warehouse using traditional technology which leads to problems such as theft, rain, flood, variation in temperature and humidity, attacks of rodents, insects etc. A granary management system based on Internet of Things (IOT) has been proposed in this paper work to address the above issues related to the storage of food grains. In this paper, smart sensing devices are integrated with IOT and Wireless Sensor Networks to preserve the quality and quantity of the stored products over time. This system can be controlled and the parameters can be monitored from remote location. The notifications can be delivered in the real time based on information analysis and processing without human intervention.**

***Index Terms*— IOT, Arduino, Raspberry Pi**

I. INTRODUCTION

Agriculture sector being the backbone of the Indian economy deserves food security. Today, food preservation is very important to fulfill the food supply chain needed by the developing countries like India. There is a huge need for preservation, protection, storage, distribution and consumption of food at later stage. The main objective of this paper is to preserve the food grains from rodents invading at warehouses and also threat to destruction of stored crops, due to variation in temperature, excess humidity, fire, theft, rain, flood, etc. So that stored food grains can be delivered as and when required (real time).In this paper we are integrating Internet of Things with smart sensors to improve the efficiency of food preservation in warehouse.

During storage, quantity as well as quality of food grains will be decreased due to insects, rodents and microorganisms. Almost all species have remarkably high rates of multiplication and, within one season, may destroy 10-15% of the grain and contaminate the rest with undesirable odors and flavors. Insect pests also play a pivotal role in transportation of storage fungi. Over the past years, IOT and WSN technology have been introduced in agriculture for improving the efficiency of food production and transportation, but these technologies are not yet used for food security purpose stored at warehouse. The significant challenge facing the food security at warehouse is the interaction between the Security devices and to provide them intelligence to control other electronic devices such as cameras, repellers etc to enhance the efficiency of food security at various warehouses.

Fig. 1: Food grains storage in warehouses

The paper is mainly worked on the IoT (Internet of Things).Internet of Things is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators and connectivity which enables these objects to connect and exchange data. Each thing is uniquely identifiable through its embedded computing system but is able to inter-operate within the existing internet infrastructure.

The IoT allows object to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems and resulting in improved efficiency, accuracy and economic benefit in addition to reduce human intervention. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical system, which also encompasses technologies such as smart grids, virtual power plants, smart homes, intelligent transportations and smart cities.

These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices.

II. LITERATURE REVIEW

Kavya P et.al [1] have proposed on agricultural land in the world with approximately 179.9 million hectares under cultivation. Still in India, food grains are stored at warehouse using traditional technology which leads to problems such as theft, rain, flood, variation in temperature and humidity, attacks of rodents, insects etc. Smart sensing devices are integrated with Internet of Things (IOT) and Wireless Sensor Networks to preserve the quality and quantity of the stored products over time. This device can be controlled and monitored from remote location and delivering real time notification based on information analysis and processing without human intervention.

Nikkila et al.[2] have proposed Farm management information systems (FMIS) which have steadily increased in their level of sophistication as they have included new technologies with Internet connectivity being the latest addition. However, few FMIS have used the full capabilities of the Internet, and the emerging concept of precision agriculture has little or no support in the current commercially available FMIS. FMIS for precision agriculture have certain additional requirements to traditional FMIS, which makes the implementation of these systems technically more complicated in several aspects. Our research aimed to identify the requirements posed by precision agriculture on FMIS and then evaluate a modern Web-based approach to the implementation of an FMIS that fulfilled these additional requirements**.**

D.Singh et.al.[3] described about the Internet Of Things, its application and services. Internet-of-Things (IoT) is the convergence of Internet with RFID, Sensor and smart objects. IoT can be defined as "things belonging to the Internet" to supply and access all of real-world information. Billions of devices are expected to be associated into the system and that shall require huge distribution of networks as well as the process of transforming raw data into meaningful inferences. This paper presents all about a novel architecture model for IoT with the help of Semantic Fusion Model (SFM). This architecture introduces the use of Smart Semantic framework to encapsulate the processed information from sensor networks. This paper presents a discussion on Internet oriented applications, services, visual aspect and challenges for Internet of things using RFID, 6lowpan and sensor networks.

Malik Tubaishat et.al.[4] described about the advances in hardware and wireless network technologies have created low-cost, low-power, multifunctional miniature sensor devices. These devices make up hundreds or thousands of ad hoc tiny sensor nodes spread across a geographical area. These sensor nodes collaborate among themselves to establish a sensing network. A sensor network can provide access to information anytime, anywhere by collecting, processing, analyzing and disseminating data. Thus, the network actively participates in creating a smart environment.

Tadele Tefer et.al.[5] they researched on traditional storage practices in developing countries cannot guarantee protection against major storage pests of staple food crops like maize, leading to 20–30% grain losses, particularly due to post-harvest insect pests and grain pathogens. On practice of traditional storage, smallholder farmers end up selling their grain soon after harvest, only to buy it back at an expensive price just a few months after harvest, falling in a poverty trap. The potential impact on poverty reduction and greater livelihood security will not be realized, however, if farmers are unable to store grains and sell surplus production at attractive prices. In order to overcome this problem a metal silo was developed as a valid option and proven effective in protecting stored grains from attack by storage insect pests. A metal silo is a cylindrical structure, constructed from a galvanized iron sheet and hermetically sealed, killing any insect pests that may be present. The use of metal silo, therefore, should be encouraged in order to prevent storage losses and enhance food security in developing countries.

Grant R. Singleton et.al.[6] researched on the needs of identification on specific priorities for research and extension for national agricultural research and extension systems (NARES) determined from consultations with collaborators in specific countries. The Rodent Ecology Work Group of IRRI provides one important avenue to promote research on rodent pests in the region. However, stronger expert input is required. In summary, IRRI has the unique comparative advantage to provide the foci and regional linkages for research and training and the continuity for tackling the important problem of rodent impacts on rice production. The major outcomes from this research and extension effort would be significant improvements in agricultural production, in food security, and in both human and environmental health.

Arduino UNO: https://store.arduino.cc [7] gives information on ARDUINO UNO IDE software and its installation, the required library files of the following sensors:
(1) DHT22 sensor
(2) PIR (Passive infrared) sensor
(3) FIRE sensor

Raspberry Pi: https://www.raspberrypi.org [8] gives information about interfacing Raspberry Pi with ARDUINO UNO and its interfacing code. Also, the information of sending the stored data to the cloud from Raspberry Pi is present in the above website.

Thingspeak: https://thingspeak.com [9] gives the information about how to create a channel in the thingspeak.

III. SYSTEM DESIGN

The block diagram and algorithm details of the proposed granary management system using IOT are presented here. The main aim is to design and develop a granary management system using IoT to protect food grains from rodents, microorganisms and insects. It can be implemented in warehouses.

To implement the proposed system, mainly used components are:

1. Sensors - PIR, DHT 22, Fire sensors
2. Arduino
3. Raspberry Pi 3
4. Relay module

5. Buzzer
6. Fan
7. Bulb

Here, PIR sensor is used to detect the motion, fire sensor is used to detect the fire accidents, DHT 22 is used to measure the temperature and humidity. The sensor senses and sends the corresponding outcome to relay module through arduino. The data is sent to raspberry pi and stored in cloud. Then the output of raspberry pi is sent to user to know the condition of the food grains and further the precautions are taken to protect the food grains. Thus, this paper prevents the wastage of food grains in the warehouse.

The arduino collects the data from the sensors – DHT 22, fire sensor, PIR. Temperature control is performed by arduino via actuators- fan and bulb. When temperature increases fan turned on and when temperature decreases bulb is switched on. Humidity control is performed by arduino via exhaust fan. Ardunio is interfaced to raspberry pi. Raspberry pi acts as a gateway to internet. Arduino sends data to raspberry Pi, via Raspberry pi values of temperature and humidity are stored in cloud. Raspberry pi sends data to the remote user or authority. Real time monitoring of the granary is possible.

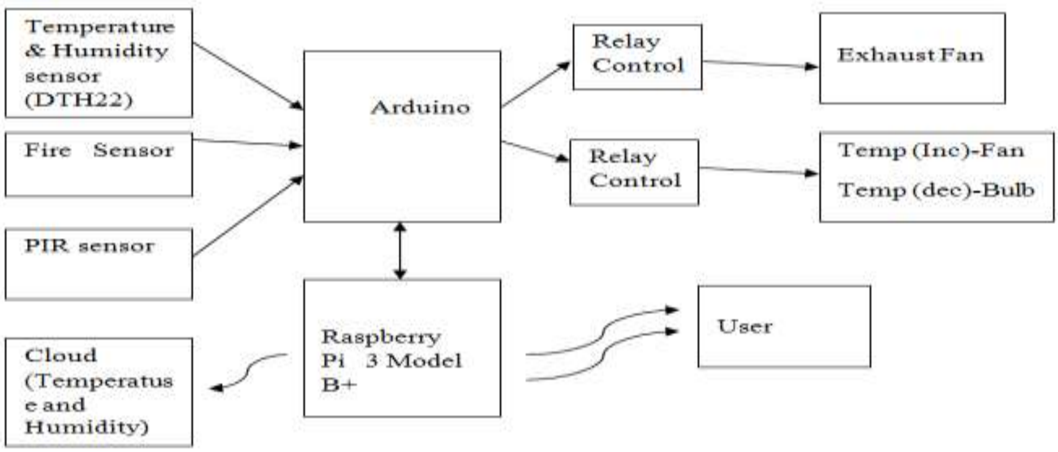

Fig. 2: Block Diagram of the Proposed Granary Management System

The following flowchart describes the DHT22 sensor detection. When the temperature is detected then the message is send to the user. If the temperature is above the threshold value the fan is ON and when the temperature measured is below the threshold value the bulb is ON.

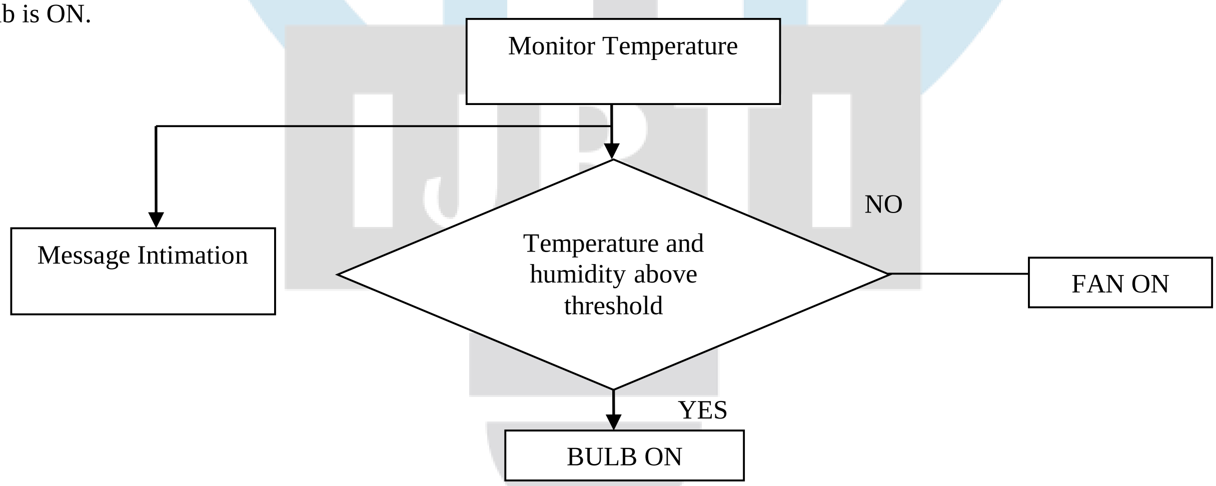

Fig. 3: Operation Flow Diagram of the DHT 22 sensor

The following flowchart describes the PIR sensor detection. When the motion within the warehouse is detected, the led blinks

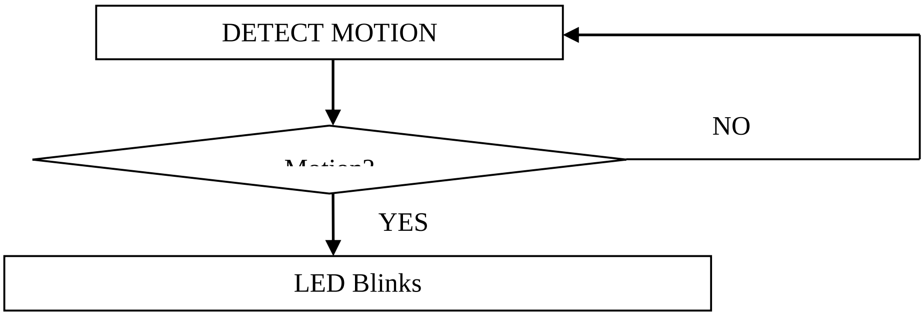

Fig. 4: Operation Flow Diagram of the PIR sensor

The following flowchart describes the fire sensor detection. When the fire within the warehouse is detected the buzzer gets on.

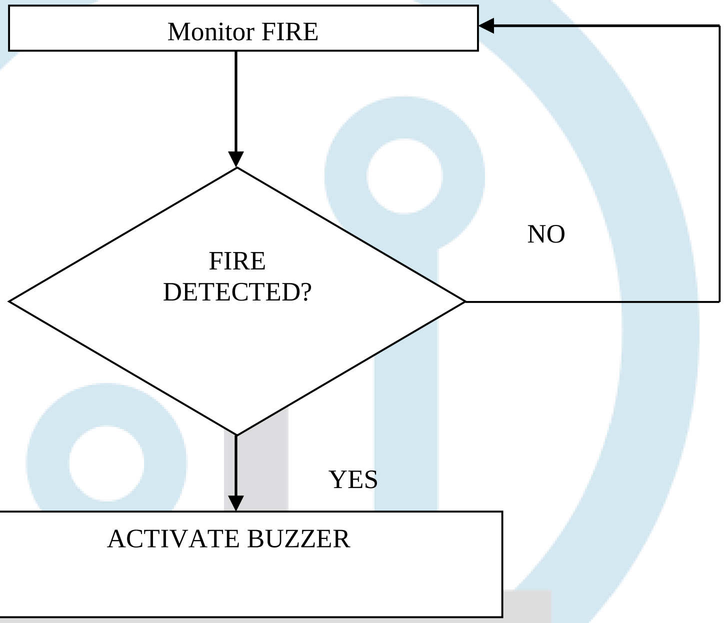

Fig. 5: Operation Flow Diagram of Fire sensor

IV. System Requirements Specifications

To develop a prototype of the proposed granary management system the hardware and software requirements are described below.

Software Requirements:

The software tools required for the project work are:

1. Python
2. Android studio
3. Thingspeak

Hardware Requirements:

The hardware components required to complete the project are given below.

1. Raspberry Pi 3 Model B+.
2. Arduino Uno.
3. Sensors (PIR, Temperature and Fire).
4. Relay module.
5. Web Camera.
6. Buzzer.
7. Fan

V. Results

After all the sensors are tested, they are interfaced with Arduino and actuators (fan, bulb) are interfaced to arduino via relay module. The Arduino is connected to Raspberry Pi. The sensor values are sent from Arduino to cloud through Raspberry Pi and further the values are sent to user/authority. The integrated prototype model of the proposed granary management system is as shown in Fig. 6.

Fig. 6: Prototype of the proposed of the granary management system

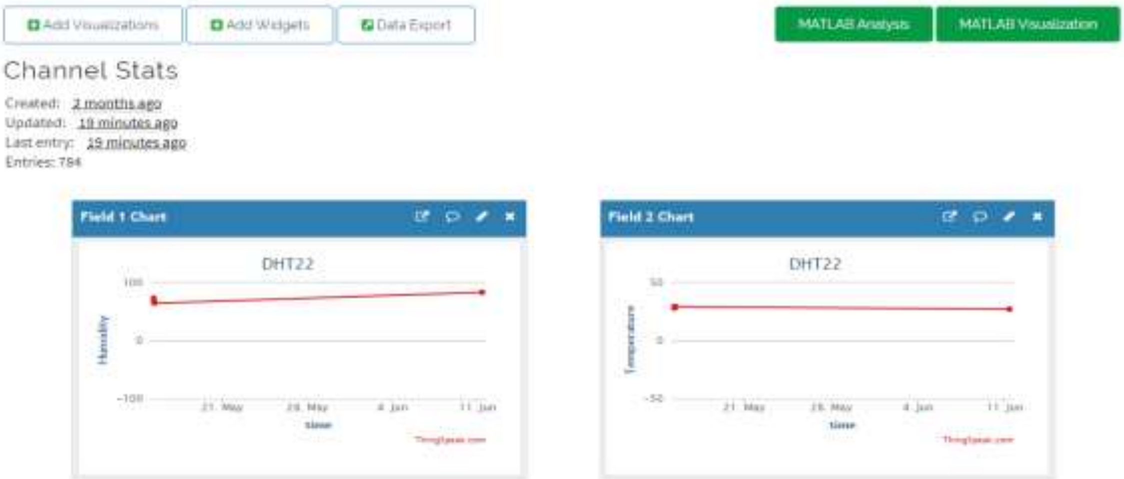

Fig. 7: Temperature and humidity values in thingspeak

V. ACKNOWLEDGMENT

We would like to acknowledge the support extended by the Department of E&C Engg, GM Institute of Technology, Davanagere for the completion of this work. Lastly, we would like to thank our parents and friends for their support, encouragement and guidance throughout the course of this work.

REFERENCES

[1] Kavya P, Pallavi K N, Shwetha M N, Swetha K, Mrs. Jayasri B S, " Use of Smart Sensor & IoT to Monitor the Preservation of Food Grains at Warehouse", vol. 2, no. 6, pp 449-454, 2017.
[2] Nikkila, R., Seilonen, I., Koskinen, K. 2010. "Software Architecture for Farm Management Information Systems in Precision Agriculture" Comput. Electron.Agric. 70 (2), 328-336.
[3] D. Singh, G. Tripathi, A.J. Jara, "A survey of Internet-of Things: Future Vision, Architecture, Challenges and Services in Internet of Things" (WFIoT), 2014.
[4] Malik Tubaishat, Sanjay Kumar Madria "Sensor networks: An Overview", IEEE Potentials 05/2003.
[5] Tadele Tefera, Fred Kanampiu, Hugo De Groote, Jon Hellin, Stephen Mugo, Simon Kimenju, YosephBeyene, Prasanna M. Boddupalli, Bekele Shiferaw, Marianne Banziger. "The Metal Silo: An effective grain storage technology for reducing postharvest insect and pathogen losses in maize while improving smallholder farmers' food security in developing countries", The International Maize and Wheat Improvement Center (CIMMYT), Volume 30, Issue 3, March 2011.
[6] Grant R. Sing5leton. "Impacts of rodents on rice production in Asia." IRRI Discussion Paper Series No. 45, 30 pp. (International Rice Research Institute: Los Banos, Philippines.)
[7] Arduino UNO: https://store.arduino.cc
[8] Raspberry Pi: https://www.raspberrypi.org
[9] Thingspeak: https://thingspeak.com