FOOD STORAGE MONITORING SYSTEM

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ABSTRACT

Food safety and cleanliness must be prioritized if food waste is to be avoided. Temperature, stickiness, gas, fire, gate crashers, and other climatic circumstances might hurry or rush the ruining of food as well as its quality. Therefore, it is advantageous for supermarkets to install equipment for quality monitoring. These tools for quality control keep an eye on the conditions that accelerate or cause food spoilage. Later on, refrigeration, vacuum storage, and other techniques may be used to regulate environmental conditions, depending on the need. The project's central component is a food monitoring system that calls for the systematic use of numerous sensors to manage and monitor the quantity and quality of food components. With the assistance of a savvy food observing framework, you can be sure that your food will constantly be of the greatest quality, no matter what the climate outside. Through the Internet of Things, this unit informs the user of any changes to the quantity or quality of the unit via Bluetooth to an Android smartphone and GSM-based text messaging to a mobile that has been approved. A large amount of monitoring and quality control equipment can be set up at a single location. The Arduino Sketch, which is installed on the device and is in charge of receiving sensor data, transforming it into strings, displaying it on the LCD, and transmitting it over the Internet of Things platform, is responsible for putting the project's various components into action. The Arduino IDE is utilized to make, construct, and transfer the Sketch.

KEYWORDS: Alarm, Bluetooth, Sensors, GSM Module, and Arduino.

INTRODUCTION

One of the most disastrous things that could happen to our food store is a catastrophe brought on by changes in temperature and humidity. When it comes to storing the food we eat, maintaining the right temperature and humidity is the most important aspect. Our project to monitor food storage using Arduino will make use of the Arduino Uno board. An Arduino-based system will transmit data from various sensors, including temperature, humidity, gas, fire, intruder, and others, to an Android smartphone or GSM mobile. Control and monitoring systems are in place to ensure that everything goes according to plan by constantly monitoring it. For monitoring purposes, several electronic sensors may be utilized. The controlled values can also be used as recorded values. Sensor readings might be contrasted with target boundaries. The control circuit will intervene to adjust the designated action until the target values are once again met if the data from the sensors is found to be inconsistent with them. When designing a system to keep raw food fresh for a longer period of time, we recommend taking this approach. A smart food monitoring system's goal is to keep an eye on food supplies and protect them from rotting due to unanticipated weather changes. Food that is safe and clean needs to be available to everyone. Among the various likely reasons for food contamination, changes in both temperature and moistness frequently assume a critical part. It is impossible to overstate the importance of a monitoring system that can monitor changes in temperature and humidity throughout shipping and warehousing. The food we eat now affects nearly everyone negatively; this isn't just an issue with cheap food, yet with all pre-bundled feasts, veggies, and things used consistently, since they all need quality because of changes in temperature, dampness, and oxygen content. 12 Food spoilage is also exacerbated when food is not properly frozen or refrigerated. A smart food monitoring system ensures that stored food remains safe by monitoring and adjusting a wide range of factors related to food components. The electronic sensors in the capacity units identify changes in the circumstances that influence the food. The creation of control circuits to address the issue of unfavourable conditions in food storage is an essential component of this concept. A control mechanism can be set up whenever there is a need for a change. Each container's exact quantity of uncooked food will be revealed by quantity control checks. Quality checking information might be utilized to help the client endlessly store food. As a result, a communication technology of some kind is required to keep the user informed about quality monitoring. As a result, establishing a wireless sensor network is essential. There are a few techniques for correspondence available to one these days. speed of data transfer, dependability, and other factors are all aspects that distinguish these different technologies from one another. A communication protocol that makes it possible for users to retrieve data from any location would be beneficial for this system. The user is able to make any necessary adjustments while physically close to the device and check in on their storage from anywhere. IoT and GSM might be the best information move technique in light of the previously mentioned models. This may keep the user informed about its precise contents if the food storage is located far away. It is suggested that Bluetooth and GSM innovations be utilized as a feature of a Savvy Food Checking Framework, a use of the Web of Things.

CONCEIVED APPROACH

A device for monitoring temperature, humidity, gas levels, intruder alarms, and other environmental conditions will be developed as part of this thesis. The board used to develop the contraption is the generally utilized Arduino UNO. There are a number of sensors, such as a temperature monitor (LM 35), a gas sensor (MQ2), an intrusion detector (IR), a fire detector (LDR), and others, are plugged into the Arduino board. This Internet of Things device sends a text message to a nearby Android smartphone via GSM and Bluetooth to send data from its sensors. An Arduino is connected to Bluetooth and GSM modems in order to send data to the right places. Additionally, a character LCD connected to the Arduino UNO displays data from the sensors. The Internet of Things platform used to track sensor data is Freeboard. The Web of Things empowers continuous, remote observing of any ecological component influencing food stockpiling. A large amount of monitoring and quality control equipment can be set up at a single location. The Arduino Sketch, which is installed on the device and is in charge of receiving sensor data, transforming it into strings, displaying it on the LCD, and transmitting it over the Internet of Things platform, is responsible for putting the project's various components into action. The Arduino IDE is utilized to make, construct, and transfer the Sketch.

LITERATURE SURVEY

A smart food monitoring system ensures that stored food remains safe by monitoring and adjusting a wide range of factors related to food components. The electronic sensors in the capacity units identify changes in the circumstances that influence the food. Anticipating the fundamental part of this idea is the utilization of control circuits to resolve the issue of horrible circumstances in food capacity. A control mechanism can be set up whenever there is a need for a change. Food that is safe and clean needs to be available to everyone. Among the various likely reasons for food contamination, changes in both temperature and moistness frequently assume a critical part. It is impossible to overstate the importance of a monitoring system that can monitor changes in temperature and humidity throughout shipping and warehousing. The food we eat now affects nearly everyone negatively; this isn't just an issue with cheap food, yet with all pre-bundled feasts, veggies, and things used consistently, since they all need quality because of changes in temperature, dampness, and oxygen content. Insufficient refrigeration or freezing additionally adds to food deterioration. Control and monitoring systems are in place to ensure that everything goes according to plan by constantly monitoring it. For monitoring purposes, several electronic sensors may be utilized. The controlled values can also be used as recorded values. Sensor readings might be contrasted with target boundaries. On the off chance that the information from the sensors is found to be conflicting with the objective qualities, the control circuit will intercede to change the assigned activity until the objective qualities are by and by met. When designing a system to keep raw food fresh for a longer period of time, we recommend taking this approach. A smart food monitoring system's goal is to keep an eye on food supplies and protect them from rotting due to unanticipated weather changes. 18 This project makes use of a variety of sensors and monitors to keep track of how perishables are stored. These include an Arduino, a DHT-11 temperature and humidity sensor, a gas sensor, a fire alarm, and a GSM and Bluetooth module. Transfers are utilized to defend put away food from potential deterioration chances. Accordingly, we can watch out for the circumstances in the ice chest and ensure nothing turns out badly. It is also possible to determine the state of the food that is stored, such as whether or not it is still edible. There is a Bluetooth interface in the android cell phone that sends us caution messages on the off chance that there are any expected risks in our nearby area. The relays will be triggered automatically. No more entertainers are expected for this succession. In a food storage system that is used for monitoring, ZigBee and Bluetooth are used as a part of a controlling platform. Additionally, a PIC microcontroller is used to carry out this. The suggested system interfaces the Arduino UNO board, a common prototyping board, with a number of sensors, including the LM 35 for temperature monitoring, the MQ2 for gas detection, the IR sensors for intrusion detection, the LDR for fire detection, and so on. To send information to the ideal locations, Arduino is associated with GSM and Bluetooth modules. We can send the data from our sensors to our Android phone using Bluetooth and a GSM module. Data are also shown on the LCD.

HARDWARE REQUIREMENTS FOR PROJECT ANALYSIS

The Gadgets Market in Hyderabad gave the vital coordinated circuits in general (ICs) and other key parts for this endeavor. The ICs' details, known as information sheets, are recovered on the web. The accompanying internet based assets can be investigated for collecting the previously mentioned records.

1. www. Texas Instruments.com
2. www. National semiconductors.com
3. www. Fairchild semiconductors.com

The components used in the project work are as follows:

1. Arduino Micro Controller
2. Bluetooth
3. GSM Module
4. Voltage Regulator IC 7805
5. BC 547 NPN Transistor
6. IR Sensors
7. LM567 Tone Decoder
8. 555 Timer Chip
9. Humidity Sensor
10. MQ2 Gas Sensor
11. LM 35 Temperature Sensor
12. Fire Sensor
13. Relays
14. Android
15. Liquid Crystal Display (LCD)

GSM Network Design Overview

The Global System for Mobile Communications (GSM) mobile telephony service is built on a network of radio cells that are connected to each other and span the entire service area. These radio cells allow subscribers to make and receive calls from any location in the network. Radiophones could only have one transmitter for the entire service area without this cellular concept. Cellular telephony stands out from radiophone service because it uses multiple smaller transmitters to cover the same area as a single larger transmitter. What to do when a phone user in one cell suddenly leaves that cell's coverage area is the primary issue. The huge inclusion region of the radiophone administration was an immediate consequence of the failure to determine call dropouts. In cell phone frameworks, the issue is settled by giving the call to the following cell. This is a hands-off operation that doesn't need anyone to help. However, it does include a complicated technological task that needs a lot of computing power to finish quickly. The three most important parts of the GSM system's functional architecture are the Mobile Station, the Base Station Subsystem, and the Network Subsystem. Operational entities make up each subsystem and use predetermined protocols to exchange data across interfaces. The 68 subscriber carries the mobile station, and the radio connection to the mobile station is managed by the base station subsystem. The central node of the network subsystem, the Mobile services Switching Center, is in charge of managing mobile services and call switching between mobile and other fixed or mobile network users.

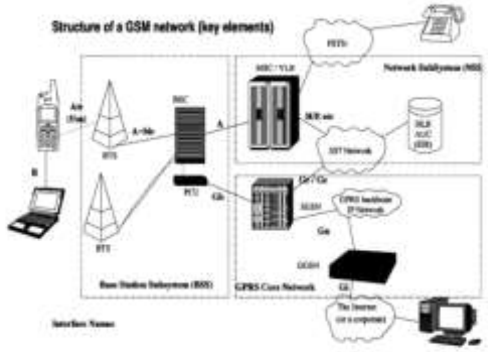


Fig 1: Structure of a GSM network

Utilizations of GSM Modem GSM is world's most popular Portable stage. Cell phones with SIM cards use GSM innovation to assist you with speaking with your family, companions and business partners.

PRINCIPLE OF OPERATION

Block diagram

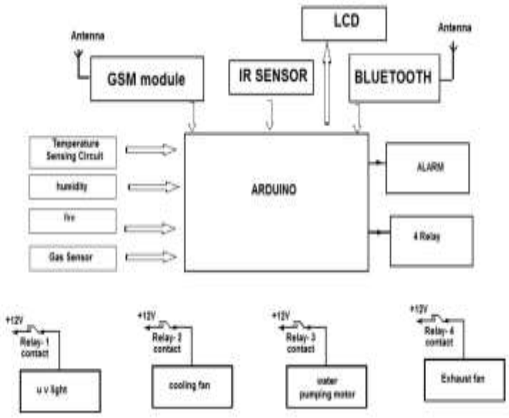


Fig 2: Block diagram for food storage

The food storage monitoring system is shown in action in the functional block diagram that is included. Various sensors and different gadgets are communicated with an Arduino microcontroller in this block graph. A gas (DHT-11) sensor, an infrared (IR) sensor, a fire (FS), and a GSM module are among these. The Arduino UNO is the framework's essential regulator. The embedded code is received by the Arduino UNO, and its operation varies depending on the code's action and the outputs from the various components. When attempting to communicate with someone who is physically separated by a significant distance, the Bluetooth module's limited range presents a challenge. We can get an idea of how the food is doing and how the storage conditions are holding up as long as we are within Bluetooth range of the system.

Therefore, if we want to know the food conditions while we are far away from it, GSM, which has a SIM slot through which a SIM card can be asserted and the numbers that have been fed into that SIM receive a message in the event of an alert, would be extremely beneficial. Different sensors are implanted all through this framework; Please inform us of their particulars. To begin, we take temperature and relative humidity readings from the DHT 11 Sensor. When storing perishable goods, this humidity sensor monitors the relative humidity of the air and turns on an exhaust fan if it rises above acceptable levels. If a temperature measuring instrument detects an imbalance, a cooling fan is utilized. Since there is plausible of the bugs getting into the framework, we've introduced UV lights to kill them. If an intruder is detected, a buzzer will sound and an infrared sensor will go into action. The GAS sensor has the ability to sound an alarm in response to the off-gassing gases produced by spoiled food. A siphoning engine and a smoke alarm cooperate to keep a fire from spreading in a storage space.

WORKING

The transformer powers all other devices and serves as the primary source of electrical power. The Arduino uno fills in as the framework's mind, gathering information from the numerous hubs and handling it to track down arrangements. It works on a 12V power source, equivalent to any remaining parts. This project utilized both GSM and Bluetooth modules; The first is better for shorter distances, while the second is more useful when text alerts allow us to monitor the system even when we are physically separated from it. The GSM module houses the SIM card, which is where we enter the contact data for the beneficiaries. The DHT-11 sensor tracks the ideal stickiness and temperature range for saving food. An alert with the text "ALERT, HIGH TEMP, COOLING FAN IS ON" will be sent to our phones if the room temperature rises above 35 degrees Celsius. The cooling fan will turn on automatically to bring the temperature back down to a safe level. Additionally, we will be able to see the temperature expressed in degrees Celsius on an LCD screen. The humidity threshold has been set at 50%; If it goes above that, the exhaust fan starts and the user gets a message that says "ALERT, HIGH HUMIDITY, EXHAUST FAN IS ON."

Indicator HM:

The relative humidity and temperature will be displayed in percentages on the LCD screen, and once the environment has stabilized, the ventilation fans will stop blowing cold air in and hot air out. In the event of a fire, the pumping motor will start and use high-velocity air to put out the flames. An admonition, for example, "ALERT, FIRE Distinguished, SPRINKLER IS ON" is likewise sent when a fire is identified. The fire data are displayed as FIRE: Indeed/NO on the LCD screen. The presence of exhaust demonstrates that the feast has turned sour. "ALERT, GAS DETECTED" notifications are pinging us from our mobile devices in this circumstance. The G: LCD displays use the Y/N format. At the point when the caution is actuated, the UV lights will kill any undesirable guests. The IR sensor is used to locate any intruders. An alarm message such as "ALERT" is sent when an intruder is detected. Information is displayed on LCD in the form of I: Y/N.

FEATURES AND DEFECTS

ADVANTAGES

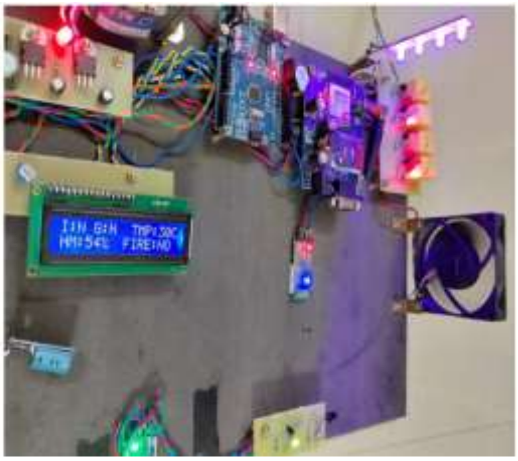
- Collecting precise data automatically
- Adaptable detailing that works with cross-area and authentic information examination.
- To avoid and prevent outbreaks of foodborne disease, accurate information regarding the handling and safety of each food item is essential.
- By maintaining records manually and immediately notifying management of issues like forgotten checklists and unsafe food temperatures, we can avoid potentially disastrous outcomes caused by human error.
- Protection of stored food from fire, unauthorized access, and other dangers.
- This helps to maintain a safe environment.
- You can send a text message to see how much food is available, no matter how far away you are.
- There is no need for a human operator because this monitoring system operates on its own.
- Fans might be utilized to direct the temperature and ventilation can eliminate overabundance dampness from the air.

DISADVANTAGES

- Bluetooth cannot be used for system-wide communications because it is a short-range wireless technology.
- The construction of the components is difficult and costly.
- If the environment in which the food is stored is unbalanced, it may result in food spoilage.

RESULTS

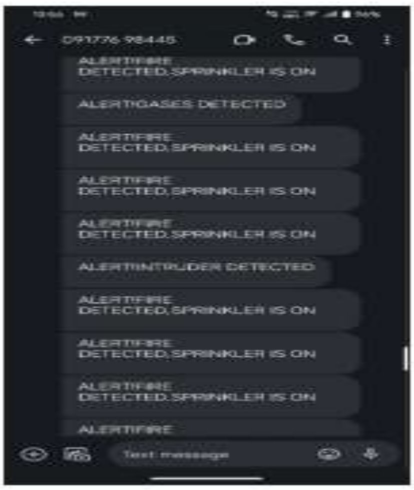
HUMIDITY



If the humidity parameter is greater than 50%, we can see HM: above 50% and then the exhaust fan gets on. After the humidity gets stable cooling fan comes into off state.

FIRE SENSING

If fire is detected through fire sensor in the system then the sensor becomes LOW indicating it's been activated and sends an input to Arduino. In LCD it is displayed as FIRE:YES. If there is no fire then it shows as NO.



The fire alert message received in our mobile phones.

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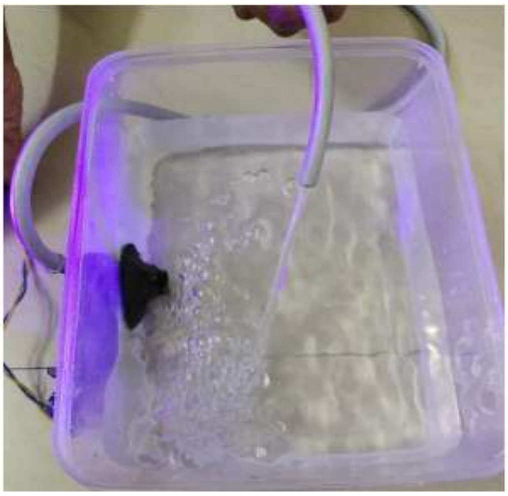
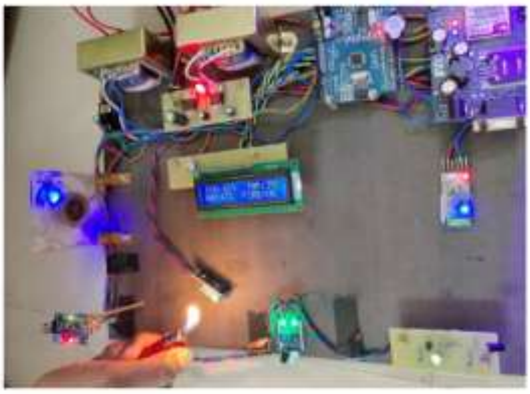


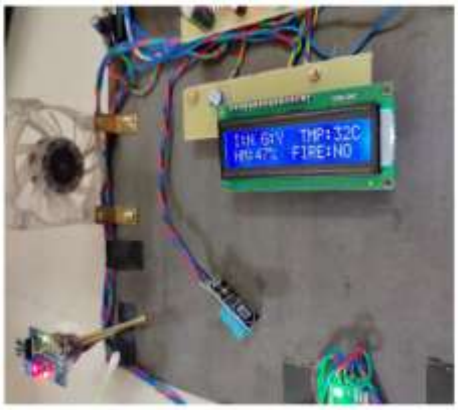
The pumping motor gets on when fire is detected and comes to off state when fire is been controlled.

TEMPERATURE SENSING



If the temp is greater than or equal to 35 degrees centigrade the cooling fan gets ON. The temperature is displayed in LCD.

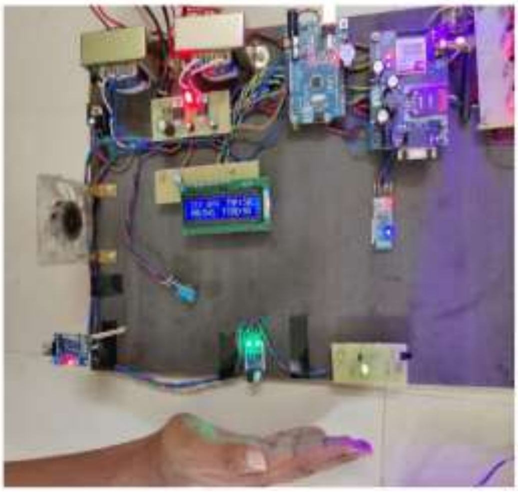
GAS SENSING



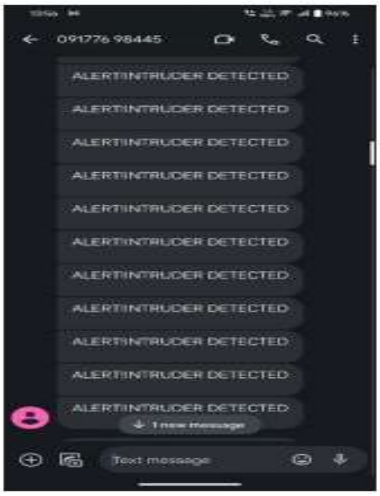
The gas sensor is activated when it detects the unpleasant gases from the food and G: Y is displayed on LCD.

The gas alert message is received to our mobile phone. The messages are received through GSM module.

IR SENSING



If an intruder is detected IR sensor gets activated and we receive a message to mobile.



CONCLUSION

The project work has been created and developed successfully; The results of the construction of a prototype module for demonstration purposes have been deemed acceptable. We propose an electronic item plan for safe food stockpiling with the choice of client notices, and we term it the savvy food observing framework. The research's main idea is to use a network of inexpensive sensors to monitor the quality and quantity of raw food and notify users of any changes. This idea's working model has been constructed and its design has been thoroughly investigated. The first and most crucial duty is to prepare the software to perform the tasks based on the inputs. The machine's output is solely controlled by the controller's software (code). This technology could only be used to make the prototype module; more headways are expected to make a completely practical framework. At the moment, the biometrics industry is expanding and developing rapidly. Electronics have improved precision and safety when applied to biological issues. Biometric sensors might work on the exactness and accuracy of a savvy food checking framework. The quality and health of the food can be assessed by a variety of biometric sensors. A pH meter, for example, can be used to determine a substance's pH. Milk and different beverages might utilize this information to check their immaculateness. As a result, liquid food storage may be added. Similar to this, a number of biometric sensors can be used to precisely detect biological changes in the characteristics of food. The food industry could be changed forever by a smart storage system with multiple containers, sensors, and a central compressor-powered cooling unit. From a product standpoint, expanding on this idea has the potential to assist individuals.

REFERENCES

[1]. Ki-hwan Eom, Chang Won Lee, Nghia Truong Van, Kyung Kwon Jung, JooWoong Kim and Woo Seung Choi “Food Poisoning Prevention Monitoring System Based on The Smart RFID Tag System” InInternational International Journal of Computer Applications (0975 – 8887) Volume 148 – No.12, August 2016 4 Journal of Multimedia and Ubiquitous Engineering Vol.8, No.5 (2013), Pp.213-222.

[2]. Rajesh Kumar Kaushal, Harini. T, Pavithra Lanced, Sandhya.T, Soniya.P, “IoT Based Smart Food Monitoring System”, International Journal Of Current Engineering And Scientific Research, Vol 6, Issue 6, 2019, pp. 73-76.

[3]. Mir Sajjad Hussain Talpur, Soofia Khan etal “IoT based grain storage monitoring with android application” Int. J. Adv. Trends Comput. Sci. Eng., Volume 10, No.2, March-April 2021.

[4]. H. Fan, Theoretical Basis and System Establishment of China Food Safety Intelligent Supervision in the Perspective of Internet of Things, in IEEE Access, vol. 7, pp. 71686-71695, 2019.

[5]. E. A. G. K. A. V. Robert N. Dean, Jeffery D. Craven, A pcb sensor for status monitoring of stored food stocks, in IEEE Sensors Letters, vol. 3, 2019.

[6]. Ove Schimmer1, Frank Daschner2 And Reinhard Knöchel „Uwb-sensors In Food Quality Management – The Way From The Concept To Market” PROCEEDINGS OF THE 2008 IEEE INTERNATIONAL CONFERENCE ON ULTRA-WIDEBAND (ICUWB2008), VOL. 2

[7]. Saleem Ulla Shariff , M. G. Gurubasavanna, C. R. Byrareddy, “IoT-Based Smart Food Storage Monitoring and Safety System”, International Conference on Computer Networks and Communication Technologies, 2018,pp. 623-638.

[8]. F. Kamoun, O. Alfandi and S. Miniaoui, "An RFID Solution for the Monitoring of Storage Time and Localization of Perishable Food in a Distribution Center”, Global Summit on Computer & Information Technology, 2015, pp. 1-6.

[9]. Li Lijuan and Minchai Hao, "The mathematical model of food storage safety monitoring and control system”, International Conference on Computer Application and System Modeling, 2010, pp. 591-594.

[10]. Kaushik S, Singh C (2013) Monitoring and controlling in food storage system using wireless sensor networks based on zigbee & bluetooth modules. Int J Multidisc Cryptol Inf Secur 2(3):7–10.

[11]. R. K. Kodali, J. John and L. Boppana, IoT Monitoring System for Grain Storage, in 2020 IEEE International Conference on Electronics, Computing and Communication Technologies (CONECCT), 2020.

[12]. Srivastava, A., Paliwal, K., Reddy, S.R.N.: Smart food tracker—smart monitoring system for food safety. In: National Conference on Product Design (NCPD 2016), July 2016.

[13]. D. Roy Choudhury, Shail B. Jain, “Linear Integrated Circuits”, New Age International (p) Ltd., Second edition, 2004.

