VISVESVARAYA TECHNOLOGICAL UNIVERSITY

JnanaSangama, Belagavi – 590018

Project Report on

"STOCKPILE TRACK OFF APPROACH"

Submitted in partial fulfilment of the requirement for the award of degree of

BACHELOR OF ENGINEERING
IN
ELECTRONICS AND COMMUNICATION ENGINEERING

Submitted by

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DEPT. ELECTRONICS & COMMUNICATION ENGINEERING

RAJARAJESWARI COLLEGE OF ENGINEERING

[Accredited by NBA & NAAC, Affiliated to VTU, Belagvi, Approvedby AICTE, New Delhi]

#14, Ramohalli Cross, Mysore Road, Kumbalagodu, Bengaluru-74

2022-2023

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ELECTRONICS & COMMUNICATION ENGINEERING

CERTIFICATE

This is to certified that the project work entitled "STOCKPILE TRACK OFF APPROACH" is a bonafied work carried out by RITHIN D (1RR19EC064), SADHANA R (1RR19EC066), SURIYAPRABHA S (1RR19EC084), SHWETHA (1RR19EC076) in partial fulfilment for the award of Bachelor of Engineering in Electronics and Communication Engineering of the VISVESVARAYA TECHNOLOGICAL UNIVERSITY, Belagavi during the year 2022- 2023. It is certified that all corrections & suggestions indicated for internal assessment have been incorporated in the report & deposited in the departmental library. The project report has been approved as it satisfies the academic requirements.

Signature of the Guide	Signature of the HOD	Signature of the Principal
Mr. V Sreepathi	Dr. L. Rangaiah	Dr. Balakrishna R

Name of the Examiners: Signature with date:

1.

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DECLARATION

We, RITHIN D (1RR19EC064), SADHANA R (1RR19EC066), SHWETHA (1RR19EC076), SURIYAPRABHA S (1RR19EC084) students of 8th semester BE in Electronics and Communication Engineering, RAJARAJESWARI COLLEGE OF ENGINEERING, Bengaluru hereby declare that the project work entitled "STOCKPILE TRACK OFF APPROACH" submitted to the VISVESVARAYA TECHNOLOGICAL UNIVERSITY during the academic year 2022-23, is a record of an original work done by us, under the guidance of V Sreepathi, Assistant Professor, Electronics & Communication Engineering, RajaRajeswari College of Engineering, Bengaluru. This project work is submitted in partial fulfillment of the requirements for the award of the degree of Bachelor of Engineering in Electronics & Communication Engineering. The results embodied in this have not been submitted to any other University or Institute for the award of any degree.

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ABSTRACT

Dietary is essential for all living things, and we depend on agribusiness to give our major food prerequisites. India is a country that is wealthy in agrarian assets. India creates a sizable amount of food to meet its current and future food requests. In any case, there are issues like yearning, helpless food quality, and food value expansion attributable to deficiencies. We squander over 20% of the food we produce as a nation inferable from wasteful grain stockpiling in stockrooms. Food squander happens at each level of the food inventory network, including creation, reaping, handling, transportation, retailing, and utilization. To diminish how much food is lost, legitimate capacity arrangements are crucial for shielding food items assembled and guaranteeing that they arrive at customers on schedule. There is a necessity for compelling observing. Capacity stockrooms are utilized by makers, merchants, purchasers, customers, and so forth consistently, ranchers face a tremendous misfortune because of the issue of capacity necessities in stockrooms. This is because of ill-advised observing of the food put away and the failure to give appropriate refrigeration frameworks. Different conventional stockpiling techniques were started which constrained an enormous manual methodology that is tedious and wasteful. This undertaken project presents a smart IOT based food observing framework in stockrooms utilizing ESP32 and different sensors that ceaselessly screen the different variables which might influence the food quality. This proposed structure aims to screen distribution center boundaries like temperature, dampness, CO, movement, and smoke which are exceptionally impacted to grains. The ESP32 Wi-Fi module gathers the information from the sensors and this module sends information to the Node-red dashboard through the MQTT agent. Numerous IoT hubs are to be introduced at alternate areas inside the distribution center which will give data about the stockroom climate to the ranchers through Mobile SMS and E-mail notice.

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CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

India is a nation where the agrarian sections have a significant influence on the economy. Consistently ranchers deal with various issues because of the capacity prerequisites, the absence of legitimate checking of the food put away. Stockrooms are utilized for capacity purposes. Just a little piece of the food grains is put away in the state-run distribution centers. An enormous piece of the harvests is left without suitable storage spaces. The worldwide creation of India incorporates maize, wheat, and rice.

However, because of the variances in the market, the misfortunes that the nation faces consistently because of inappropriate stockpiling is about Rs.50,000 Crores in financial terms. A food warehouse is a place used by food establishments or individuals to store and distribute food for wholesale. In a traditional food warehouse, a lot of food is wasted because there is no data about the parameters that affect the food and no efficient system to monitor the food stored in the warehouse also the system is labor-intensive as it requires people to monitor the warehouse at all times.

There are different natural components that sway the normal contamination of food grains, for instance, kind of limit structure, clamminess, temperature, CO2, moisture, and so on as the piling up time builds, the food will lose its worth. Different customary stockpiling strategies were started which constrained a tremendous manual methodology that requires additional time and is likewise less productive. Another burden was the deficiency of a multi-limit really taking a look at the structure.

India needs to properly assess and address the problem of food loss in transit. An efficient food warehouse monitoring system can help to reduce food waste, keep agricultural produce and grains less volatile to market variations, and help to increase food grains exports and overcome food shortages. This attempted project presents a smart IOT based food noticing structure in stockrooms using ESP32 and various sensors that constantly screen the various factors which may impact the food quality.

This proposed structure intends to screen appropriation focal constraints, for example, temperature, humidity, CO, development, and smoke, all of which have a significant impact on grains. The ESP32 Wi-Fi module collects data from the sensors and transfers it to the Node-red dashboard over the MQTT specialist. Various IoT hubs will be placed at

various locations across the appropriation area to provide information about the back room environment to authorized individuals by mobile SMS and e-mail announcement.

1.1 OBJECTIVE OF THE PROJECTS

The United Nations Food and Agriculture Organization (FAO) appraises that in excess of 40% of food created is squandered in India, and its expenses could be pretty much as high as US$14 billion (12.42 billion euro) consistently. India develops more food, squanders more, while more go hungry. There is a requirement for better food frameworks that will follow the food being put away in stockrooms and its conditions and report it to the power.

- To detect the temperature, humidity, methane level, CO level, and food grain levels in the warehouse and predict the degradation time and dispatch time of food grains so that there is no food grain wastage.
- To monitor multiple warehouses and alert the authority if there is the possibility of food wastage because of storage conditions or long period accumulation.
- To predict decay time for multiple types of crops like rice, ragi, etc.
- Display data of multiple warehouses on multiple devices. The Node-RED dashboard needs to show the temperature, humidity, levels, dispatch, and decay time of various kinds of crops.

1.2 MOTIVATION

The motivation for doing this project is to solve the problem of food waste in India due to mismanagement. Despite India's status as an independent food-producing country favored with jobs and riches, a shocking number of people are directly or indirectly affected by food scarcity. For a long time, this has been a neglected topic. As the global population grows and resources become scarcer, there is a need to better manage the food produced so that fewer people go hungry. A better food monitoring system will help us cut down our cost of food and resource wastage and help in the efficient utilization of resources.

1.3 SCOPE OF THE PROJECT

This project will be helpful in tracking the environmental parameters of the warehouse-like temperature. Humidity, presence of gases like CO, methane, Sulphur, and benzene. This will help us better monitor the warehouse and efficiently store the food products.

- This project will help in reducing the losses that occur due to storage mismanagement.
- This when implemented on a large scale will help monitor different warehouses at different locations. It will check artificial scarcities caused because of stock holding by certain warehouse managements
- It can be used in different products storage as well
- It will keep the food quality in check
- Agriculture consumes land, water, and labor intensively managing the food produced in a better way will help us in better managing these resources.
- Further control components can be integrated into the system to control the environment
- New age tools like AI, ML, and DL can be used to train the system to monitor different parameters and take actions accordingly
- The data can be stored in databases and can be accessed during food quality inspections

CHAPTER 2

LITERATURE SURVEY

2.1 INTRODUCTION

Literature survey is very important to get a knowledge on desired topic. By using the information provided in the several literatures give credit to other researchers to prevent duplication. By surveying the several literatures, we can identify inconstancies like gaps in research, conflicts in previous studies, open question left from other research. We referred some of the scholars to know some of the information about the project. The scholars which we have referred is listed below.

2.2 BASE PAPERS

1. **Optimized Sensor-Based Smart System for Efficient Monitoring of Grain Storage**
   The aim of the paper by Sazia Parvin, Amjad Gawanmeh, Sitalakshmi Venkatraman is to address the problem of food waste that occurs during the storage of grains by monitoring environmental factors. The authors in this work have stationed a matrix of sensors in the storage containers of the warehouse the data from these sensors has been sent to the central processing node. This paper gives a method that can be used to determine the number of sensor matrixes that need to be deployed and also determine cluster heads. The paper also aims at boosting the system by improving power utilization, field coverage, etc. The study offers a network design in which nodes broadcast sensed data to cluster head nodes through a link. The research team suggested a technique that may be used to choose cluster heads in a network. The authors' technique used a three- stage process to determine the maximum- min hop counts at each sensor. During the initialization process, the root node must be conFigureured with default values. The authors calculated the number of hops in the second step. The maximum expense at the end of the process has been calculated by the authors. The authors repeated this procedure for all of the network's nodes, and once they had completed inspecting all of the nodes, they choose the node with the lowest i. The authors consider this node to be the cluster head in their study. Overall, this work introduces a method for using continuous data monitoring in storage silos to check food at regular intervals and assist minimize waste.

2. **IoT Instrumented Food and Grain Warehouse Traceability System for Farmers.** The authors Susmita Banerjee, Anil Kumar Saini, Himanshu Nigam, Vijay have designed an Internet-empowered monitoring system for distribution in isolated areas where approachability for countrymen with good storage facilities is very minimal to turn down food squandering and increase food safety. The proposed system has used a temperature sensor that will sense if the temperature rises in the storage. The package incorporates a humidity sensor, which will aid in determining the percentage of humidity in the warehouse. When a detrimental gas is detected, the gas sensor aids in the identification of CO within the warehouse. The shock sensor is utilized to provide alerts about tilt and movement if the sensor senses a tilt or any lateral movement of the rack that will physically damage the grains, leading to greater decay. The system can also identify the presence of a fire flame, preserving the grains stored in the warehouse from fire. A fire sensor was utilised, and a fire notification was conveyed using SMS and email. The system will automatically update the dashboard parameters with the most recent sensor data collected at various warehouse nodes. The writers' system will also send an e-mail to the user at the same time. This proposed method can be used to control food kept in a warehouse.

3. **Nano Warehouse: A New Concept for Grain Storage in India.** This paper by Dhananjay Kumar Singh, Rahul Desai, Nilima Walde, P.B. Karandikar proposes a suggestion of a nano distribution center that can cure worldwide areas' grain stockpiling inconvenience. To accomplish this goal the fundamental is that it should be appropriately planned and kept up with distribution center without a doubt Protected that must be finished effective as feasible and incorporate the variables like site In this paper, the principle perception is the real intention that should be Examined before the decision of the stockroom. The nano stockroom might be made without Worrying with regards to soil bearing capacity, geology, direction, and locale anyplace in a tremendous reach and even at a ton lesser cost. GIS Geographical Information framework will screen the environmental factors change like temperature, dampness in nano Warehouse. The detected realities are assembled with the guide of WSN and assessed with the guide of GIS. The processor module controls the Operation of sensor hubs stores and strategies the insights which become amassed through sensors. Since each nano stockroom is having a data set and individuals' information base will contain the measurements Approximately area individuals like their families realities. Thumb and keep the trial of each own family givers Can be accessible in this

information base so any person of the relative can move and gain the grain. Accordingly, this idea of nano stockroom can aid appropriation gadget of grains and lessen the Mismatch among U.S.'s suppers grain stockpiling limit and developing assembling.

4. **Trustworthy, Secure, and Privacy-aware Food Monitoring Enabled by Blockchains and the IoT** The writers Christoph Stach, Clémentine Gritti, Dennis Przytarski, Bernhard Mitschang have discussed food scandals that are occurring in today's globe, such as falsely stated meat or non-compliance for food goods with cleanliness requirements, which have caused significant concern about their food to customers. To solve this, the authors have incorporated the SHEEPDOG architecture in their study, which will enable trustworthy, secure, and privacy-aware food monitoring from production to purchase. The SHEEPDOG architecture proposed by the authors leverages attribute-based credentials to provide trustworthy information gathering. The SHEEPDOG design will provide reliable data capture by calibrated sensors in the initial step of this proposed effort. It is critical for this stage that the sensors validate data before passing it to the SHEEPDOG. The authors create a secure data management system, and they store transferred data using blockchain-based storage. A blockchain-based data storage system, such as the one used in this study, would allow for contaminate-proof and immutable data preservation. The pattern-based access restriction employed in this proposed effort will preserve the privacy of impacted data subjects while ensuring transparent data provision. This paper's planned SHEEPDOG work is a work in progress. That is, while SHEEPDOG has proved the usability and feasibility of individual concepts, in reality, the overall efficiency of SHEEPDOG has yet to be examined as part of future study.

5. **Storage Technology, and control of Aflatoxin in Corn (Zea mays L.) with the Internet of Things (IoT) Application.** The purpose of the report made by the authors M Hadipernata, A Ni’matullah Al-Baarri, M Somantri, E Rahayu, S J Munarso, R Rachmat, Miskiyah, Misgyarta, M Hayuningtyas, and S Pangidoan is to address the problem where because maize becomes a favorable substrate for fungal growth there is difficulty to store maize. The authors' research goal in this paper was to analyze a maize storage system with a low aflatoxin concentration using an IoT system. Both the field observation and desk research done by the authors has been included. Their research demonstrated that when there is an increase in moisture content of corn beyond a certain percentage, the fungus growth gets stimulated. In this suggested work, the authors used sensors to detect and monitor the stored

corn condition. The data from this sensor was then processed by a computer program, and the actuator provided feedback for the system. This system enables human activities like data transmission and processing via the internet, autonomous networks, and virtual networks. The air conditioner, blower, and dehumidifier were all powered by the actuator in this proposed system. The authors' research sought to evaluate the possible use of IoT for controlling corn storage systems. The authors' research should contain a thorough discussion of the options for adopting an integrated system, its mechanism, and the obstacles of controlling the corn storage system. Thus, the authors' study may have the potential to drive additional research into how to overcome the necessity for high flexibility and connectedness of storage systems in order to control and maintain the quality of food goods, primarily maize kernels.

6. **An Intelligent IoT-Based Food Quality Monitoring Approach Using Low-Cost Sensors.** The work by Alexandru Popa, Mihaela Hnatiuc, Mirel Paun, Oana Geman, D. Jude Hemanth, Daniel Dorcea, Le Hoang Son and Simona Ghita discusses the concept of Internet of things (IoT) as a model-based with energy for the declaration of endless articles which, through remote or cabled affiliations and stunning tending to plans, can relate and help different things, making new affiliations and applications featured appearance up at a shared objective. Before long, Figureuring, parties, and correspondence affiliations will be open and passed on. Individuals, sharp things, vehicles, stages will make a commonplace in interconnected assets. IoT is setting a nonexclusive term, and everything is reachable is a functioning part through the Internet affiliation, making a careful climate where the control of the Internet has changed. WSN (Wireless Sensor Networks) and M2M should be perceptible as different events of IoT. In the WSN case, checked-on information from a sensor is shipped off a server, or the data held by the server is passed on off an actuator. The lead of food in vacuum packs is examined utilizing an excellent electronic framework, portrayed all things considered. Power use is major in WSNs. The protected information gives data about the situation with the food, the level of corruption, and the cutoff conditions. The information-getting module joins key and computerized sensors for temperature, wetness, gas fixation, and strain. The arrangement is the technique engaged with procuring the most solid sensor data. Expecting a model transmits somewhere around two of the gases that the sensor can check, the results will be dubious. To deal with this issue, the primary thing to do is to know what substance is assessed or to use a predominant, and all the more exorbitant, sensor. In any case, these sensors are satisfactory for assessing changes in the gathering of explicit gases and to give an important theory of concentration.

7. **An Effective Approach for The Design of Safety Fresh Food Supply Chain Networks with Quality Competition.** The research paper by Hong Li YIN, Young Ming WANG depicts a local area form of a security clean conveyance chain, with charming Reimbursement. The rendition presents yield charge of the way p to procure the quantity of harmed Foods, along these lines deciding the best of the suppers, ensure food handling. In this paper, the more prominent consideration is for every newness and well-being of food, Have a gander at the organization format of security clean dinners conveyance chain with Oligopolistic way. Furthermore Delivered several applied the remarkable time rot method to investigate newness and Protection of food and boundaries utilized as follows. Accept that the feast foundations are seeking non-participation in an Oligopolistic way, the second client can make out suitable newness and Protection, 1/3 the temperature and mugginess state of each shimmering food is given and fixed new meat or fish Quality bad and energy part are 1 through line Another clean food like shimmering finish or vegetables the Power thing is zero using line B. The form peach store network is utilized here this conveyance chain has two Clean food habitats and the focal point of every supper has fabricating regions and in that best one useful Method and two dissemination communities.

8. **IoT Based Smart Food Monitoring System.** The paper by Professor Rajesh Kumar Kaushal, Harini. T, Pavithra Lency.D, Sandhya.T, Soniya. P. proposes a van IoT system for working with a feast following for the security of the Food so that it'd never again get tainted because of the encompassing circumstance all through capacity and Transportation. The proposed arrangement dissects temperature, dampness, gentle as those Parameters influence dietary upsides of food things which incorporate finish and greens, and make the Analysis impacts helpful to the purchaser through a cell utility. A net server is utilized for carport Of records esteems detected continuously and also for the assessment of results. Using IoT inside the food store network (FSC) enriches the uncommon ways of life by following and checking the state of the dinners and live imparting the gained data to the purchaser or the FSC administrator. Shrewd suppers following contraption centers around the secure capacity of fixings by following And controlling boundaries influencing food substances. This task proposes an IoT system for Facilitating food observing for the assurance of the food so that it'd not get contaminated Due to encompassing conditions for the length of capacity and transportation. By this strategy, we will store results and greens for a more drawn-out time frame, keep cleanliness and a simple climate, store data into the cloud for fate

examination, decrease business misfortune, increment business benefit.

9. **Systematized Warehouse Based on IoT.** The authors have talked about how distribution centers are used to store goods and products. They concentrate on the issue that if a client has to locate an item at a distribution center, it is inconvenient because the client will have to conduct a physical search of all available stockrooms. The system is designed to track the items linked with the markings and item information, as well as their unique timestamps, which will be valuable for additional checks. When compared to current stockroom stock management frameworks, the proposed framework produces an extremely simple framework that functions well. Robots are used for putting away and picking measures mostly because they can move faster and transport a greater number of things than humans. Authors' efforts will allow inventions to communicate with one another and share knowledge. The Warehouse created by the authors in this work using the goods management substructure can be exceptionally high yielding, it is able to explore chores from the information base by using Cloud MQTT Protocol. The proposed system that employs RFID is just an arrangement for the research facility, however, can be applied for various uses. The cost of this system is comparatively low in comparison with the existing models in the commercial center.

10. **The mathematical model of Food storage safety monitoring and control system.** In the work by Li Lijuan and Minchai Hao ShiJiaZhuang, the machine consists of a microcontroller A T89S51, the doors circuit, temperature sensor, humidity sensor, Wi-Fi transceiver module PTR2000, and so forth. This machine and its peripheral circuits use AT89S51 MCU to finish the DS18B20 twine digital temperature sensor and humidity sensor management and statistics conversion, With the serial communication among computer systems and microcontroller to complete the manipulation of human-laptop interplay, and growing the interface with VC language to acquire the video, temperature, human-computer interplay via the pc. The device consists of four components meals garage through using the virtual digital camera tool, video, and temperature signal transmission, centralized monitoring, and managing middle and far off monitoring.

11. **Iot Based Monitoring System In Smart Agriculture.** The work by Prathibha S R1, Anupama Hongal, Jyothi M P senses the temperature values in real-time and humidity sensor- HDC1010 track the relative moisture of air inside the farming concern. The camera is interfaced with. CC3200 Single chip with an included microcontroller, community processor and Wi-Fi. CC3200 includes the networking subdevice together with an internal MCU software program processor. CC3200 person programming controls the strength mode of the microcontroller through the networking subsystem.TMP007 temperature infrared thermopile sensor is used which has a built-in math engine. The TMP007 is designed with mobility and a coffee energy supply. The HDC1010 digital humidity sensor is used and it presents the accurate size of moisture diploma in the environment at low power. The HDC1010 is nicely suitable with I2C.

12. **Study of Smart Warehouse Management System Based on the IOT.** The work by Wen Ding proposed IOT can help to fast tally. Using IoT, virtually examine the bar code of the products to get the goods records of warehouse variety, place and previous logistics process information to speedy whole the tally way. IOT can simplify the technique of stock of products Using the Internet of Things (IOT) technology, we are capable to achieve examining data from remote multiple objects and despatched it to the system host. IOT can beautify the extent of warehouse automation management It is able to automate take a look at the goods out of garage non-contacting with IoT. Compared with conventional manipulate, it is not required to open the boxes to get the shipment statistics, so notably advanced storage velocity. At the equal time, barcode distinctive shipment data to assist businesses to enhance the meticulous control. The concept of Internet and cloud computing technology achieves sensible processing and control of the products in in/out of garage and cargo dealing with way.

13. **An IoT based Warehouse Intrusion Detection (E-Perimeter) and Grain Tracking Model for Food Reserve Agency.** The proposed model by Sipiwe Chihana, Jackson Phiri, Douglas Kunda tries to address the holes in grain robbery at FRA distribution center stockpiling utilizing movement detecting and grain following utilizing RFID. It has been observed that once these techniques are adopted by the food hold agency, food security will significantly improve because the sole purpose of these strategies is to decrease the chances of burglary at FRA, and the other ways under which these processes will achieve improvement in food security are that public assets will be

saved, for example, the cash put resources into purchasing grain will be reduced as security instruments will be set up. Innovations and developments in the Internet of Things RFID, WSN, and dispersed storage utilization reduce the likelihood of robbery and regulatory errors and, as a result, aids in the expansion of proficiency and responsibility. It was also derived from the experiment and perception inquiry on the model that the organization benefited from the proposed innovation.

14. **Implementation of IoT based Smart Warehouse Monitoring System.** The authors Sowmya T K, Shreya V Agadi, Saraswathi KG and Puneeth B Nirvani, Prajwal S have proposed an IoT based Smart Warehouse Monitoring System.The warehousing time and nature of the organic products are incredibly affected by the warehousing climate factors. Right now, this paper presents the ecological elements that impacted the natural products warehousing quality and conventional security method and proposed the multiparameter observing framework in light of WiFi. This paper gives a more reasonable answer for natural products warehousing observing and control.The handled information can now be utilized to perform either factual or visual investigation with the assistance of MATLAB devices over the web or disconnected. The protected stockpiling of products of the soil which is firmly connected with our day to day routine and wellbeing, the ongoing checking on natural products warehousing climate advances the redesigning of the stockroom the board framework, prompting streamlining of the natural products warehousing climate, ensuring the protected stockpiling of foods grown from the ground organic products waste may it be over a present moment or a long haul consequently staying away from pointless monetary misfortunes.

15. **IoT-Based Smart Food Storage Monitoring and Safety System.** The proposed framework by Saleem Ulla Shariff, M. G. Gurubasavanna, and C. R. Byrareddy is furnished with an auto SMS and email-ready framework to caution the proprietor in regards to the food stockpiling level and the data connected with the food waste. Henceforth, it turns out to be vital for us to screen the food stockpiling level and keep up with it to lead a strain-free sound life. The proposed GR Peach-based shrewd home food stockpiling observing support and wellbeing ready framework has been planned considering the current most recent patterns. The proposed framework will be of most extreme significance for the everyday existence of the bustling common families who rely upon precise information for their month-to-month home financial plan readiness. The proposed framework has been planned given the guideline of multi-facet security. The proposed framework not just functions admirably as a food level observing

framework yet additionally as a wellbeing gadget in kitchens and food stockpiling godowns.

16. **Wireless Sensor Networks:** The survey Wireless Sensor Networks by Vidyasagar Potdar, Atif Sharif, Elizabeth Chang helps us understand WSN. This paper describes Wireless Sensor Networks (WSN) as a pervasive computing ingredient that is being used to scan everyday environmental variables on a large scale, according to the authors. These sensors, on the other hand, operate athigh energy levels and are designed for a specific purpose. The authors compared and contrasted the proposals for WSN sensor nodes from a variety of research groups. To make the comparison, the following technical features are employed. 1. Picking a design 3. Technology to Be Aim For Antenna Design is the second step in the process. 4. Components Non-Volatile Storage (NVS) is a type of non-volatile storage. The technology of information and communication (ICT) 7.Fortitude 8. Precautionary measures 9. Sensor Interface and Programming 10. Dimensions The eleventh application has been submitted.

    As a product of their research, the writers argue that WSN is a potential future technology that is being utilized in a range of applications that need little human involvement. The authors evaluated WSN technology in their study. They also evaluated the WSN model based on its significant technical aspects.

17. **A reference architecture for IoT-based logistic information systems in agri-food supply chains.** The authors C.N. Verdouw, R.M. Robbemond, T. Verwaart, J. Wolfert, and A.J.M. Beulen describe how perishable products, unpredictable supply changes, and demanding food safety and sustainability criteria all need to be addressed in the food and agriculture industry's logistics. The scholars assert that the Internet of Things (IoT) technology, which allows us to follow the location and condition of shipments and goods from a distance, might play a critical role in addressing these concerns. In this study, the authors developed a prototype system for IoT-based logistic information systems used in agri-food supply chains. . The FIWARE technologies, which are part of the FI-PPP programme, have been used to create the Smart Agri-Food. The authors' research is founded on a design-oriented methodology, which is detailed in this publication. The authors' design-oriented research has focused on delivering good artefacts that will address previously unresolved issues and may be assessed in terms of utility in resolving the issues. The authors' research was divided

into three sections: the requirements definition phase, the reference architecture for agri- food supply chain design phase, and the evaluation phase. The authors began by defining the criteria by analysing the specific characteristics found in agri-food supply chains, after which they investigated their impact on logistic information systems through desk research. The authors then identified seven different application situations. As a consequence of this initiative, cost-effective solutions independent of geographic location and particular implementation options may be designed and implemented. The baseline design of the authors is based on two research articles in the FFV and F&P industries. They believe it will also be useful to other industries, although additional study is required to prove this. Furthermore, adopting the anticipated carefully developed in operational information systems will be a big future challenge .

CHAPTER 3

PROPOSED METHODOLOGY

3.1 INTRODUCTION

This proposed structure screens the conveyance place climate at various focuses for limits like temperature, sogginess, CO, presence of grains, and smoke which is astoundingly affecting the grains. The ESP32 Wi-Fi module accumulates the data from the sensors and this module sends data to the Node-red dashboard through the MQTT convention introduced on the raspberry pi module. Various IoT center points will be presented at a substitute region inside the dissemination place which will give information about the stockroom environment to the farmers through Mobile SMS and E-mail notice. The IR sensor identifies the presence of grains in the distribution center and conveys a message to ESP 32. The ESP 32 then takes the contribution from different sensors like temperature and moistness sensor(DHT-11) to quantify mugginess and temperature of the stockroom, Gas sensor to gauge levels of methane, CO, Sulfur, Benzene which influences the grains. High methane and CO levels show the rot of food. Sulfur and Benzene will influence the food grains antagonistically. We will utilize MQ135 to recognize these gases. The ESP module will send the information through wi-fi to a server comprising of Raspberry pi and a SD card. We will attach the GSM module to the ESP module any major variations will be reported to the concerned authority by SMS and Email. This monitoring system will help in monitoring the warehouse parameters at different points. Multiple nodes will send the data to the raspberry pi router through wi-fi and the raspberry pi will communicate the data to the connected devices. We can view the data of the warehouse on connected devices through the Node-RED dashboard. The Node-RED dashboard will display temperature, humidity, CO, Sulphur, and methane levels. We will code the Node-Red dashboard using the node-red drag and drop program. The node-red terminal uses the terminal language that is based on the node.js application. Depending on the crop variety we will be adjusting the temperature, humidity, and gas levels any fluctuations will be reported to the authority. There are a lot of cases of fire accidents in warehouses due to dry mass storage. To detect and warn about fire accidents we will also be implementing fire sensors into our system.

3.2 BLOCK DIAGRAM

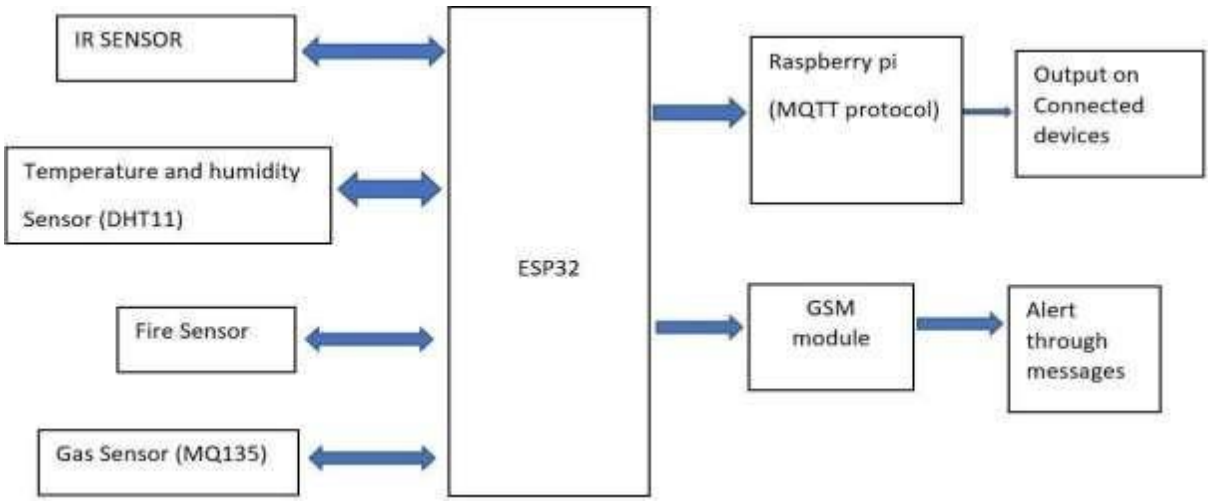

Figure 3.1 Block diagram of the proposed system

The block diagram of the system consists of sensors unit, controller unit, server unit, and output devices. Various sensors like temperature, humidity, fire, gas, IR are integrated into the sensor unit. ESP 32 is a microcontroller with wi-fi and Bluetooth. Several nodes with ESP and sensor units will be installed at different locations at the warehouse. These sensor unit data will be sent to ESP. We will integrate the GSM module into the ESP module which will help us send SMS notifications to the authority when there are deviations. The ESP will transmit the data to the server created using Raspberry Pi and an SD card. The raspberry pi module will transmit the data to the node-red dashboard using the MQTT protocol. MQTT is a standard messaging protocol for the Internet of Things (IoT). It is designed as an extremely lightweight publish/subscribe messaging transport that is ideal for connecting remote devices with a small code footprint and minimal network bandwidth. The node-red will intake the various sensor parameters and will process the data and it will display parameters. The system will also display the dispatch time of the products so that there is no food waste due to overtime storage.

3.3 PROGRAM FLOW DIAGRAM

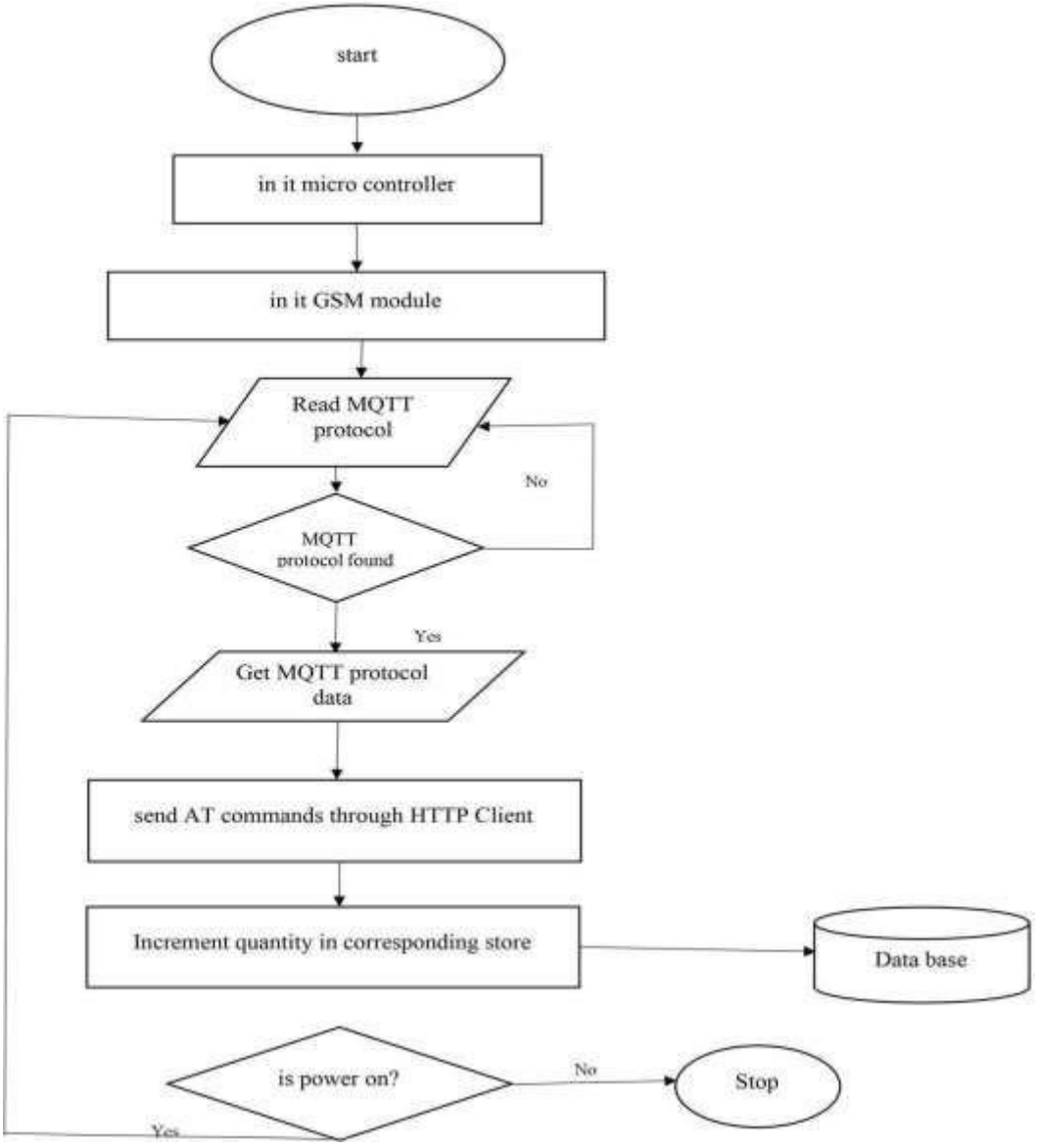

Figure 3.2 Flow Diagram

Figure 3.2 Shows the Flow diagram of stockpile track-off approach. And the below steps involves the discussion about Flow diagram.

- Initialize the system and set up sensors, RFID tags, barcodes, and other data collection technologies.
- Start data collection: The system collects data on inventory levels, stock movements, and other key metrics within the warehouse using sensors, RFID tags, barcodes, and other data collection technologies.
- Store the collected data in a database: The system stores the collected data in a centralized database for easy retrieval and analysis.
- Analyze the data: The system analyzes the collected data using algorithms to identify trends, patterns, and anomalies. The algorithms can be designed to detect discrepancies between actual inventory levels and the expected inventory levels, identify potential stockouts, or track the movement of items within the warehouse.
- Generate reports and alerts: Based on the analyzed data, the system generates reports and alerts for warehouse managers and other stakeholders. The reports can include information on inventory levels, stock movements, order fulfillment rates, and other key metrics. The alerts can be triggered when inventory levels fall below a certain threshold, when items are misplaced or mislabeled, or when other anomalies are detected.
- Send reports and alerts: The system sends the generated reports and alerts to warehouse managers and other stakeholders via email, text message, or other communication channels.
- Take action based on the data and reports: Warehouse managers and other stakeholders use the data and reports generated by the system to make informed decisions about inventory management, resource allocation, and other key aspects of warehouse operations. The system can also be designed to integrate with other systems, such as inventory management software or logistics management software, to automate certain tasks or streamline operations.
- Continuously monitor and update the system: The system is continuously monitored and updated to ensure it remains effective and efficient. This can include adding new sensors or data collection technologies, refining the algorithms used to analyze the data, or upgrading the system hardware or software.

CHAPTER 4

HARDWARE AND SOFTWARE REQUIREMENTS

4.1 SYSTEM REQUIRMENTS:

4.1.1 Hardware Requirements:

- **ESP32.**
- **MQ135 Gas Sensor.**
- **DHT11.**
- **Power Supply.**
- **Fire Sensor.**
- **IR Sensor.**
- **GSM module.**
- **Raspberry pi.**

4.1.2 Software Requirements:

- **Arduino IDE.**
- **Embedded C.**
- **VNC viewer.**
- **Node-Red.**

4.2 HARDWARE COMPONENT DESCRIPTION

4.2.1 ESP 32

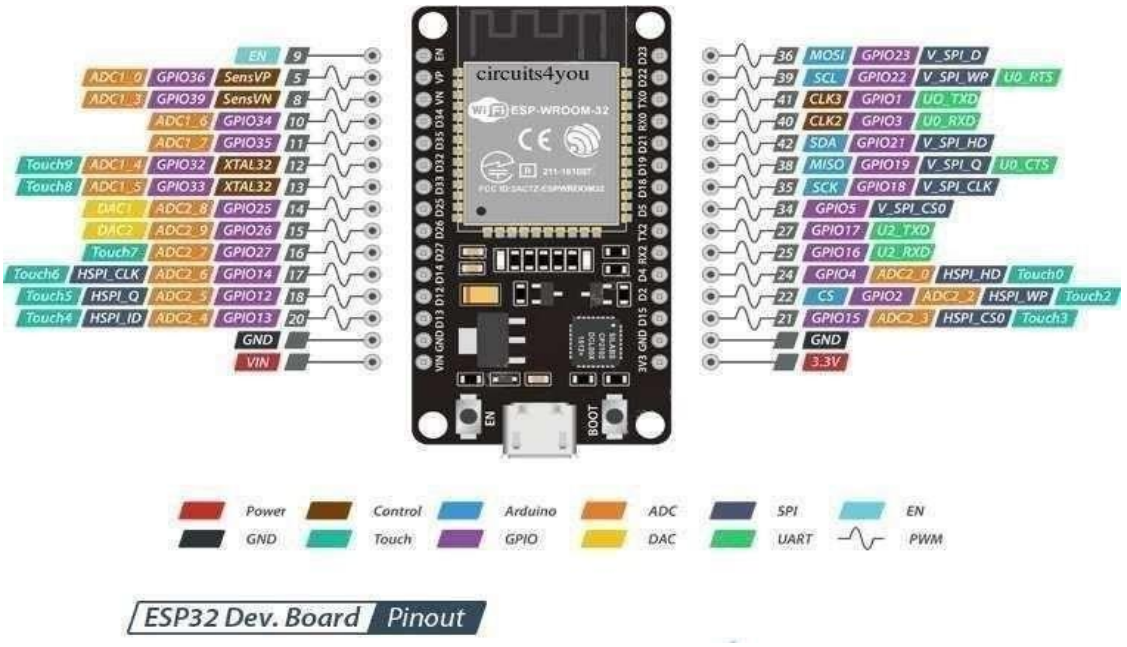

Figure 4.1 ESP 32 board

ESP32-WROOM-32 is a solid, nonexclusive Wi-Fi+BT+BLE MCU module that goals a wide collection of uses, going from low-power sensor associations to the most mentioning tasks, for instance, voice encoding, music streaming and MP3 interpreting. At the focal point of this module is the ESP32-D0WDQ6 chip*. The chip embedded is planned to be flexible and adaptable. There are two CPU habitats that can be independently controlled, and the CPU clock repeat is mobile from 80 MHz to 240 MHz. The client may moreover control off the CPU and use the low-power co-processor to persistently evaluate the peripherals for changes or passing of limits. ESP32 joins a rich course of action of peripherals, going from capacitive touch sensors, Hall sensors, SD card interface, Ethernet, high speed SPI, UART, I2S and I2C.ESP32 Peripherals.

Features:

- 18 Analog-to-Digital Converter (ADC) channels
- 10 Capacitive sensing GPIOs
- 3 UART interfaces

- 3 SPI interfaces
- 2 I2C interfaces
- 16 PWM output channels
- 2 Digital-to-Analog Converters (DAC)
- 2 I2S interfaces

4.2.2 MQ135 SENSOR

Figure 4.2 MQ135 Gas sensor

The MQ-135 Gas sensor can distinguish gases like Ammonia (NH3), sulfur (S), Benzene (C6H6), CO2, and other destructive gases and smoke. Like other MQ series gas sensor, this sensor likewise has a computerized and simple result pin. Whenever the level of these gases go past an edge limit in the air the computerized pin goes high. This limit worth can be set by utilizing the on-board potentiometer. The simple result pin, yields a simple voltage which can be utilized to inexact the level of these gases in the environment. The MQ135 air quality sensor module works at 5V and consumes around 150mA. It requires some pre-warming before it could really give exact outcomes.

- Operating Voltage: 2.5V to 5.0V
- Power consumption: 150mA
- Detect/Measure: NH3, Nox, CO2, Alcohol, Benzene, Smoke
- Typical operating Voltage: 5V
- Digital Output: 0V to 5V (TTL Logic) @ 5V Vcc
- Analog Output: 0-5V @ 5V Vcc

4.2.3 DHT 11

Figure 4.3 DHT-11 Temperature and humidity sensor

The DHT11 Temperature And Humidity Sensor Module with LED is a small humidity and temperature sensor that you can connect to your Arduino to acquire temperature and humidity data. DHT11 can communicate with any microcontroller, such as Arduino, Raspberry Pi, and so on, and get immediate results. DHT11 is low-cost wetness and temperature sensor that offers great consistency and long-term security. The temperature and humidity sensors are communicated with the ESP32. These are calculated using a single wire sequential connection point and are expressed in degrees Celsius and percent. We use a resistive sort portion for sogginess estimate and a negative temperature coefficient part for scorching heat estimation. The result of DHT11 is a synchronized advanced signal that Raspberry Pi can understand, and there is no compelling requirement to have a simple the computerized converter. DHT11 is concerned with a voltage supply range of 3-5.5V and a current inventory range of 0.5-2.5mA. DHT11 is a temperature and stickiness sensor that is computerized. This sensor is a composite one that combines wetness and temperature to produce an adjusted sign result that addresses a computerized structure. Because of the computerized signal modules, the item has incredibly high dependability, extremely high security, and furthermore extremely low cost.

Specifications:

- Operating Voltage: 3.5V to 5.5V
- Operating current: 0.3mA (measuring) 60uA (standby)
- Output: Serial data
- Temperature Range: 0°C to 50°C ,Humidity Range: 20% to 90%
- Resolution: Temperature and Humidity both are 16-bit , Accuracy: ±1°C and ±1%

4.2.4 POWER SUPPLY

Figure 4. 4 Power supply

A power supply is an electrical contraption that arrangements electric ability to an electrical weight. The fundamental limit of a power supply is to change electric stream from a source over to the right voltage, stream, and repeat to control the load. Along these lines, power supplies are occasionally suggested as electric power converters. Some power supplies are free pieces of stuff, while others are consolidated into the load machines that they power.All power supplies have a power input affiliation, which gets energy as electric stream from a source, and somewhere around one power yield affiliations that pass on stream to the stack. The source power may come from the electric power framework, for instance, a fitting, energy accumulating devices like batteries or power modules. The power supply which we are using contains transformers which lessens subbing current to required voltage going with the movement of power supply after reduction of voltage then we use a full wave length rectifier to change AC over to DC and a short time later the DC current procured is dealt with to the channels and subsequently to the vital voltage regulator and the to a pile, the aftereffect of this power supply is gotten from the store and given to the parts and the microcontroller. The limit of an immediate voltage regulator is to change a varying DC voltage over to a consistent,

routinely express, lower DC voltage. In addition, they consistently provide a current confining ability to safeguard the power supply and weight from overcurrent (exorbitant, potentially tragic current). A consistent outcome voltage is required in many power supply applications, yet the voltage given by various energy sources will contrast with changes in load impedance. In addition, when an unregulated DC power supply is the energy source, its outcome voltage will moreover vary with changing data voltage. To sidestep this, some power supplies use an immediate voltage regulator to stay aware of the outcome voltage at a reliable worth, liberated from changes in input voltage and weight impedance. Direct regulators can in like manner reduce the significance of wave and noise on the outcome voltage.

4.2.5 FIRE SENSOR

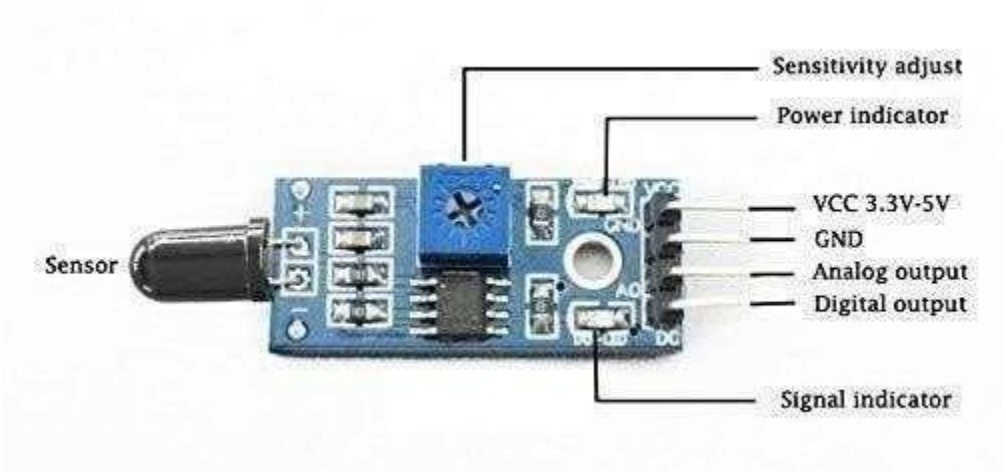

Figure 4.5 Fire sensor

The fire sensor recognizes and reactions to the presence of fire or fire. The module depends on the IR beneficiary and fundamentally recognizes the presence of combustible gases likes nitrogen, hydrogen, carbon mono oxide. The sensor can be straightforwardly connected with I/O pins of processors and regulators. It works in the frequency of the reach between 760 nm to 1100 nm in the light source.

Specification

- Voltage supply: 3.3-5V
- Signal detection capacity: adjustable
- Wavelength range: 760 nm-1100 nm

- Detection angle: up to 60 degree
- Fast response time

APPLICATIONS

- Easy to use
- FireFigurehting robot
- Home security system

4.2.6 GSM MODEM

Figure 4.6 GSM module

A GSM modem, otherwise called a GSM module, is a piece of equipment that utilizes GSM cell phone innovation to interface with a remote organization. According to the point of view of the cell phone organization, they are considerably indistinguishable from a standard cell phone, including the necessity for a SIM card to distinguish themselves to the organization. TTL-level sequential connection points are typically given by GSM modems to their hosts. They are commonly used as a part of an inserted framework. A GSM modem is a particular type of modem

that, similar to a cell phone, acknowledges a SIM card and capacities through a membership to a portable administrator. A GSM modem looks very much like a cell phone to a portable administrator. At the point when a GSM modem is connected to a PC, the PC can convey over the versatile organization utilizing the GSM modem. While these GSM modems are most generally used to associate with versatile web, a significant number of them can likewise send and get SMS and MMS messages. Since no specific membership to a SMS specialist organization is vital, GSM modems can be a fast and

productive technique to get everything rolling with SMS. Since the shipper pays for message conveyance, GSM modems are a financially savvy elective for getting SMS messages in many districts of the world.

4.2.7 RASPBERRY PI

Figure 4.7 Raspberry pi 3B+

Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation. The boards are designed to be low-cost, high-performance devices that can be used for a variety of purposes, including teaching basic computer science, building home media centres, controlling home automation systems, and running various software applications.

The first Raspberry Pi was released in 2012, and since then, the line has expanded to include several different models, each with different specifications and capabilities. Some of the most popular models include the Raspberry Pi 4, the Raspberry Pi 400, and the Raspberry Pi Zero. Raspberry Pi devices run on a variety of operating systems, including the Linux-based Raspbian, which is the recommended OS for most users. The devices are also compatible with a variety of programming languages, making them an ideal platform for learning to code.

The Raspberry Pi 3B+ is a single-board computer that was released in March 2018 as an upgrade to the Raspberry Pi 3. It is powered by a Broadcom BCM2837B0 system-on-chip (SoC), which includes a 1.4 GHz 64-bit quad-core ARM Cortex-A53 CPU and a Broadcom VideoCore IV GPU.

The Raspberry Pi 3B+ also includes 1GB of RAM, Gigabit Ethernet, dual-band 802.11ac wireless, Bluetooth 4.2/BLE, four USB 2.0 ports, and HDMI output. It can run a variety of operating systems, including Raspbian, Ubuntu, and other Linux-based distributions. Compared to the Raspberry Pi 3, the 3B+ features improved thermal management, which allows it to run at higher clock speeds for longer periods of time. It also includes a faster Ethernet controller and improved wireless connectivity.

The Raspberry Pi 3B+ is a versatile and powerful device that can be used for a wide range of applications, including as a media center, a home automation controller, or even as a desktop computer with the addition of a keyboard, mouse, and monitor.

Specifications:

CPU: Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit SoC @ 1.4GHz GPU: Broadcom Video Core IV

RAM: 1GB LPDDR2 SDRAM

Wireless: 2.4GHz and 5GHz IEEE 802.11.b/g/n/ac wireless LAN, Bluetooth 4.2/BLE Ethernet: Gigabit Ethernet over USB 2.0 (maximum throughput 300 Mbps)

Storage: MicroSD card slot for operating system and data storage

GPIO: 40-pin GPIO header (fully backwards-compatible with previous boards) USB: 4 x USB 2.0 ports

Video & Sound: 1 x full-size HDMI port, MIPI DSI display port, MIPI CSI camera port, 4 pole stereo output and composite video port

Multimedia: H.264, MPEG-4 decode (1080p30); H.264 encode (1080p30); OpenGL ES 1.1,2.0 graphics

Power: 5V/2.5A DC via microUSB or GPIO header Dimensions: 85 x 56 x 17 mm, 45g.

4.3 SOFTWARE REQUIREMENTS:

4.3.1 Arduino IDE

Figure 4.8 Arduino IDE

The Arduino IDE (Integrated Development Environment) is a software application that is used to program and upload code to Arduino boards. It is a cross-platform application that runs on Windows, macOS, and Linux, and provides a simple interface for writing, compiling, and uploading code to an Arduino board.

It uses a simplified version of the C++ programming language, and includes a variety of libraries and examples that can be used to develop applications for a wide range of sensors and other electronic components. The IDE includes a text editor for writing code, a compiler for converting the code into machine language, and a uploader for uploading the code to the Arduino board.

One of the key features of the Arduino IDE is its simplicity and ease of use, which makes it accessible to beginners and experienced programmers alike. It also provides a range of debugging tools and a serial monitor for testing and troubleshooting code.

The Arduino IDE can be downloaded for free from the Arduino website, and is compatible with a wide range of Arduino boards, including the popular Arduino Uno, Mega, and Nano boards.

4.3.2 Embedded C

Introduced C is a lot of language extensions for the C programming language by the C Standards Committee to address divided characteristic gives that exist among C increases for different embedded systems. Introduced C programming generally requires nonstandard expansions to the C language to help redesigned chip components, for instance, fixed-point math, various undeniable memory banks, and fundamental I/O errands. In 2008, the C Standards Committee loosened up the C language to address such limits by giving a run of the mill standard to all executions to adhere to. It consolidates different features not open in normal C, for instance, fixed-point math, named address spaces and fundamental I/O hardware tending to. Embedded C uses most of the accentuation and semantics of standard C, e.g., rule() work, variable definition,data type declaration, unforeseen clarifications (if, switch case), circles (while, for), limits, groups and strings, plans and affiliation, cycle undertakings, macros, etc Inserted writing computer programs is PC programming, written to control machines or contraptions that are not usually considered as PCs, ordinarily known as embedded structures. It is conventionally explicit for the particular gear that it runs on and has time and memory objectives. This term is occasionally used equally with firmware. An accurate and stable brand name feature is that no or not all components of embedded writing computer programs are begun/constrained through a human association point, but through machine-interfaces taking everything into account. Producers fuse introduced programming into the equipment of vehicles, telephones, modems, robots, mechanical assemblies, toys, security systems, pacemakers, TVs and set-top boxes, and electronic watches, for example. This item can be astoundingly fundamental, for instance, lighting controls running on a 8-digit microcontroller with a few kilobytes of memory with the healthy level of not permanently set up with a Probably Approximately Correct Computation structure (a way of thinking taking into account randomized estimations), or can end up being incredibly complicated in applications like planes, rockets, and communication control systems.

4.3.3 VNC VIEWER

Figure 4.9 VNC Viewer App

VNC Viewer is a software application that allows users to remotely access and control a computer desktop from another device. It uses the VNC (Virtual Network Computing) protocol, VNC Viewer is available for a wide range of platforms, including Windows, macos, Linux, and mobile devices. It can be used to connect to remote computers that are running VNC server software, such as realvnc, tightvnc, or ultravnc. The VNC server software must be installed and conFigureured on the remote computer before it can be accessed using VNC Viewer.

VNC Viewer provides a simple and intuitive interface for connecting to a remote computer and controlling its desktop. It supports a variety of connection options, including direct connections over a LAN (Local Area Network) or WAN (Wide Area Network), and encrypted connections over the internet using a VNC server with built-in encryption or a VPN (Virtual Private Network) connection.

Overall, VNC Viewer is a useful tool for remote access and support, and can be used in a variety of scenarios, such as remote desktop access, remote technical support, and remote trainingand collaboration.

Which allows a user to connect to a remote computer and see its desktop in real-time, as if they were sitting in front of the remote computer.

4.3.4 Node-red app

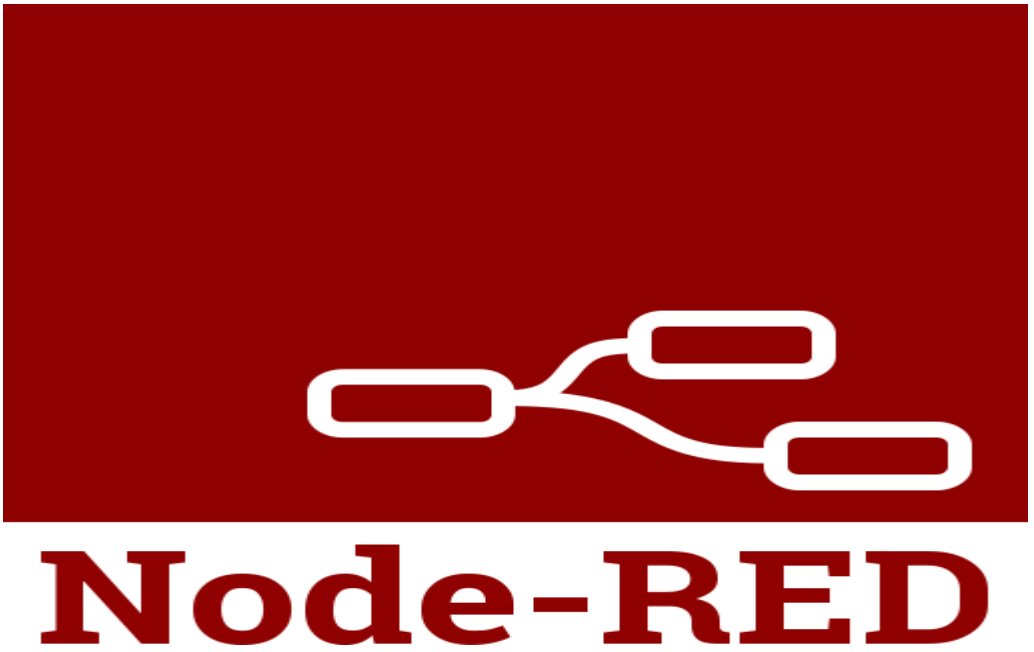

Figure 4.10 Node-Red

Node RED is a stream-based headway mechanical assembly for visual programming developed at first by IBM for wiring together hardware contraptions, APIs and online organizations as an element of the Internet of Things. Center point RED gives a web program based stream supervisor, which can be used to make JavaScript limits. Parts of uses can be saved or shared for re-use. The runtime depends on Node.js. The streams made in Node-RED are taken care of using JSON. Since variation 0.14, MQTT center points can make suitably organized TLS affiliations. In 2016, IBM contributed Node-RED as an open source JS Foundation project. Node-RED is an open-source flow-based programming tool that is used for wiring together devices, APIs, and online services. It provides a web-based visual editor that allows users to drag and drop nodes onto a canvas and connect them together to create flows that can be used for a variety of applications, such as home automation, data visualization, and IoT (Internet of Things) applications.

Node-RED can be used as a standalone application or can be integrated with other tools and services. It is built on Node.js, which is a server-side JavaScript platform, and uses the JavaScript programming language to define the logic of the flows.

Node-RED provides a large library of pre-built nodes that can be used to interact with a wide range of devices and services, such as GPIO pins on a Raspberry Pi, REST APIs, MQTT brokers, and databases. It also allows users to create custom nodes using JavaScript, which can be shared and reused by others in the Node-RED community.

Overall, Node-RED provides a flexible and powerful platform for building applications that require the integration of multiple devices and services. It is easy to use, highly customizable, and can be deployed on a variety of platforms, including on-premise servers and cloud-based services.

CHAPTER 5

RESULTS AND DISSCUSION

The experimental setup of our system discussed in the above chapters is shown in Figure 5.1 Using the designed prototype, we conducted the abundant trials, the results are presented below.

Figure.5.1 Hardware Implementation

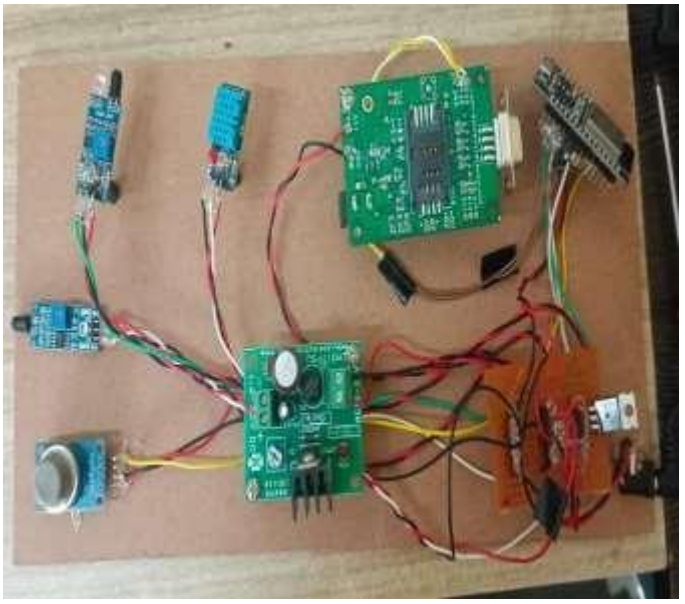

Figure 5.2 Proposed System

The Figure.5.1 and Figure.5.2 shows the hardware implementation of stockpile track-off approach.

Figure 5.3 Software Implementation

Figure 5.4 Software Implementation

Figure 5.5 Software Implementation

The Figure 5.3, Figure 5.4 and Figure 5.5 Shows the software implementation of our proposed system.

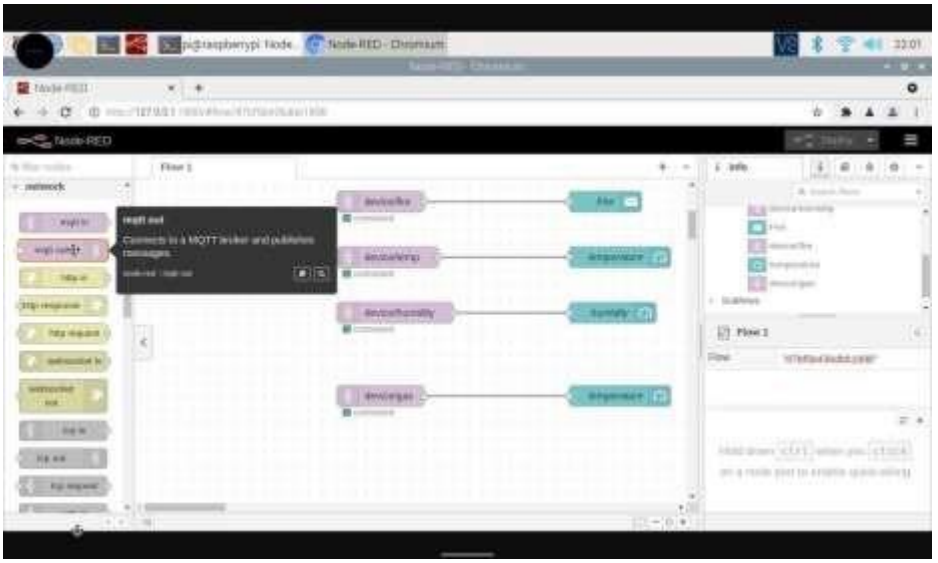

Figure: 5.6 Interface between ESP32 and Raspberry pi

The Figure 5.6. Shows the software implementation of our proposed system and the interface between ESP32 and Raspberry pi (MQTT protocol).

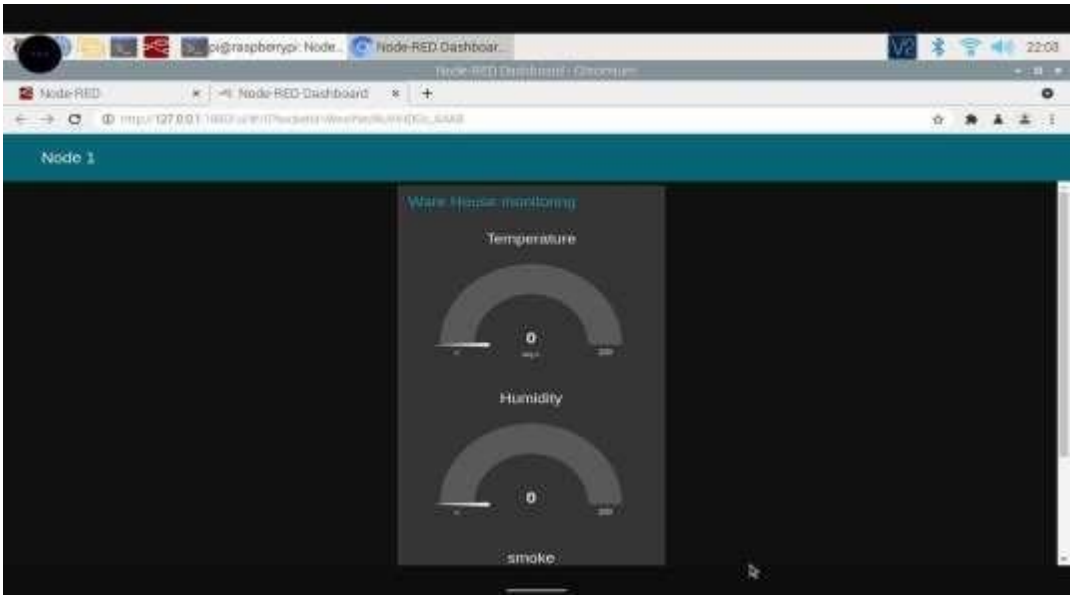

Figure 5.7 Dashboard of Node-Red

The Figure 5.7 Shows the Dashboard of Node-Red, it is used to display the different monitoring levels of sensor status.

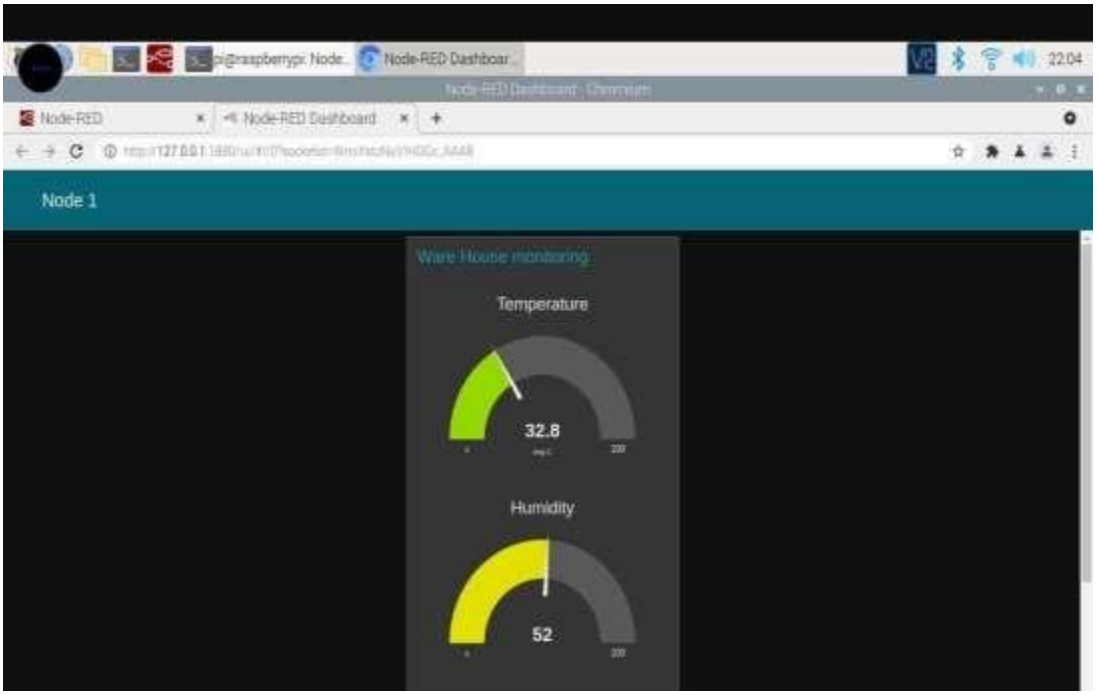

Figure 5.8 Monitoring Level of different Sensor

The Figure 5.8 Shows the monitoring level of different sensors

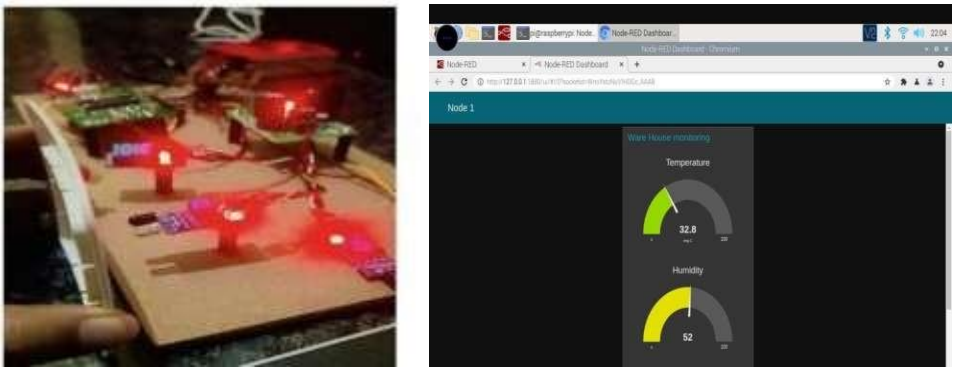

Figure 5.9 IR sensor Detected

The Figure 5.9 Shows the detection of IR sensors which helps to monitor the presence of Grains.

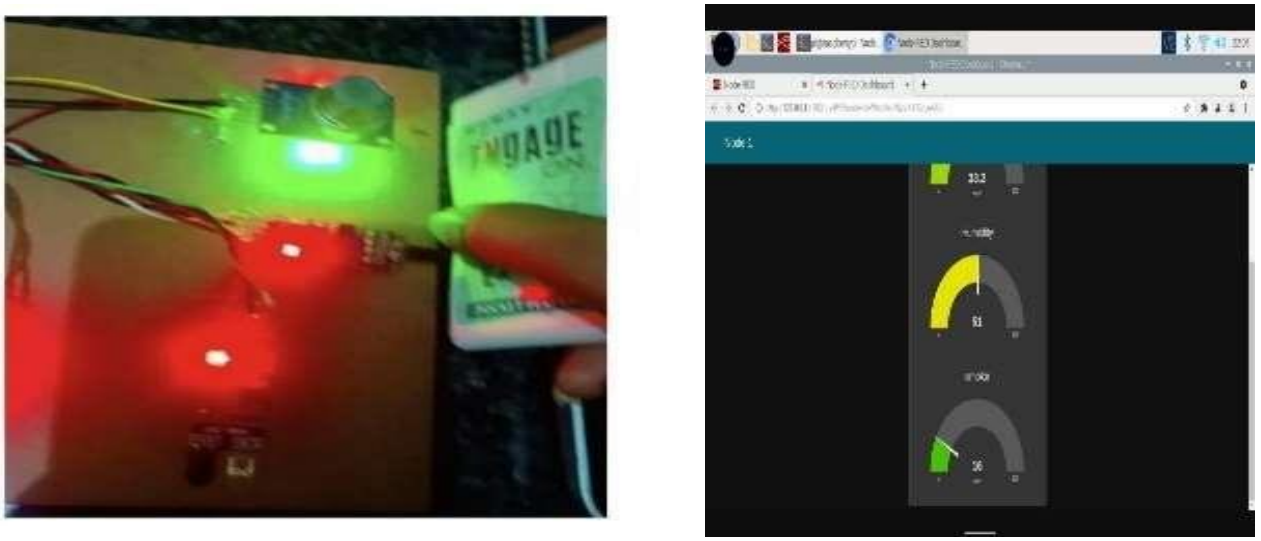

Figure 5.10 Gas sensor detected

The Figure 5.10 Shows the detection of different gas, which helps to detect the different types of gas.

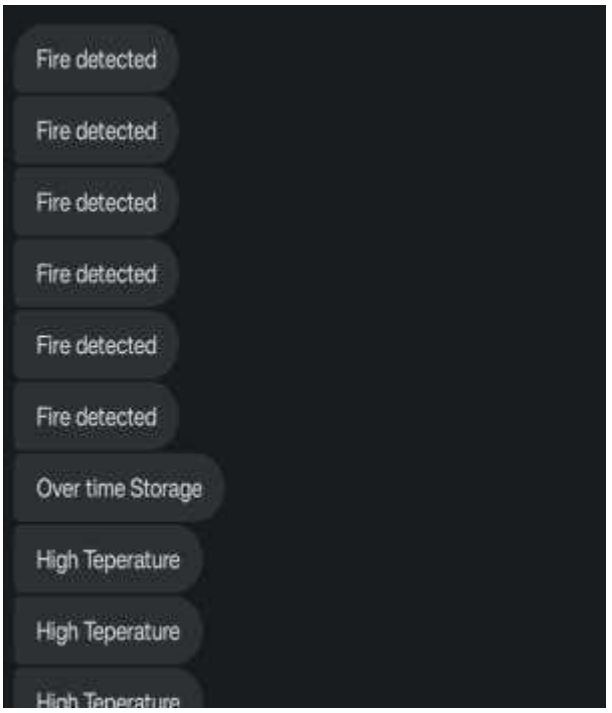

Figure 5.11 Fire Sensor detected

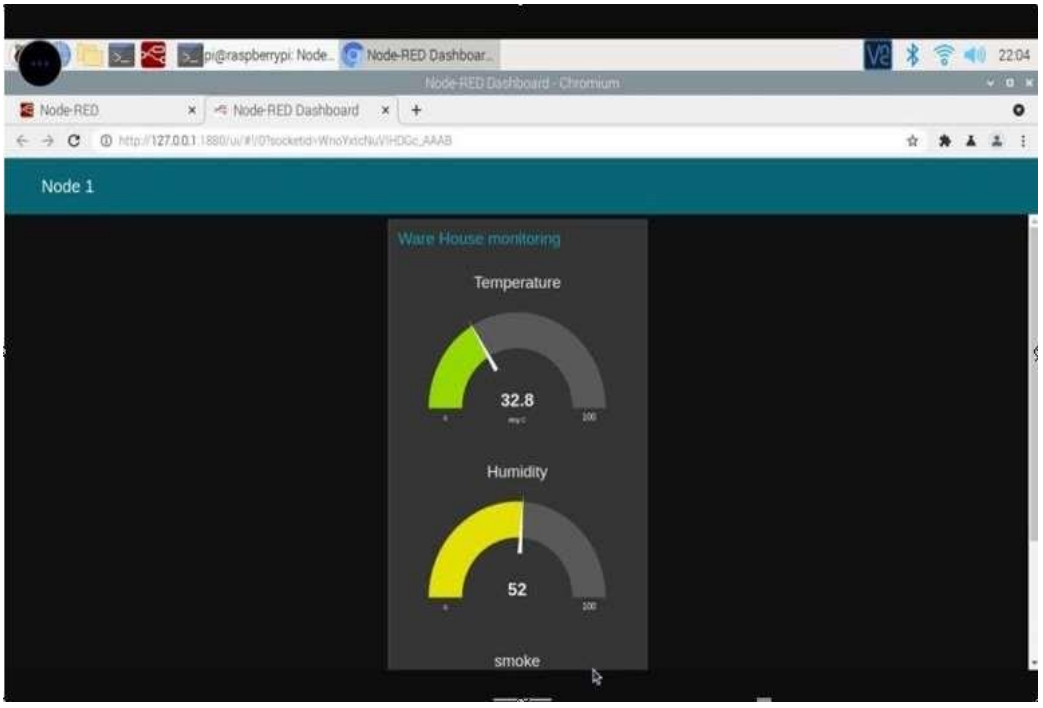

Figure 5.12 Temperature sensor detected

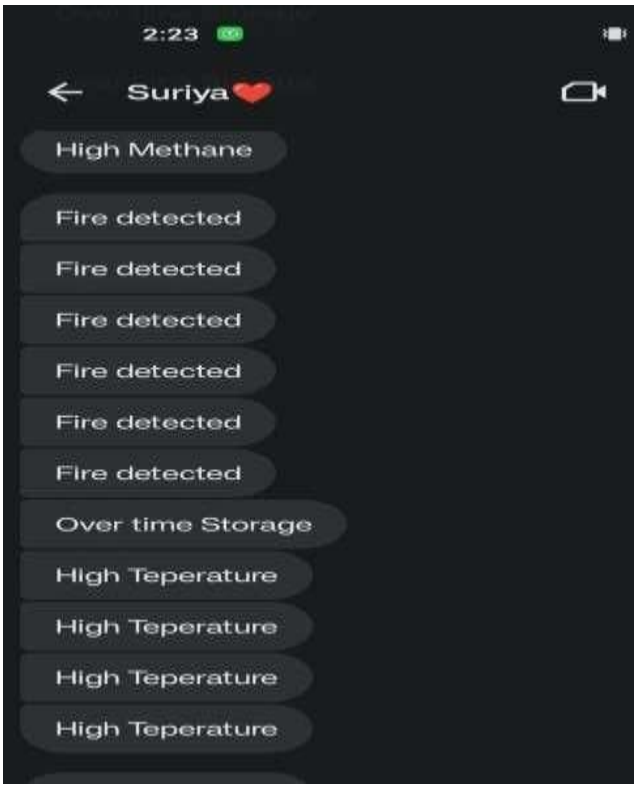
2:23
Suriya
High Methane
Fire detected
Fire detected
Fire detected
Fire detected
Fire detected
Fire detected
Over time Storage
High Teperature
High Teperature
High Teperature
High Teperature

Figure 5.13

FUTURE SCOPE

In the future we can use, different sensors with high sensitivity, high adaptability, and high reliability will be developed and which can be helpful to preserve the grains and vegetables. The sensor's data can be stored in a database to which a user can monitor the current and the history of data from anywhere and anytime. The system can be considered for monitoring food items stored in the warehouse. The device can be facilitated to collect the information of theft so that the implementation of machine learning is achieved.

CONCLUSION

There is a need to better monitor our warehouses. IoT has entered the agriculture field, this technology will be easily accessible to farmers. The target of this project is to resolve the problem of food waste in India as a result of poor management. Despite India's prominence as an independent food-producing country with abundant jobs and wealth, a startling number of people are afflicted by food scarcity directly or indirectly. This project will be helpful in tracking the environmental parameters of the warehouse-like temperature. Humidity, presence of gases like CO, methane, Sulphur, and benzene. This will help us better monitor the warehouse and efficiently store the food products. This project will help in reducing the losses that occur due to storage mismanagement. When done on a broad scale, this will aid in the monitoring of several warehouses in various places. It will look into artificial scarcities that have arisen as a result of stock holding by certain warehouse managers. It can also be used to store a variety of things. It will ensure that the food quality is maintained. Agriculture uses a lot of land, water, and labor, therefore better managing the food we produce will help us better manage these resources. To govern the environment, additional control components can be introduced into the system. New age tools like as AI, ML, and DL can be utilized to train the system to monitor various metrics and take appropriate action. The information can be saved in databases and retrieved during food safety inspections.

REFERENCES

[1] Optimized Sensor-Based Smart System for Efficient Monitoring of Grain Storage by Sazia Parvin, AmjadGawanmeh, Sitalakshmi Venkatraman (2018 IEEE International Conference on Communications Workshops (ICC Workshops))

[2] IoT Instrumented Food and Grain Warehouse Traceability System for Farmers by Susmita Banerjee, AnilKumar Saini, Himanshu Nigam, Vijay(2020 International Conference on Artificial Intelligence and Signal Processing (AISP))

[3] Nano Warehouse: A New Concept for Grain Storage in India. By Dhananjay Kumar Singh , Rahul Desai,Nilima Walde, P.B. Karandikar(2014 International Conference on Green Computing Communication and Electrical Engineering (ICGCCEE))

[4] Trustworthy, Secure, and Privacy-aware Food Monitoring Enabled by Blockchains and the IoT by Christoph Stach, Clémentine Gritti, Dennis Przytarski, Bernhard Mitschang(2020 IEEE International Conference on Pervasive Computing and Communications Workshops (PerCom Workshops))

[5] Storage Technology, and control of Aflatoxin in Corn (Zea mays L.) with the Internet of Things (IoT)Application by M Hadipernata, A Ni'matullah Al-Baarri, M Somantri, E Rahayu, S J Munarso, R Rachmat, Miskiyah, Misgyarta, M Hayuningtyas, and S Pangidoan(IOP Conf. Series: Earth and Environmental Science 803 (2021) 012041)

[6] An Intelligent IoT-Based Food Quality Monitoring Approach Using Low-Cost Sensors **by** Alexandru Popa, Mihaela Hnatiuc, Mirel Paun, Oana Geman, D. Jude Hemanth, Daniel Dorcea , Le Hoang Son, and Simona Ghit (Proquest Symmetry 2019)

[7] An Effective Approach for The Design of Safety Fresh Food Supply Chain Networks with Quality Competition by Hong Li YIN, Young Ming WANG(2017 IEEE International Conference on Information and Automation(ICIA))

[8] IoT Based Smart Food Monitoring System by Professor Rajesh Kumar Kaushal, Harini. T, Pavithra Lency.D, Sandhya.T, Soniya. P. (International Journal Of Current Engineering And Scientific Research (Ijcesr)

[9] Systematized Warehouse Based on IoT By Bakyalakshmi V, Anithamary M, Bharathy R, Jhanani Shree U(Iraqi Academics Syndicate International Conference for Pure and Applied Sciences (IICPS), 5-6 December 2020,

[10] The mathematical model of Food storage safety monitoring and control system By Li Lijuan and Minchai Hao ShiJiaZhuang (2010 International Conference on Computer Application and System Modeling (ICCASM 2010))

[11] Iot Based Monitoring System In Smart Agriculture by Prathibha S R, Anupama Hongal , Jyothi M P(2017 International Conference on Recent Advances in Electronics and Communication Technology (ICRAECT))

[12] Study of Smart Warehouse Management System Based on the IOT By Wen Ding(Part of the Advances in Intelligent Systems and Computing book series (AISC, volume 180) by Springer)

[13] An IoT based Warehouse Intrusion Detection (E-Perimeter) and Grain Tracking Model for Food Reserve Agency by Sipiwe Chihana, Jackson Phiri , Douglas Kunda(Published 2018, International Journal of Advanced Computer Science and Applications)

[14] Implementation of IoT based Smart Warehouse Monitoring System by Sowmya T K, Shreya V Agadi, Saraswathi KG and Puneeth B Nirvani, Prajwal S (30 July 2018,Computer Science, International journal of engineering research and technology)

[15] IoT-Based Smart Food Storage Monitoring and Safety System by Saleem Ulla Shariff, M. G. Gurubasavanna, and C. R. Byrareddy(Springer Singapore,2019, International Conference on Computer Networks and Communication Technologies)

[16] Wireless Sensor Networks: A Survey byVidyasagar Potdar, Atif Sharif, Elizabeth Chang(2009 International Conference on Advanced Information Networking and Applications Workshops)

[17] A reference architecture for IoT-based logistic information systems in agri-food supply chains by: C.N. Verdouw, R.M. Robbemond, T. Verwaart, J. Wolfert & A.J.M. Beulen(Taylor and Francis ,Enterprise Information Systems ,Volume 12, 2018 - Issue 7: Development in Internet of Things and Information Technology)

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"STOCKPILE TRACK-OFF APPROACH"

Abstract

India is a nation where the agrarian sections have a significant influence on the economy. Consistently ranchers deal with various issues because of the capacity prerequisites, the absence of legitimate checking of the food put away. Stockrooms are utilized for capacity purpose. Just a little piece of the food grains is put away in the state-run distribution centres. An enormous piece of the harvests in left without suitable storage spaces. The worldwide creation of Incorporates maize, wheat, and rice. However, because of the variance in the market, the misfortunes that the nation faces consistently because of inappropriate stockpiling is about RS. 50,000 crores in financial terms. A food warehouse is a place used by food establishments or individuals to store and distribute food for wholesale. So in this project we use a proposed solutions for this problem. We use raspberry pi, IR sensor, fire sensor, smoke sensor, Temperature sensor, GSM module, Esp32 micro-controller. By writing an Embedded C code to run the out-put and we use the Arduino ide to program and dump the program in esp32 micro-controller. We get the out-put in the node-red dashboard using VNC viewer. The data is collected to the micro-controller and it is sent to node-red dashboard by MQTT protocol and we obtain the output.