Shree Shankar Narayan Education Trust's

PRAVIN PATIL COLLEGE
OF DIPLOMA ENGINEERING & TECHNOLOGY

A

CAPSTONE PROJECT REPORT

ON

GRAIN WAREHOUSE MONITORING USING "IOT"

PROJECT WORK SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DIPLOMA.

SUBMITTED BY

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Academic Year (2019-2020)

Shree Shankar Narayan Education Trust's

PRAVIN PATIL COLLEGE
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The project completed in a group consisting of three persons under the guidance of the faculty Guide.

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Project Members

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Abstract

Warehouse environment monitoring is an important part of storage safety management. The traditional method of adopting a warehouse management system may not be sufficient for managing a food warehouse as it lacks temperature and pressure monitoring ability. **Grain warehouse Monitoring system** significantly reduces the amount of deteriorated/inferior grains as well as reducing the cost of quality control. The temperature of the warehouse can be recorded and monitored. Depending on the size and shape of the area multiple sensors can be installed inside the warehouse. Humidity of the area also needs to be recorded and monitored based on the type of grains being stored and the humidity conditions of the location. India has total agriculture warehousing capacity of around 91 MMT at present to store and conserve such large quantities with state agencies owning 41% of the capacity and the balance distributed among private entrepreneurs, cooperative societies, farmers, etc. However, these government agencies use 66% (60 MMT) of India's total agriculture storage capacity which also includes hired capacity of 23 MMT. The total state owned storage capacity of 37 MMT is held through three public sector agencies viz. Food Corporation of India (FCI), Central Warehousing Corporation (CWC) and State Warehousing Corporation (SWC). With the average buffer stock norms for food grains of around 25 MMT and peak of 32 MMT in July every year, the storage capacity available with Government agencies is primarily used for keeping central stock of food grains for the buffer stock, public distribution systems and other Government schemes.

Contents

1. Introduction

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The Internet of things (IOT) is remodeling the agriculture enabling the farmers with the wide range of techniques. IOT technology helps in collecting information about conditions like weather, moisture, temperature and fertility of soil, Crop online monitoring enables detection of weed, level of water, pest detection, animal intrusion in to the field, crop growth, agriculture. To enhance the productivity of the crop there by supporting both farmer and nation we have to use the technology which estimates the quality of crop and giving suggestions. Wireless sensor network are sensors of different types are used to collect the information of crop conditions and environmental changes in information is transmitted through network to the Administrator or devices that initiates corrective action. Some disadvantages in communication must be overcome by advancing the technology to consume less energy and also by making user interface ease of use. Wireless sensor networks are used for monitoring the farm condition and microcontrollers are used to control and automate the farm processes. IO technology can reduce the cost and enhance the productivity of traditional farming. Over the past decade, the popularity of Python as a mainstream programming language has exploded.

1.1Current Scenario

India has total agri warehousing capacity of around 91 MMT at present to store and conserve such large quantities with state agencies owning 41% of the capacity and the balance distributed among private entrepreneurs, cooperative societies, farmers, etc. However, these government agencies use 66% (60 MMT) of India's total agri storage capacity which also includes hired capacity of 23 MMT. The total state owned storage capacity of 37 MMT is held through three public sector agencies viz. Food Corporation of India (FCI), Central Warehousing Corporation (CWC) and State Warehousing Corporation (SWC). With the average buffer stock norms for food grains of around 25 MMT and peak of 32 MMT in July every year, the storage capacity available with Government agencies is primarily used for keeping central stock of food grains for the buffer stock, public distribution Systems and other Government schemes

1.2 Problem Faced in Current scenario

Nowadays farmers are facing huge problems of loss of grains. As rainy season start farmers face many problems such as:-

- Humidity and Temperature cannot be controlled.
- Damaged grains will have reduced market value
- Reduced germination in seed material.
- Due to the attack of rodents one can face the loss of grain.
- Due to lack of water irrigation one can face the loss of growth in the crops.

1.3 Solution and Planning

These problems can be avoided or solved by building an software which

Performs the following tasks:

- Improving the quality of grains in origin.
- Reducing intermediation of loss in grains.
- Pricing flexibility since pricing can be done at various times after.

Due to the perfect planning one can save the grains due to the hazardous effect of the climate.

- By applying fertilizers to the crops the fertility of the soil will increase and it will help in the growth of the crops.
- By applying water irrigation practices, one can pour water properly to the crops.
- By implementing grain warehouse monitoring device one can save the grains by the attack of rodents.

2. Literature Review

2. Literature Review

These frameworks permit more prominent straightforwardness, control, and execution when connected to any industry .In this paper, we are going to discuss about loss due to atmospheric moisture beyond threshold results in infestation etc and hence damages the food grain. In this paper, we are going to discuss about loss due to atmospheric moisture beyond threshold results in infestation etc and hence damages the food grain. Those losses can be reduced effectively with support of various sensors to detecting the status of food grains stored in the Central Warehousing [1].

This device can be controlled and monitored from remote location and delivering real time notification based on information analysis and processing without human intervention. In this paper we integrate smart sensing devices with Internet of Things (IOT) and Wireless Sensor Networks to preserve the quality and quantity of the stored products over time [2].

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 [3].

This system significantly reduces the amount of deteriorated/inferior grains as well as reducing the cost of quality control. The temperature of the warehouse can be recorded and monitored. Depending on the size and shape of the area multiple sensors can be installed inside the warehouse. Humidity of the area also needs to be recorded and monitored based on the type of grains being stored and the humidity conditions of the location.

3. Scope of the project

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1. **Difficulty in maintaining a crop's value after harvesting in long sunning-** In the past, it relied heavily on guesswork and gut instinct. Many farmers' intuitions were spot on. But, there would be times when the mark would be missed leading to post-harvest spoilage and insect infestation
2. **How convenient would it be to use a for farmer just by sensing:** Yes, it would be very nice. Sensors are device, module, machine, or subsystem which is used to sense the environment. So, there is no pain of learning to use it. If you are using a DHT22 Temperature and Humidity Sensor then you don't have to worry about the humidity in the surrounding. we use this sensor for taking the storage internal temperature and humidity as well then send to the web server for real-time monitoring purpose.
3. **Sensors are built for the places where the grains actually are:** quantity as well as quality of food grains will be decreased due to insects, rodents, insects and micro-organisms. 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.
4. **Keeping track of the grains:** As people are getting more conscious about the grains they are consuming, they keep track of the grains they consume per day.
5. **"Improving Record Management":** Data which is been retrieved from the sensors will be stored in the database and also depending upon the amount of goods stored within the warehouse the database will be updated, the addition and deletion of good within the warehouse will also be logged.
6. **Improving grain Storage area:** The temperature variation that does affect the grain mass is caused by the fermentation processes, that is, when there is a moisture focus that begins to deteriorate the grain, and one of the consequences is the temperature increase. Hence the importance of detecting moisture sources by means of tools that allows to measure the temperature inside the silos and set an

alarm when there is an increase in temperature in any of the points, indicating that something serious is happening inside. Once the moisture has been detected, it is necessary to act, either by ventilating, that is to say, putting air at medium pressure inside the silo; or by recirculation and transferring the grain to another place, which is much safer.

7. User benefits: The Grain warehouse monitoring system is an advanced solution for monitoring the physical parameters within warehouse. The system deals with monitoring and controlling the various environmental conditions in a warehouse by using temperature sensors, humidity sensors, load cell, fan, PIR, Raspberry pi 3 microcontroller. The system helps farmer to prevent food losses during harvesting.

8. Raspberry Pi 3 Model B:- The Raspberry Pi Foundation provides Raspbian, a Debian-based (32-bit) Linux distribution for download, as well as third-party Ubuntu, Windows 10 IoT Core, RISC OS, and specialized media center distributions. It promotes Python and Scratch as the main programming languages, with support for many other languages

9. Use Temperature and humidity sensor(DTH11):- The DHT11 temperature and humidity sensor is a nice little module that provides digital temperature and humidity readings. It's really easy to set up, and only requires one wire for the data signal. These sensors are popular for use in remote weather stations, soil monitors, and home automation systems.

10. Use of PIR Sensor using Raspberry Pi 3 Model B:- In this project, we will see how to implement a PIR Motion Sensor using Raspberry Pi by learning how to interface a PIR Sensor with Raspberry Pi. In this project, when the PIR Sensor detects any human motion, a buzzer is activated.

11. Buzzer using Raspberry Pi 3 Model B: - The output pin of PIR sensor is connected with the GPIO 23 of Raspberry pi which is used to give input to Raspberry Pi. The GPIO pin 24 which is declared here for output is connected with positive of buzzer, and ground of buzzer is connected with the ground (pin 6) of raspberry pi

4. Methodology

4. Methodology

Automation is the state of the art of modern day's technology. With the application of automation in grain storage system in India, the losses incurred every year can be minimized to a quite low extent. At present grains are stored in sheds which are kept open most of the time for their aeration. Aeration is important for grains as a rise in humidity or temperature in the climate where they are stored can lead to their infestation. However, this system of aeration also causes damage to the grains as they are prone to the attack by rats, birds, insects etc. This paper proposes a model of solar energized automated grain storage system which is equipped with defense mechanism against attack by rodents Grain storage is a very important and tedious task. It requires constant inspection of the climate where they are stored for long period of time. The climate should be dry otherwise infestation can take place in grain. At present most of activities involved in storage and maintenance of grains are done manually. Our country not only faces shortage of storage houses but shortage of labor is also a big problem.

All these factors that leads to huge loss of grains every year. Grains are stored in sheds which are kept open for aeration. This causes exposure of grains to the attack of birds, rats, insects etc. The bags in which grains are packed get damaged by such attacks and hence it results in increase of expenditure and degradation of quality of grains. Sensing of climatic condition at proper stage of grain storage can save the grain from deterioration. Humidity and temperature are the factors which affect the grain. Undesirable combination of humidity, temperature and pests in the environment can lead to potential damage.

Through aeration of grains proper climate inside the storage sheds can be restored. The rate of air flow of 6(m3/hr.)/ton must continuously operate in the storage shed. High–airflow forced aeration can maintain the stored grain in a condition which prevents immediate damage and it normally contributes to much improved storability.

4.1 Automatic temperature controlling Algorithm:

The system detects the temperature and depending on which if the temperature is above or below the threshold value the cooling fans are turned on and bring back the warehouse temperature as needed. Following set of algorithms used in order to maintain the temperature within the warehouse.

```
if(temperature > 26)
{
        set GPIO "pin-number" high;
}
        else
        {
                set GPIO "pin-number" low;
        }
```

Fig no :- 4.1.1 Temperature value evaluation

```
if( humidity  >30)
{
        set GPIO "pin-number" high;
}
        else
        {
                set GPIO "pin-number" low;
        }
```

Fig no :- 4.1.2 Humidity value evaluation

The system included with the temperature and humidity graph with the help of graph user can easily interact with the data, which provides administrator hazel free experience by elimination of long analysis.

4.2 Image detection Method:

The system will collect the data from temperature and humidity sensor also camera will be placed which will send the captured image to the AWS Rekognition. the Amazon Rekognition provides two API sets. They are Amazon Rekognition Image, for analyzing images, and Amazon Rekognition Video, for analyzing videos. Sensors of different type are used to collect the information of warehouse conditions in information is transmitted through network to the Administrator or devices that initiates corrective action. Some disadvantages in communication must be overcome by advancing the technology to consume less energy and also by making user interface ease to use. Sensor networks are used for monitoring the atmospheric condition and microcontrollers are used to control and automate the farm processes. IO technology can reduce the cost and enhance the productivity. The camera used for object detection is 1.3MP with built-in microphone depending upon the video been captured the video will be divided into frames and then those frames will be labeled and action can be taken either ultrasonic sound can be activated and by this the rodents will move out of the warehouse.

In AWS Rekognition API perform detection and recognition analysis of images and videos to provide insights you can use in your applications. For example, you could use Amazon Rekognition Image to enhance the customer experience for a photo management application. When a customer uploads a photo, your application can use Amazon Rekognition Image to detect real-world objects or faces in the image. After your application stores the information returned from Amazon Rekognition Image, the user could then query their photo collection for photos with a specific object or face. The AWS Rekognition will then return a JSON file which will be taken as an input for analysis and based on which r rectification can be performed and hence the analysis can be done and necessary action can be taken if necessary.

4.3 Monitoring and Analysis Phase:

The warehouse database also contains the amount of grain stored within the warehouse the type of grain been stored it also contains the quantity of grain that can be added or removed depending on the warehouse current volume that are currently within the warehouse. This will make the task of the warehouse administrator easy and can perform task hazel-free. It is much more interesting to turn the fan on when it reached or surpassed a high temperature threshold, and this sensor records the temperature, altitude and atmospheric pressure of the area around the sensor. This data will be displayed on the Python main terminal window every 10 seconds, per given code settings, allowing you to track the temperature changes over time. en turn it off when the CPU was cooled below a low temperature threshold.

On the flip side, warehouses can also get very cold in the winter. That's where the likes of ceiling fans as a ventilation solution come into play. Hot air rises, so ceiling fans work to push the hot air down to the work floor in the winter, thereby helping the temperature rise. And in the summer, they help with the circulation of air to cool the environment. It's why ceiling fan are among the most simple, and best, solutions for ventilation.

4.4 User Interface:

The user interface for the tourism recommendation system designed is as follows Following is the home page after user logs in.

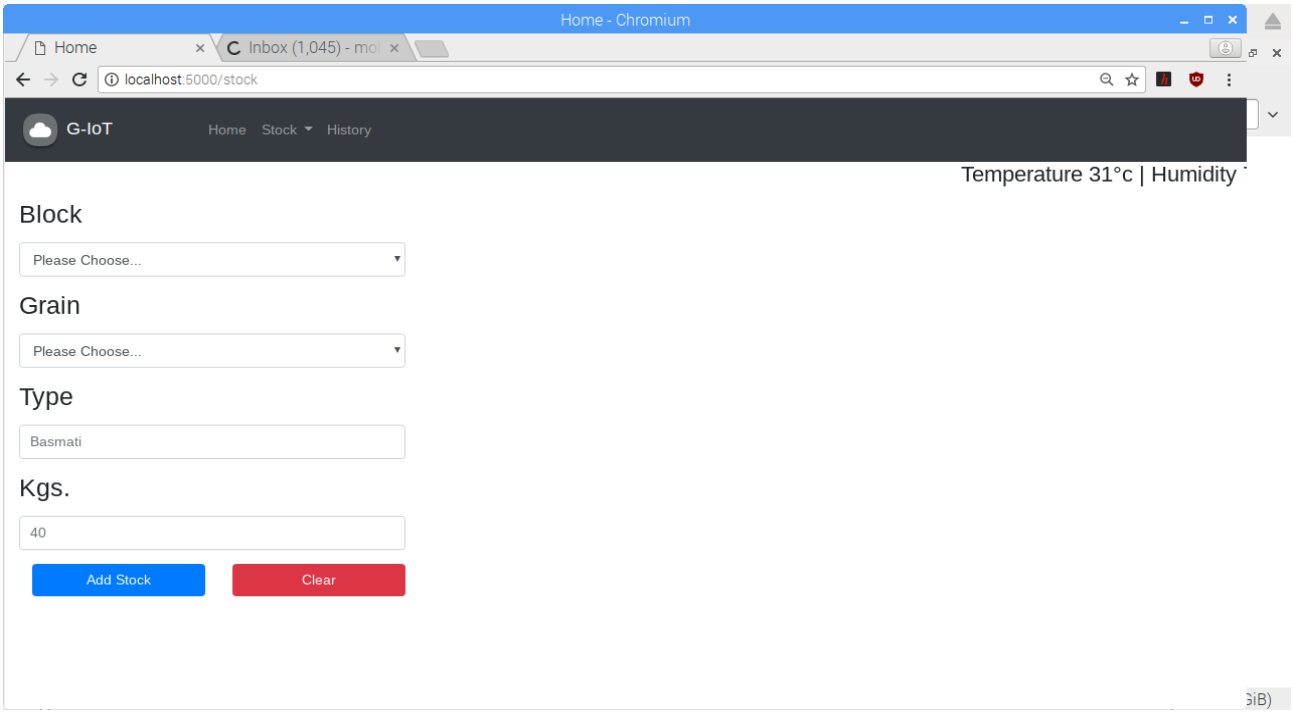

Figure No – 4.4.1 Module to add new goods

Depending on the quality and type of crops been stored in the ware house the admin can maintain a clean table to sort most of the grains stored location, when they have entered the warehouse and been removed can be traced with help of this module.

Following shows the data been plotted recorded from sensors:

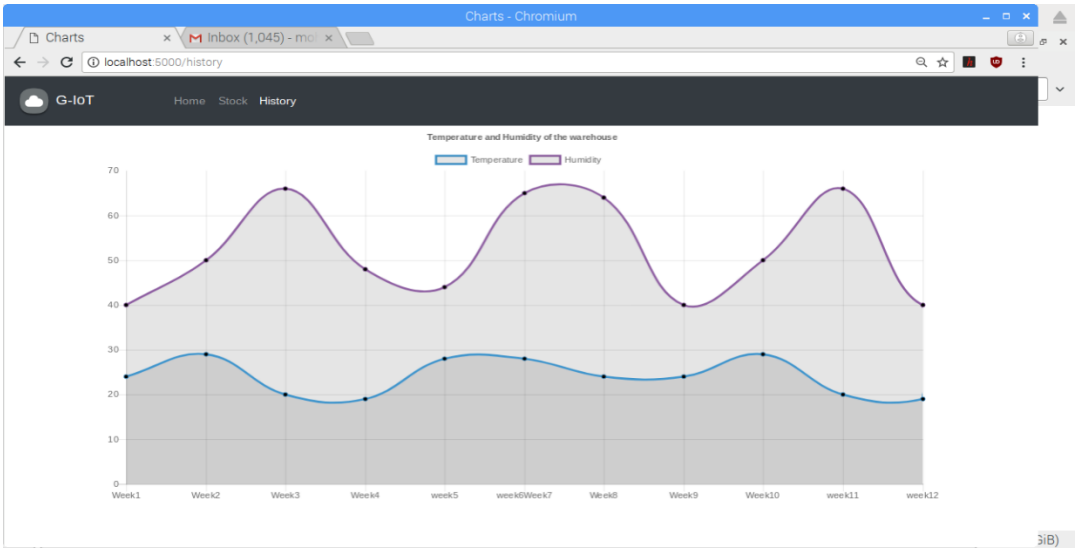

Figure No -4.4.2 Graph plotting from real time Data extracted from sensors

Following shows the data of Stored goods in Database.

Maintenance of data is also taken into practice as the data which is added and is to be deleted when grains are removed out of the warehouse it needs to be updated in database when the stock is added in the warehouse the administrator can update in the database and when the product is sold it can be deleted from the database but when a particular quantity is deleted it will be maintained in a excel sheet which can be later used for verification. The excel sheet will contain the following labels within excel sheet: “Id”, Block”, ”Added-Time”, ”Grain”, ”Type”, ”Weight”, ”Deleted”, ”Time”.

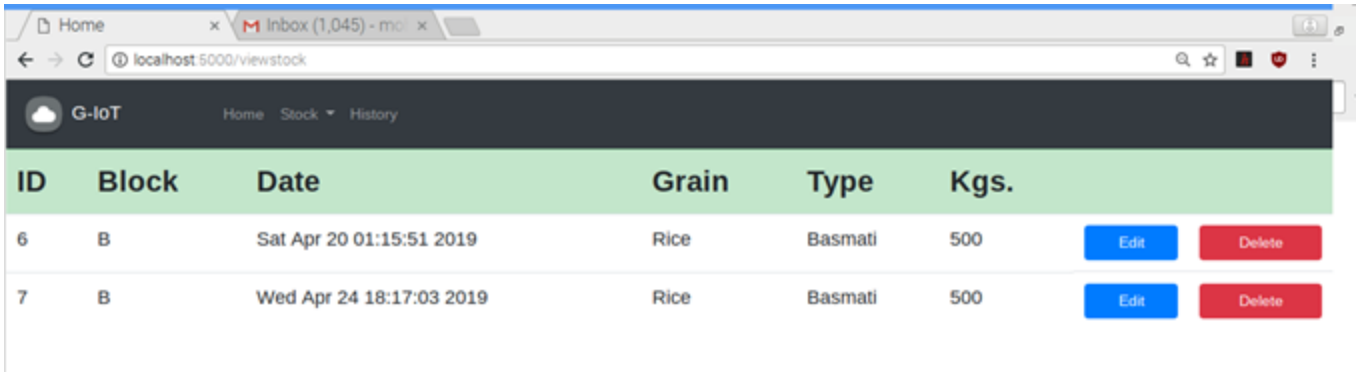

Figure No -4.4.3 Stored Goods module.

5. Designing

5. Designing

5.1 Activity Diagram

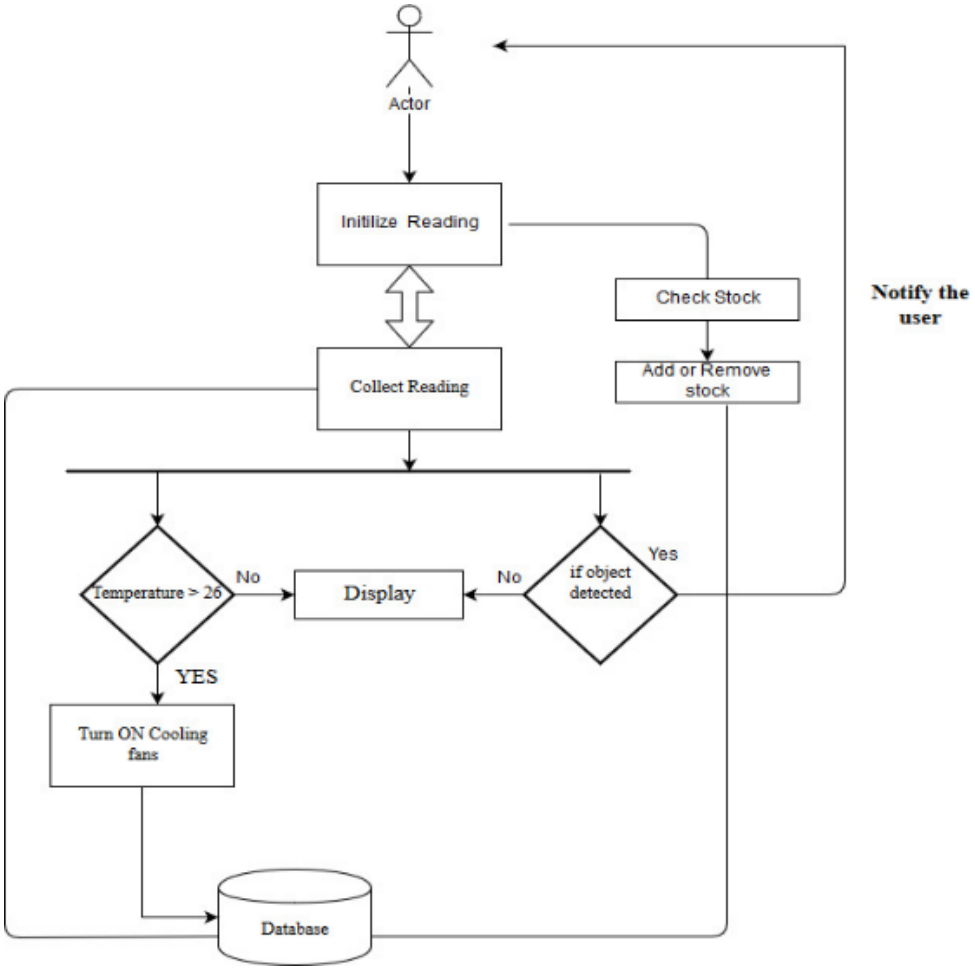

Figure No -5.1.1 Activity diagram for Grain warehouse monitoring system.

5.2 Data Flow Diagram

Figure No -5.2.1 DFD level-0 for Grain warehouse monitoring system.

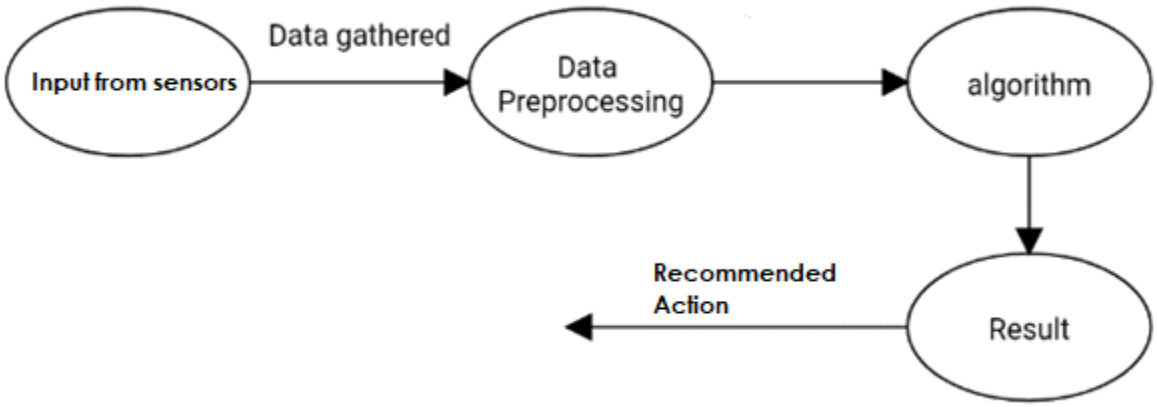

Figure No -5.2.2 DFD level-0 for Grain warehouse monitoring system.

5.3 System flowchart

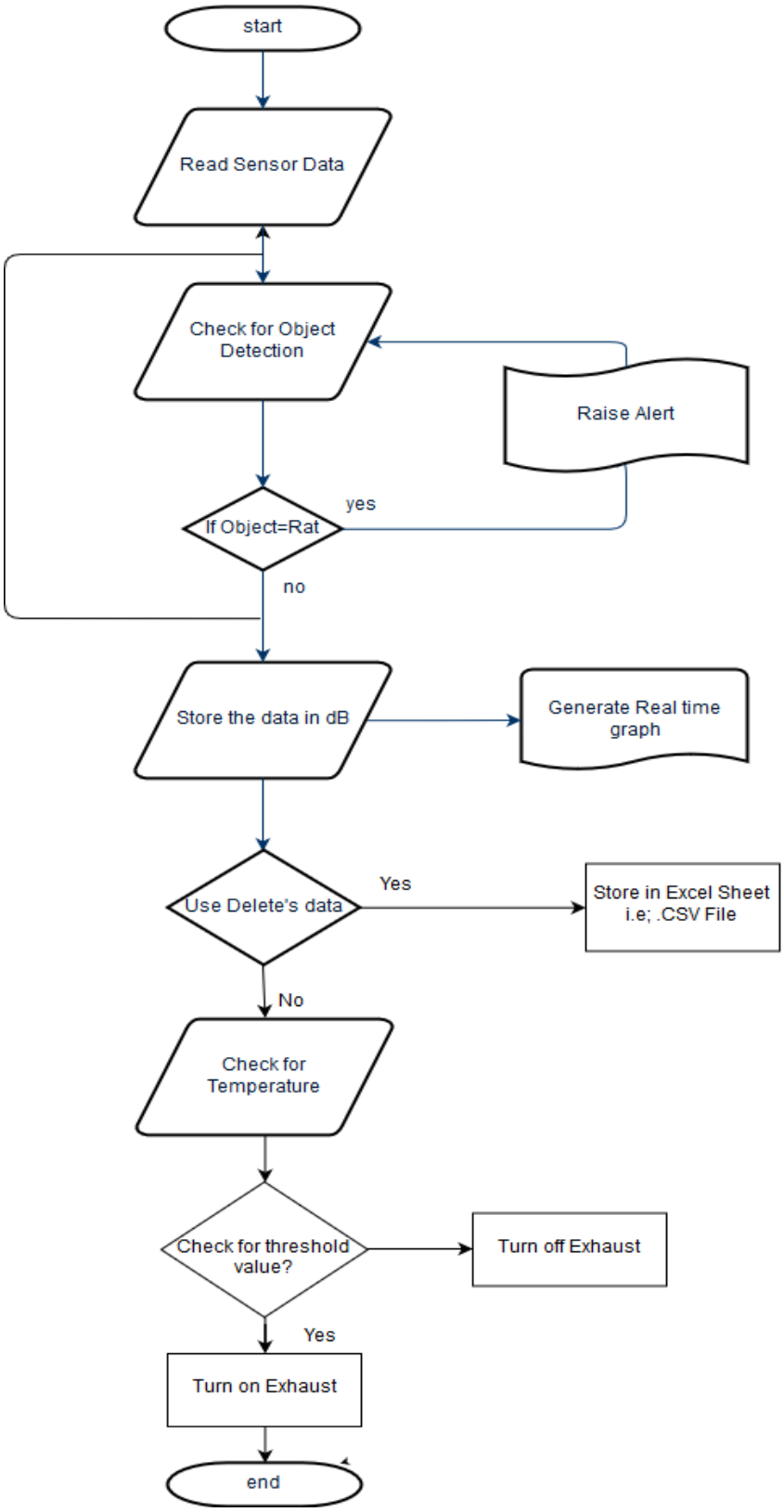

Figure No -5.3.1 System flowchart for Grain warehouse monitoring system.

5.4 Sequence Diagram

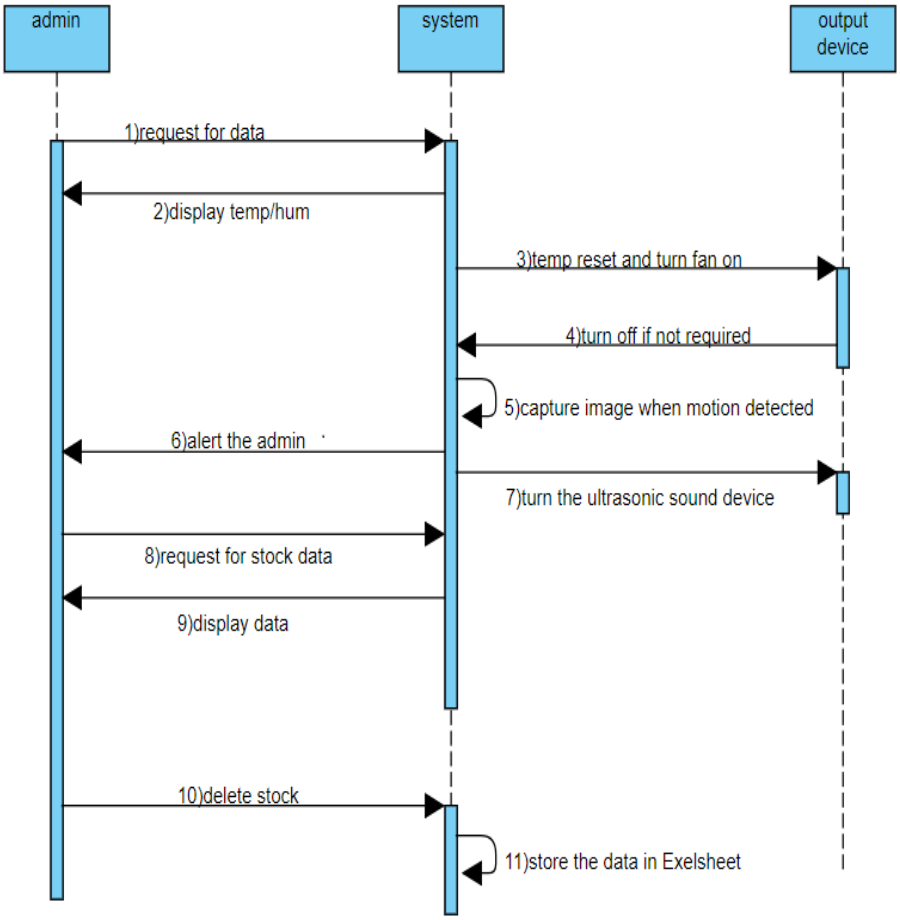

Figure No -5.4.1 Sequence diagram for Grain warehouse monitoring system.

6. Results and Applications

6. Results and Applications

6.1 Results

Air temperature monitoring systems and devices should be installed in all temperature-controlled rooms, cold rooms, freezer rooms, refrigerators and freezers used to store Time- and temperature-sensitive pharmaceutical products. Electronic sensors should be accurate to ± 0.5°C or better4. Sensors should be located in areas where the greatest variability in temperature is expected to occur within the qualified storage volume and they should be positioned so as to be minimally affected by transient events such as door opening. Humidity monitoring systems and devices should be used in temperature-controlled rooms that are used to store Time- and temperature-sensitive pharmaceutical products that require a humidity-controlled environment.

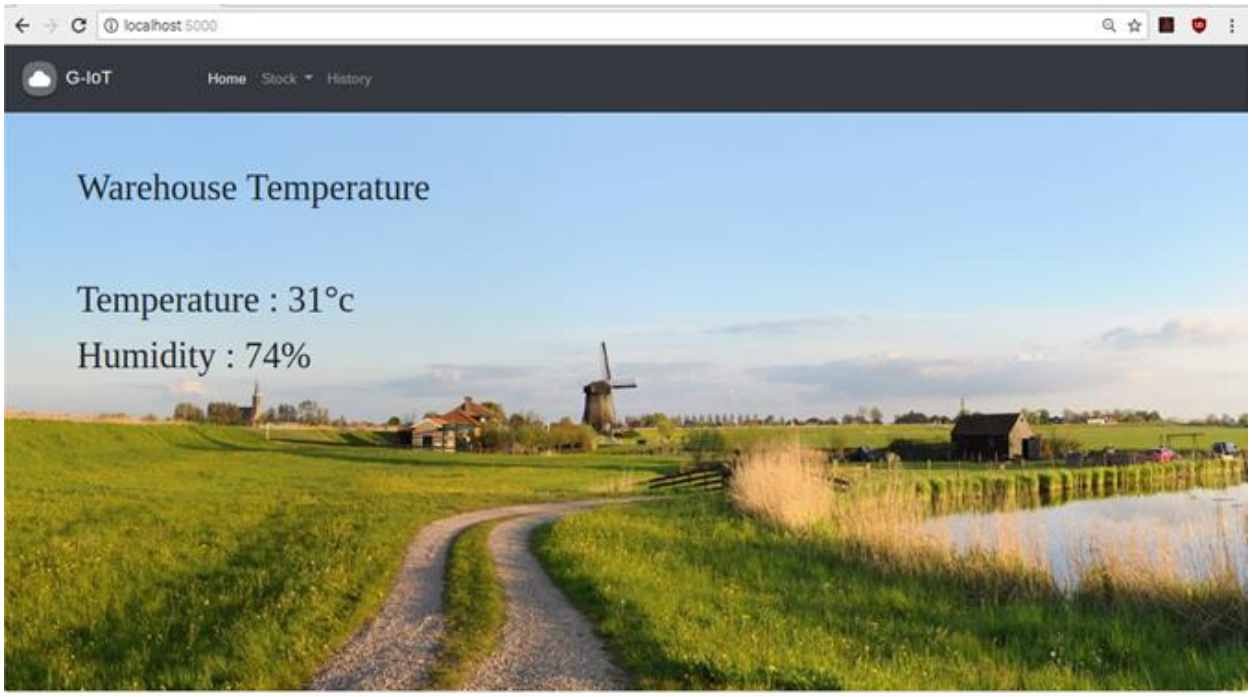

Figure No -6.1.1 Output of web crawler

Monitoring sensors should be accurate to ± 5% RH and located to monitor worst-case humidity levels within the qualified storage volume and they should be positioned so as to be minimally affected by transient events such as door opening. Temperature, and where necessary, humidity alarm systems should be linked to the monitoring system(s) with high and low alarm set points. There should be a visual alarm and also preferably an audible alarm to key personnel such as administrator.

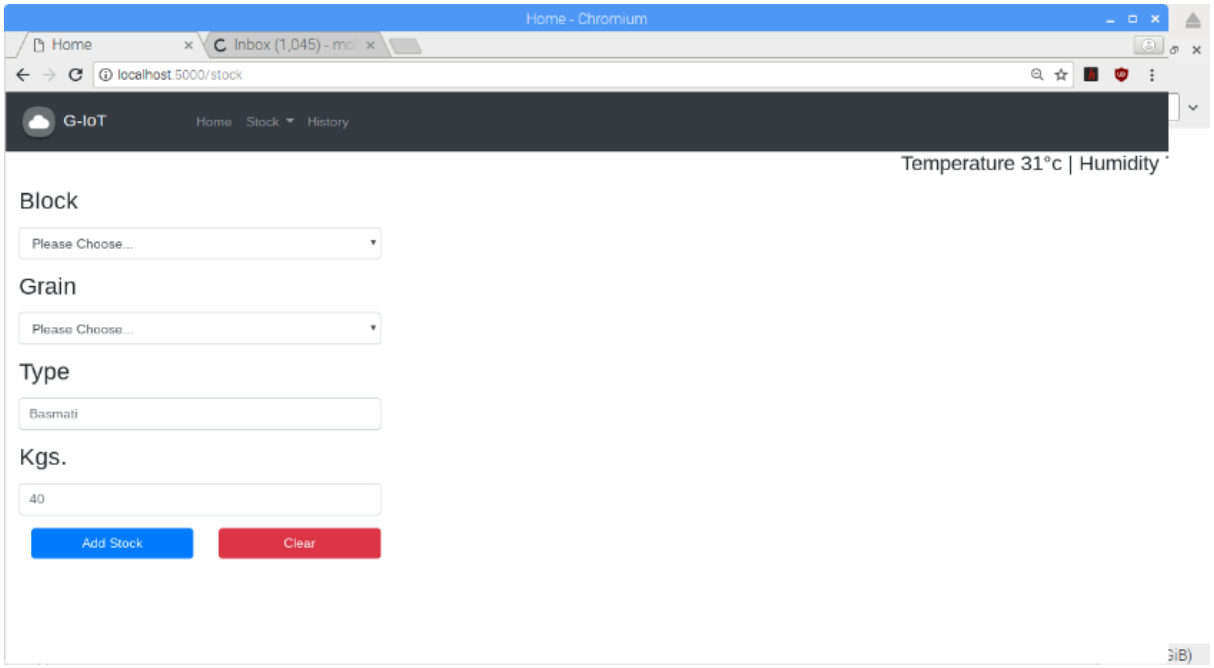

Figure No -6.1.2 Add and view goods

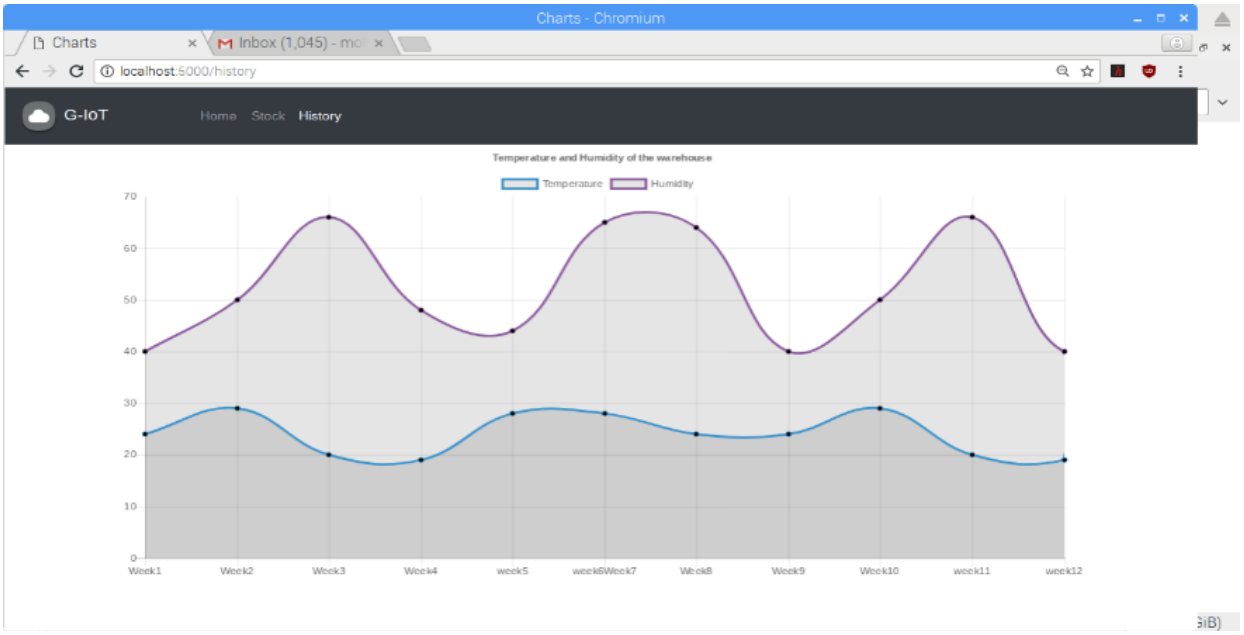

Figure No -6.1.3 Graph

6.2 Applications

- Currently available system provides various Storage facilities which requires huge amount of efforts to maintain.
- The proposed system overcomes the limitations of the current system by providing a automation and more specifically for storage and to provides grain stock management with various sets of crops like Rice, Wheat, Jawar, etc.
- The main objective of the proposed system is to provide complete automation of the Grain Warehouse.

7. Conclusion and Future scope

7. Conclusion and Future scope

7.1 Conclusion

The proposed system provides farmers best Grain storage areas and preserve grains for longer time by usage of the IOT. In warehouse during certain condition the temperature might go above the threshold level during that duration the fan will be switched on which will be placed within the warehouse which will reduce the temperature and henceforth will maintain the warehouse condition. This will give the farmers best productivity and provide grain long lasting storage. Thus, will give the farmers best productivity and provide grain long lasting storing time.

7.2 Future scope

The proposed system can include the infrared camera for better detections of rodents during low light condition. The security can be improved by using motion detection sensors such as passive infrared sensor. The future scope should include Warehouse Management Systems Provide an Organizational Framework such as warehouse that lacks an adequate labeling and management system becomes a maze for workers who waste precious time trying to locate the proper area of the facility to stock grains. Messaging system should be included if there is a sudden change in temperature the administrator should get the current condition message automatically. Wireless connectivity can be included to make the system more reliable and cost efficient.

8. Appendix

8. Appendix

	Activity	JUNE 2019 To JULY 2019	JULY 2019 TO AUG 2019	AUG 2019 TO SEP 2019	SEP 2019 TO OCT 2020	NOV 2019 TO FEB 2020	FEB 2019 TO MAR 2020
SR NO.	Dates	02-jun-2019 TO 02-july-2019	03-july-2019 To 15-aug-2019	16-aug-2019 To 15-sep-2019	16-sep-2019 To 31-oct-2019	01-nov-2019 To 07-feb-2019	08-feb-2019 To 02-mar-2020
1.	**Preliminary investigation**						
2.	**System Analysis**						
3.	**System Design**						
4.	**System Coding**						
5.	**Testing**						

9. References & Bibliography

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9.1 References

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2) 2014 International Conference on Innovations in Engineering and Technology (ICIET'14) On 21st & 22nd March Organized by K.L.N. College of Engineering and Technology, Madurai, Tamil Nadu, India

3) B.E. Students, 5Associate Professor Computer Science Department, NIE Institute of Engineering, koorgalli, Mysuru , Karnataka , India. Vishweshvara Technological University

4) "The Internet of Things" by Samuel Greengard

5) "The Fourth Industrial Revolution" by Klaus Schwab

6) "Getting started with Internet of Things" by Cuno Pfister