AUTOMATED GRAIN REPOSITORY USING IOT

P. Ramchandar Rao¹, V. Ravi², S. Sanjay Kumar³, Ch. Rajendra Prasad⁴, Shyamsunder Merugu⁵

¹Member, Center for Embedded & IoT, Assistant Professor, Department of ECE, S R Engineering College, Warangal, India.
²,³,⁴Assistant Professor, Department of ECE, S R Engineering College, Warangal, India
⁵Assistant Professor, Department of ECE, Sumathi Reddy Institute of Technology for Women, Warangal, India

¹ramchandar_rao_p@srecwarangal.ac.in, ²ravi_v@srecwarangal.ac.in, ³sanjay.shanigarapu202@gmail.com,
⁴rajendra_prasad_ch@srecwarangal.ac.in, ⁵shyamala.merugu99@gmail.com

Corresponding Author: P. Ramchandar Rao

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Abstract

The objective of this paper is to monitor and control the environmental conditions for proper food grain repository. We have implemented a monitoring and controlling system that monitors and controls the weather parameters like Temperature, Humidity, Gas and Light intensity. The users can control and monitor the above said parameters of the repository using IOT. These sensor values are sent to the cloud. When these values get exceeded by the threshold values then the user can take an action against the conditions. By using of Thingspeak to retrieve the cloud sensor data is monitored and controlled.

Keywords: ESP32, Temperature and Humidity Sensor (DHT11), Gas Sensor, Buzzer, Light Dependent Resistor (LDR), Thing Speak.

I. Introduction

Internet has a great impact on the human life since past decades. The Internet of Things (IOT) has been seen as a sign of major developments to be realized throughout the internet portfolio managements. The IOT is considered as the interconnection of objects which can collect and exchange information through network without the human intervention. Each and every object is given a unique ID, which is used in monitoring and controlling several streams like household applications, productions, industrial, transportation, education, governance, mining, etc. Internet of things is a kind of network technology where unique ID’s are given for the sensors to collect and exchange the information. The cloud receives the
information of sensors through internet. To control and monitor the proposed system we used the cloud computing technology. Cloud computing provides the access of applications as utilities, over the internet.

In [XIII] article, the author represented the real time monitoring of grain storage by using ARM 7 and GPRS/GPS technique to reduce the grain loss and man power in grain repositories. In [II] article, the author represented Zigbee network, the wireless sensor technology to monitor and control the environmental conditions using microcontroller and CC213 module. In [IX] article, the author explained how to configure the authentication keys and passwords of Blynk application to monitor and control for the given specific source application. In [X] article, the author designed real time monitoring and controlling system for grain storage to control humidity and temperature using sensors and wireless devices. In [XI] article, the author discussed about remote sensing technology called Graintac which monitors the damage of grains in the godown using partial least square and Takagi surgeon models. These models also used to track the quality and sustainability of the food grains. In [I] Cloud computing is a technology which stores and runs the information on internet in spite from computer hard drive. Cloud computing services like information storage, database, software, networking, servers, analysis are rendered through cloud computing. In [XII] article, the author discussed the quality of the food grains by using the parameters like gas, temperature and moisture sensors values are sent via wireless sensor networks and if the sensed values are above the specified level then user get the information through message or buzzer, so that the user can thus take the preventive actions. In article [V], the author said that Arduino and web server is used to monitor and alert the user through messages. In article [VI], the author implemented a home monitoring system by using ESP32 module, which can control the environmental conditions like room temperature, gas leakage, water levels in the tank, human detection and control several things like light, fan, motor, gas knob and take decision based on the requirement and controls remotely. In article [III], the authors design system for hotels to test the quality of food and food order using Bluetooth technology. In [VII] authors states that although IoT has abundant benefits, there are some flaws in the IoT similar to insecure web interface, insufficient authentication/authorization, leads to security issues in network services, lack of transport encryption and privacy concerns. In [IV] article the author explains the healthcare applications like patient health condition, symptoms by using wireless body bio sensors are networked together and sends this information to doctors via internet or cloud. In [VIII] article, the author addressed the pollution issue in industry and discussed how it affects air, water, soil. Here the pollution level tracking using IoT and Turbidity sensor is also addressed.

Food grain repositories are used to store the food grains by the farmers after yielding the crop, as they do not have the facility to retain the farm products with themselves until they get their favourable prices. It is essential to provide some techniques to store the farm products scientifically, so that the food grains may not be spoiled. These techniques may require some parameters like Humidity, Temperature, and Ventilation etc. to retain the food grains. Parameters may vary for different food grains.
Food grain repositories construction and storage space we must check the room temperature i.e., 27°C, paddy moisture level must be 15%, rice moisture level 13%, Cowpeas/Beans rice moisture level 15%, wheat, maize rice moisture level 13.5%, ground nut rice moisture level 7%, mustard seed rice moisture level 5 to 6%, for cold storages to store fruits and vegetables they maintain a room temperature is ± 1°C, humidity 65 to 98% depending on the freshness of fruits or vegetables, due to storage some harmful gases are released, sometimes any short circuit or due to dust some smoke released in the rooms, to monitor all the conditions depending on the requirement to control the devices.

II. Proposed System

The proposed model consist of hardware, Software, and web application peripheral interfaces protocols, which collectively create a flawless atmosphere which allow smart embedded product to be connected to internet such that sensor data can be monitored and control system can be triggered through internet.

Also, devices could be connected to internet in various ways such as Ethernet, WiFi, and so on. Furthermore, devices may not need to be connected to internet autonomously, moderately a collection of devices are created (for example a sensor network) and the cluster head could be connected to internet. This leads to more conceptual structural design for communication protocols which ranges from low level to high levels.

Thing Speak is a firmware for IoT analytics platform service that allows you to cumulative, visualize, and analyse exist in formation flow in the cloud. User can send information to Thingspeak from devices, build on the spot visualization of exist data, and send alerts. Thingspeak API to store and retrieve data from things using the HTTP and MQTT protocol under the internet or LAN. Thing Speak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates.

All the sensor devices are designed and connected according with the requirement and then every single sensor verified with the source code. The source code simulated results transfers the data to the cloud network Here it is Thing speak. Cloud network is a type of structure all the network capability and resources are available on demand through a third-party service provider that hosts them on a cloud platform. Industries can use cloud networking resources to manage an in-house network or use the resources completely in the cloud.

In present scenario people are storing all the food grains in the repository, they unknowing of the conditions of the products in the grain storages. Long-time storage of grains lead to the spoil of the food grains, dissipate of its production cost and storage time. The climatic conditions of the repository should be comfortable and as their storage would not damage, always one person observing the grains. So, in order to keep away from this problem we are connecting some sensors to monitor and some devices to control the environment in the grain repository.

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III. Hardware Description

ESP32

It is VLSI based microcontroller chip incorporated Wi-Fi and dual mode Bluetooth. The ESP32 is heart of the product. All the sensors and actuators are connected to the ESP32 board. The ESP32 board is programmed with the source code in order to execute the operation of the product. The program is stored in the on-chip memory that is inbuilt on the board. The operating voltage range is 2.2 to 3.6V, under normal operation the ESP32 thing will power the chip at 3.3V.

DHT11

The DHT11 Humidity and Temperature Sensor contains of three components. These are very cheap and accurate. A resistive type humidity sensor, an NTC (negative temperature coefficient) thermistor (to measure the temperature) and an 8-bit microcontroller, which converts the analog signals from both the sensors and

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sends out single digital signal. DHT11 Sensor having of four pins, they are Vcc, Data Out, Not Connected (NC) and Ground (Gnd). The operating voltage limits are for Vcc pin is 3.5V to 5.5V. A 5V supply would do fine. The serial digital data is available from the data output pin. DHT11 measure the humidity range from 20-90% of Relative Humidity (RH) and temperature range of 0 to 50°C.

![Fig.3: DHT11 Sensor](image)

Gas Sensor

The MQ-4 Natural gas Sensor methane, CO2 sensor identifies CO2 levels, MQ-2 gas leakage in storage places. The MQ-2,4 arrangement of gas sensors utilizes a little radiator inside with an electrochemical sensor. These are utilized in gas spillage uncovering of LPG, propane, methane, i-butane, alcohol, Hydrogen, and smoke. MQ-2 is a low cost sensor which can detect the presence of gases at concentrations range from 0.05 mg/L to 10 mg/L.

![Fig. 4: Gas sensor](image)

Relay Module

Relay is a very important actuation system in control applications. It is used control the high power appliances through low power input. The ESP32 gives the output voltage of 5V, this is applied to relay to control appliances. In this project we are using 4 channel relay to control the high power appliances Fan. Light, alarm to turn ON or OFF.

![Fig.5: 4-Channel Relay module](image)
The proposed model is evaluated step by step as shown in Fig. 6, and is as follows:

Step1: Design a system and write code in the software using python or Arduino program and program the code into hardware ESP32 then click run.

Algorithm of the Proposed Model

The proposed model is evaluated step by step as shown in Fig. 6, and is as follows:

Step1: Design a system and write code in the software using python or Arduino program and program the code into hardware ESP32 then click run.
Step 2: The process of the system firstly, DHT11 and LDR detects the Temperature Humidity and light intensity in the food grain repository.

Step 3: Then the Gas Sensor and smoke sensor are connected to detect the Gas and smoke in the area of storage.

Step 4: Every 20 seconds the entire sensor values are uploaded to the cloud storage Thingspeak.

Step 5: From the Thingspeak cloud storage access point to monitor the food grain repository condition, if any alerts are occurred the device control itself or by using this Thingspeak application we control the devices to turn ON or OFF depending on the situation.

IV. Results and Discussion

To ON the ESP32 board by using USB charger or adopter. All the sensors DHT11, MQ2/4, Light Dependent Resistor, smoke detectors are connected to the input pins of ESP32, the output pins are connected to the fan, light and buzzer for controlling through relay board. After ESP32 turns ON it detects the surrounding temperature, humidity, light intensity, smoke and gas flames. These values are sent to cloud by using thingspeak. In the controller source code the user gives the threshold values of each and every sensor. If the value gets exceed the threshold level it controls repository using Fan, light and alarm.

![Fig.7: Schematic diagram of Food grain repository system](image)

The grains get spoil depending on the temperature conditions, so it is mandatory to monitor and control the temperature. If the threshold value of temperature for food grains is room temperature 27°C, and maintain proper humidity in air. By using DHT11 to detect the temperature and humidity with the help of ESP32 and sent the detected values to cloud through thinkspeak, in thinkspeak we monitor and control the appliances. In the room light intensity, flame, smoke or dust occurs the LDR, smoke sensor, flame sensor detects and sends the values to cloud and give the alerts to the user.

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V. Conclusions

Automation in food grain repositories can reduce manpower, increases the production price. Farmers are decrease the risk of food grain wastage risk and increase quality of food grains. Incorporate of sensors, mobile connectivity and assessment tools for inexpensive monitoring and controlling. In order to provide good quality food grains parameters should be monitored and should control frequently. In this paper we conclude to reduce the wastage risk of food grains and increase their productivity, quality of food grains.

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