

COLD STORAGE MANAGEMENT SYSTEM FOR FARMERS USING IOT (INTERNET OF THINGS) TECHNOLOGY

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Technology degree in Information Technology

by

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**DEPARTMENT OF INFORMATION TECHNOLOGY
SCHOOL OF COMPUTING**

SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Accredited with Grade "A" by NAAC

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MARCH - 2021



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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **S.KARTHICK (37120038)** who carried out the project entitled "**CLOUD STORAGE MANAGEMENT SYSTEM FOR FARMERS USING IOT**" under my supervision from November 2019 to April 2020.

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ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to **Board of Management** of **SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to **Dr. T.Sasikala M.E., Ph.D, Dean**, School of Computing, **Dr.R.Subhashini M.E., Ph.D. , Head** of the Department of Information Technology for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Guide Dr./Mr.**SRINIVASULU PHD** for his valuable guidance, suggestions and constant encouragement paved way for the successful completion of my project work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the **Department of Information Technology** who were helpful in many ways for the completion of the project.

ABSTRACT

India is one of the largest producers of agricultural products having diverse agro climate zones across the country with vast range of agricultural products. The

reprehensible storage results in high losses in grains, 30% of fruits and vegetables grown. Natural contamination of food grains is greatly influenced by environmental

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factors such as type of storage structure, gases etc. During storage, quantitative as well as qualitative losses occur due to insects, rodents, and microorganisms. To address the issues of the above concern, we propose Cold Storage Management System (CSMS) for farmers that will implement a framework based on IOT (Internet of Things) technology by using heterogeneous IOT devices. The system involves various parameters such as storage level, gases for longer time to protect the integrity. The proposed information system also analyses the data to report abnormal status of crop yield during the monitoring process. So, the cold storage management system with IOT can be a ground breaking solution operated with low cost in short time interval, hence enhancing the crop availability obtain-ability throughout the year. Key Words: CH₄, Co₂ NH₃, Smoke, IOT,

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List of Abbreviations

IR	I nfra R ed
LED	L ight E mitting D iode
PIN	P ort I nput R egister
IOT	I nternet O f T hings

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CHAPTER 1

1.1 INTRODUCTION

The main idea of this concept is to overcome the time complexity and lack of detailed observation which is faced in preserving the crop yield using cold storage management system to stock up the food products or agricultural yields for a longer period. In this proposal we implement a framework for cold storage management system based on IoT (Internet of Things) technology by using heterogeneous IoT devices. This is used to preserve the parameters of yield such as gases and storage level for longer period. This information system also analyzes the data to report abnormal environmental status and jeopardizes during the storing process. So, the cold storage management systems can be innovative and operated with low cost and in short time interval, hence enhancing the crop obtainability all through the year.

1.2 OBJECTIVE

To help farmers by preventing the loss of quality in crop yields. The FAO (Food and Agricultural Organization) Cold Chain Management System can increase crop availability during the seasons by monitoring crop yields and reducing time management. In the field of agriculture, to increase the heterogeneity of yield and make it easily accessible to farmers at a low cost. Farmers and the government will also increase their income by using low-cost technologies to maintain their yields. The farmer and organization can check on the status of crop yields, and the shelf life of food products is increased.

CHAPTER 2

LITERATURE SURVEY

2.1 DETECTION OF FOOD QUALITY AND QUANTITY AT COLD STORAGE USING IOT

Through this paper, we have presented a low-cost cold storage management system based on IoT to overcome the difficulties of keeping track of food quality and quantity. Our proposed approach makes use of heterogeneous IoT devices, cloud services, and an Android application. To keep track of food quantity we have used UV Sensor which gives us the occupancy of the box in which food is kept from which food quantity can be calculated and a MQ4 gas sensor is to detect methane gas in the atmosphere which tells the quality (freshness) of the food. Based on experiments conducted we observed that our proposed model accurately detected food quantity and whenever food started degrading it alerted about it instantly thereby indicating about food quality.

2.2 IGLOOS MAKE THE COLD BEARABLE: A NOVEL HDD TECHNOLOGY FOR COLD STORAGE

The trend of storing (and retaining) everything continues as the rate of data generation grows dramatically. For the organizations that store and retain this data indefinitely, the cost grows proportionally with the increase in data generation. Furthermore, studies have shown that the bulk of this data typically becomes write once read infrequently, or worse never. The cost to store this data therefore pushes organizations away from always on storage like SSDs and HDDs to archival storage technologies like tape. However, the limitations of technologies like tape tend to push cold data to read never workloads, reducing the value of the stored data. The Igloo storage device serves to fill this need of affordable and accessible cold data storage. The novel design of the Igloo allows for a data dense device that services 15 times more data than a conventional enterprise class hard drive, while consuming only slightly more power than that same device. Our results show that the Igloo is suitable for cold

data workloads while remaining remarkably power efficient. The most power consuming workloads show an average power utilization of only 300 watts for a 4.8 petabyte storage cluster over a simulated six month workload

2.3 DESIGN AND IMPLEMENTATION OF KIWI FRUIT COLD STORAGE MANAGEMENT SYSTEM BASED ON RFID

Different varieties of kiwifruit have different storability, but in the same kind of kiwifruit, the late maturing variety is generally more storable than the medium maturing variety, and the medium maturing variety is more storable than the early maturing variety. Therefore, it is necessary to classify and manage the storage of Kiwifruit in different maturity periods. For the management of large-scale kiwifruit cold storage, kiwifruit variety, maturity, storage time, storage location and other complex information need to be associated. The traditional management of kiwifruit cold storage relies on manual recording of this information, which is time-consuming, laborious, inefficient and unreliable. Therefore, the design of Kiwi cold storage management system to achieve automatic collection and management of Kiwi cold storage information is of great significance. The system takes Kiwi cold storage as an example to design the overall framework, system composition and workflow of RFID system in cold storage management system. Taking RFID technology as the core, on the basis of the traditional management process of cold storage, this paper puts forward the overall design and functional design of the management system of cold storage, which solves the problems of the traditional management of cold storage, such as manual recording of these information, time-consuming and laborious, low efficiency and low reliability, improves the collection of real-time data of goods, and makes the process of warehousing, storage and warehouse out more Convenient.

2.4 IOT BASED SMART COLD STORAGE SYSTEM FOR EFFICIENT STOCK MANAGEMENT

In the era of smart technology Internet of things interconnect real world sensors to the internet. Today's cold storages are far more than just a facility to store inventory. In this paper we propose a "smart cold storage" by leveraging the latest supply chain

technology and the IOT, which will serve as a hub to improve the efficiency and speedup the process throughout the entire supply chain. This proto type incorporates an IOT based smart cold storage that interacts with the items stored within, collects the information about them and process this information into relevant data. The objects placed inside the smart cold storage will be detected and identified using a web camera. Load cell with HX711 IC driver is used to calculate the Weight of the objects. Raspberry Pi-3 B+ collects data from the ARDUINO and analyzes the data using python programming and transmit the stock information to the users through mobile application. It gives an alert to the users to place an order if the weight falls below the threshold value, i.e If there is any shortage or out of stock of the objects. LM35 IC Temperature sensor is used to monitor the Temperature of the storage system. This proto type will reduce the use of manual labour increasing speed and shipping accuracy, and offer retailers an opportunity to obtain unparalleled visibility into inventory and supply chains

2.5 COMPUTERIZED AGRICULTURAL STORAGE MANIPULATION SYSTEM USING IOT TECHNIQUES

In this paper, a smart storage system is developed for agricultural purpose using IOT in order to observe and maintain storage environment both manually and automatically. Ethernet shield for Arduino is used to store data in MySQL database and the communication with the sensor data and web server is established. The mobility is increased with help of android devices via android app. Observing and scheming can be done from website or android app. Privacy and security issues makes it more secured with the help of web application. The system is verified and tested on current environment and result was as expected.

CHAPTER 3

METHODOLOGY

3.1 Proposed system

Nowadays farmers are facing huge losses due to some storage requirements which are not being fulfilled and due to lack of access to affordable refrigeration systems. Hence we have come up with a project where in all the crops are being monitored in real time with the help of sensors. Basically this project uses Nodemcu which acts as a microcontroller as well as server and sensors like, smoke and IR sensor. All these sensors can be easily controlled with the mobile through a web application. This project helps us to monitor in real time and allows the user to control the changes if required. Here the methods we used to monitor the cold storage are

- Qualitative vs. Quantitative approach
- Conceptual vs. Empirical approach

3.1.1 Qualitative vs. Quantitative approach

The methodology of CSMS used to preserve the quality parameter of crop such as (decay time, temperature parameter, sensor parameter etc.) for longer period, hence enhancing the crop availability throughout the year. CSMS helps to facilitate the farmers to sell and cultivate the quality of yield whenever customer requirement encountered. The quantitative approach used will improve the crop storage capacity for the farmers as well as FAO (Food and Agriculture Organization) at larger scale. Descriptive vs. Analytic approach The methodology of CSMS uses analytical approach as it has the facts and information already available. We analyze the current status of crops and take appropriate measures to prevent crop loss. In the descriptive approach, the behavior of crops is evaluated by surveying in different agencies, FAO (Food and Agriculture Organization) and food storage yards. Applied vs. Fundamental approach The methodology of CSMS is the action based on research conducted at various food sectors. Applied research aims at finding a solution for immediate problem faced by

different agricultural organizations and food sectors. CSMS model solves economic problems faced by farmers due to harvest loss by preserving the quality of food products in cold storage for a longer time.

3.1.2 Conceptual vs. Empirical approach

The methodology of CSMS uses empirical approach as it is based on the observation done by evaluating yields in CSMS. This enhances the crop availability throughout the year. This approach aims at preserving the quality of food products and meets the economical requirements. Client and Server Architecture In CSMS Client-Server architecture, laptop is used as server and Android device being used as client. We use client-server architecture as another methodology. Client sends the request to server. Server contains all the required information regarding the crop yield in the CSMS compartment. The server sends requested information to the client/ farmer to access, review and monitor the agricultural products.

3.2 HARDWARE AND SOFTWARE SPECIFICATION

The requirements specification is a technical specification of requirements for the hardware products. It is the first step in the requirements analysis process it lists the requirements of a particular hardware system including functional, performance and safety requirements. The requirements also provide usage scenarios from a user and an operational perspective. The purpose of hardware requirements specification is to provide a detailed overview of the hardware project, its parameters and goals. This describes the project target and its user interface, hardware and software requirements.

3.3 Hardware Requirements

- Power Supply
- IoT Module (Nodemcu)
- IR sensor
- Gas SENSOR

3.3.1 Power Supply

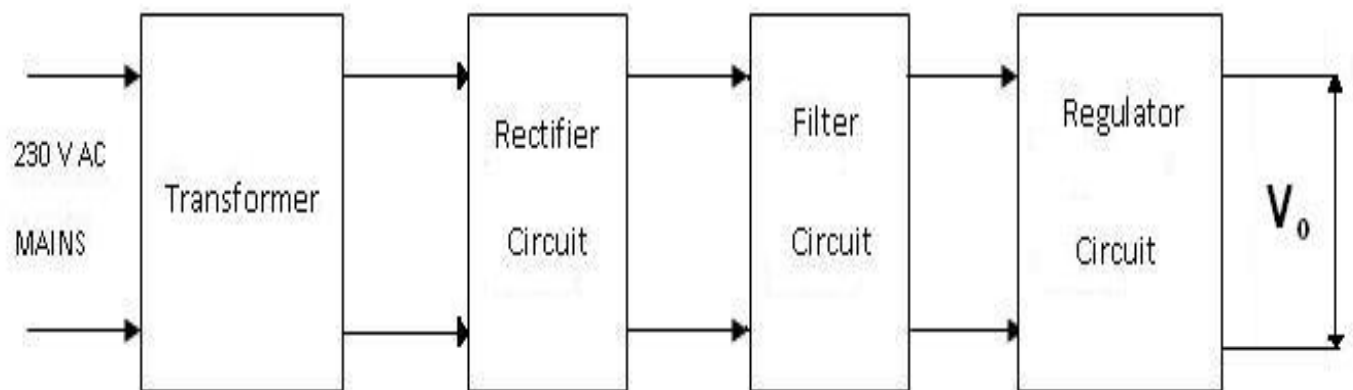


Fig 3.1 Block diagram of power supply

The given block diagram includes following

3.3.1.1 Transformer

A transformer is an electro-magnetic static device, which transfers electrical energy from one circuit to another, either at the same voltage or at different voltage but at the same frequency.

3.3.1.2 Rectifier

The function of the rectifier is to convert AC to DC current or voltage. Usually in the rectifier circuit full wave bridge rectifier is used.

3.3.1.3 Filter

The Filter is used to remove the pulsated AC. A filter circuit uses capacitor and inductor. The function of the capacitor is to block the DC voltage and bypass the AC voltage. The function of the inductor is to block the AC voltage and bypass the DC voltage.

3.3.1.4 Voltage Regulator

Voltage regulator constitutes an indispensable part of the power supply section of any electronic systems. The main advantage of the regulator ICs is that it regulates or maintains the output constant, in spite of the variation in the input supply.

3.3.1.5 Voltage Regulation

- Two basic categories of voltage regulation are:
 - line regulation
 - load regulation
- The purpose of line regulation is to maintain a nearly constant output voltage when the input voltage varies.
- The purpose of load regulation is to maintain a nearly constant output voltage when the load varies

3.3.1.6 Types of Regulator

- Fundamental classes of voltage regulators are linear regulators and switching regulators.
- Two basic types of linear regulator are the series regulator and the shunt regulator .
- The series regulator is connected in series with the load and the shunt regulator is connected in parallel with the load.

3.3.1.7 IC Voltage Regulators

- Regulation circuits in integrated circuit form are widely used.
- Their operation is no different but they are treated as a single device with associated components.
- These are generally three terminal devices that provide a positive or negative output.
- Some types have variable voltage outputs.
- A typical 7800 series voltage regulator is used for positive voltages.
- The 7900 series are negative voltage regulators.
- These voltage regulators when used with heatsinks can safely produce current values of 1A and greater.
- The capacitors act as line filtration.
- Several types of both linear (series and shunt) and switching regulators are available in integrated circuit (IC) form.
- Single IC regulators contain the circuitry for reference source, comparator amplifier, control device and overload protection
- Generally, the linear regulators are three-terminal devices that provides either positive or negative output voltages that can be either fixed or adjustable

3.3.1.8 Fixed Voltage Regulator

- The fixed voltage regulator has an unregulated dc input voltage V_i applied to one input terminal, a regulated output dc voltage V_o from a second terminal, and the third terminal connected to ground.
- The series 78XX regulators are the three-terminal devices that provide a fixed positive output voltage.

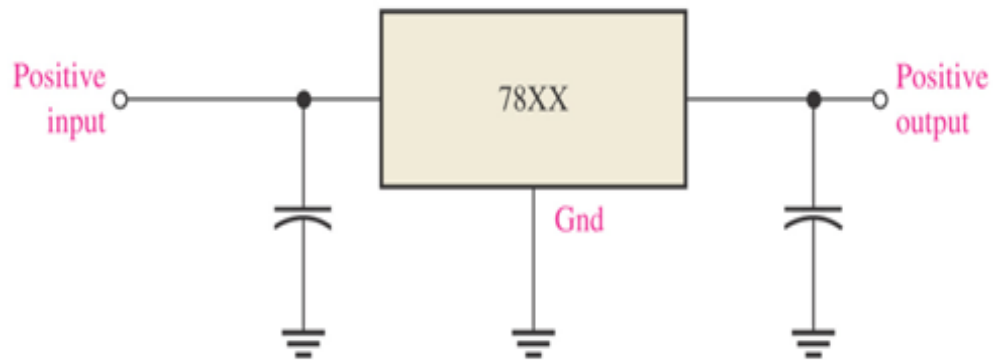


Fig 3.2 voltage Regulator pin configuration

- An unregulated input voltage V_i is filtered by a capacitor C_1 and connected to the IC's IN terminal.
- The IC's OUT terminal provides a regulated +12 V, which is filtered by capacitor C_2 .

The third IC terminal is connected to ground (GND)

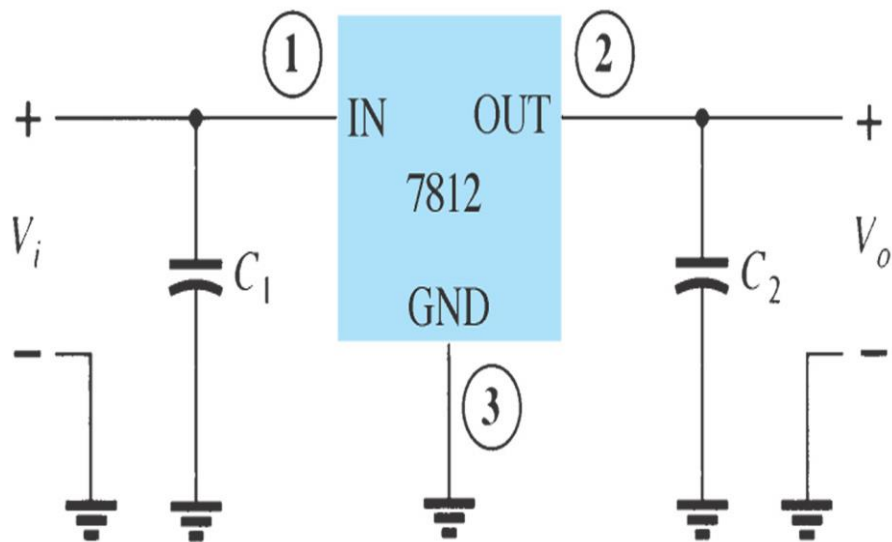


Fig 3.3 Regulator ground pin

- Voltage regulators keep a constant dc output despite input voltage or load changes.
- The two basic categories of voltage regulators are linear and switching.

- The two types of linear voltage regulators are series and shunt.
- The three types of switching are step-up, step-down, and inverting.
- Switching regulators are more efficient than linear making them ideal for low voltage high current applications.
- IC regulators are available with fixed positive or negative output voltages or variable negative or positive output voltages.
- Both linear and switching type regulators are available in IC form.

3.3.2 IoT (INTERNET OF THINGS)

3.3.2.1 Definition

The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

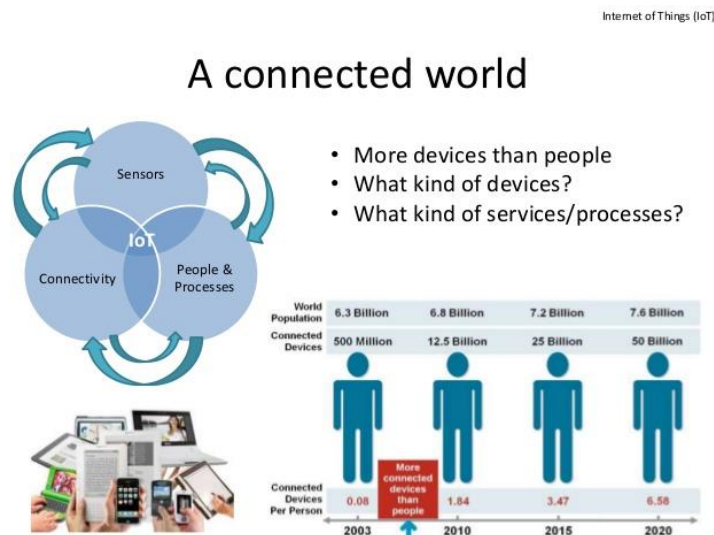


Fig 3.4 Explanation of Internet of Things (IoT)

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

Experts estimate that the IoT will consist of about 30 billion objects by 2020. It is also estimated that the global market value of IoT will reach \$7.1 trillion by 2020.

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

"Things", in the IoT sense, can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, cameras streaming live feeds of wild animals in coastal waters, automobiles with built-in sensors, DNA analysis devices for environmental/food/pathogen monitoring, or field operation devices that assist firefighters in search and rescue operations. Legal scholars suggest regarding "things" as an "inextricable mixture of hardware, software, data and service". These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices.

The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

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3.3.2.2 Wi-Fi Module



Fig.3.5 ESP8266 Wi-Fi Module

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the dev kits.

3.3.2.3 ESP8266 Arduino Core

As Arduino.cc began developing new MCU boards based on non-AVR processors like the ARM/SAM MCU and used in the Arduino Due, they needed to modify the Arduino IDE so that it would be relatively easy to change the IDE to support alternate tool chains to allow Arduino C/C++ to be compiled down to these new processors. They did this with the introduction of the Board Manager and the SAM Core. A "core" is the collection of software components required by the Board Manager and the Arduino IDE to compile an Arduino C/C++ source file down to the target MCU's machine language. Some creative ESP8266 enthusiasts have developed an Arduino core for the ESP8266 Wi-Fi SoC that is available at the GitHub ESP8266 Core webpage. This is what is popularly called the "ESP8266 Core for the Arduino IDE" and it has become one of the leading software development platforms for the various ESP8266 based modules and development boards, including NodeMCUs.

3.3.2.4 The Button

The Button is a Wi-Fi connected push button designed by Peter R Jennings. The Button is designed for single-purpose, internet-enabled functions. When the button is pressed, a connection is made to a web server which will perform the desired task. Applications include a doorbell or panic button.

3.3.2.5 NodeUSB

NodeUSB is an open IoT platform about the size of a standard USB stick. It was designed to leverage NodeMCU (Lua) for easy programming and has the extra feature of USB capability. It is ideal for Plug-n-Play solutions, allowing easy prototyping for developers.

3.3.3 IR Sensor Module

The Multipurpose Infrared Sensor is an add-on for your line follower robot and obstacle avoiding robot that gives your robot the ability to detect lines or nearby objects. The sensor works by detecting reflected light coming from its own infrared LED. By measuring the amount of reflected infrared light, it can detect light or dark (lines) or even objects directly in front of it. An onboard RED LED is used to indicate the presence of an object or detect line. Sensing range is adjustable with inbuilt variable resistor. The sensor has a 3-pin header which connects to the microcontroller board

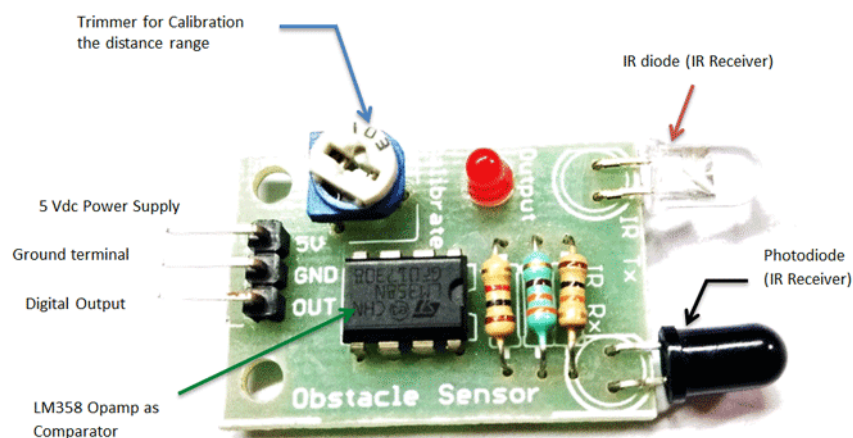


Fig.3.6 IR Sensor

3.3.3.1 IR LED Transmitter

IR LED emits light, in the range of Infrared frequency. IR light is invisible to us as its wavelength (700nm – 1mm) is much higher than the visible light range. IR LEDs have light emitting angle of approx. 20-60 degree and range of approx. few centimeters to several feet, it depends upon the type of IR transmitter and the manufacturer. Some transmitters have the range in kilometers. IR LED white or transparent in colour, so it can give out amount of maximum light.

3.3.3.2 Photodiode Receiver

Photodiode acts as the IR receiver as it conducts when light falls on it. Photodiode is a semiconductor which has a P-N junction, operated in Reverse Bias, means it starts conducting the current in reverse direction when light falls on it, and the amount of current flow is proportional to the amount of light. This property makes it useful for IR detection. Photodiode looks like a LED, with a black colour coating on its outer side, Black colour absorbs the highest amount of light.

3.3.3.3 LM358 Opamp

LM358 is an Operational Amplifier (Op-Amp) is used as voltage comparator in the IR sensor. the comparator will compare the threshold voltage set using the pre-set (pin2) and the photodiode's series resistor voltage (pin3).

Photodiode's series resistor voltage drop > Threshold voltage = Opamp output is High

Photodiode's series resistor voltage drop < Threshold voltage = Opamp output is Low

When Opamp's output is high the LED at the Opamp output terminal turns ON (Indicating the detection of Object).

3.3.3.4 Applications

- Obstacle Detection
- Industrial safety devices
- Wheel encoder

3.3.4 Smoke Sensor

The air quality sensor is also an MQ-135 sensor for detecting venomous gases that are present in the air in homes and offices. The gas sensor layer of the sensor unit is made up of tin dioxide (SnO_2); it has lower conductivity compare to clean hair and due to air pollution the conductivity is increased. The air quality sensor detects ammonia, nitrogen oxide, smoke, CO_2 , and other harmful gases. The air quality sensor has a small potentiometer that permits the adjustment of the load resistance of the sensor circuit. The 5V power supply is used for air quality sensor.

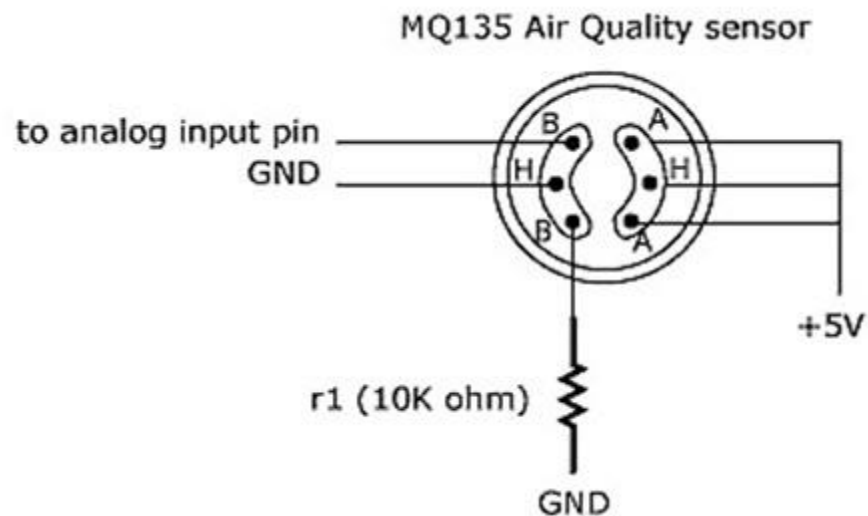


Fig 3.7 MQ – 135 Air Quality Sensor

The air quality sensor is a signal output indicator instruction. It has two outputs: analog output and TTL output. The TTL output is low signal light which can be accessed through the IO ports on the Microcontroller. The analog output is a concentration, i.e. increasing voltage is directly proportional to increasing concentration. This sensor has a long life and reliable stability as well.

3.4 Software Requirements

- Platform – Arduino IDE

3.4.1 Introduction to Arduino IDE

IDE stands for “Integrated Development Environment” :it is an official software introduced by Arduino.cc, that is mainly used for editing, compiling and uploading the code in the Arduino Device. Almost all Arduino modules are compatible with this software that is an open source and is readily available to install and start compiling the code on the go. In this article, we will introduce the Software, how we can install it, and make it ready for developing applications using Arduino modules.

3.4.2 Arduino IDE Definition

The Arduino IDE is a highly customizable program for writing and compiling code for the Arduino Module. It's official Arduino program that makes code compilation so simple that even a non-technical person can get their feet wet with the learning process. It runs on the Java Platform and is compatible with operating systems such as MAC, Windows, and Linux. It has built-in functions and commands that are useful for debugging, editing, and compiling code in the environment. Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro, and many other Arduino modules are available. - one is equipped with a microcontroller.

The key code, also known as a sketch, generated on the IDE platform will eventually produce a Hex File, which will be transferred and uploaded into the board's controller. The IDE ecosystem is made up of two key components: The Editor and Compiler are used to write the necessary code, and the Compiler is used to compile and upload the code into the Arduino Module. Both C and C++ are supported in this environment.

3.4.3 Embedded System & Microcontroller

3.4.3.1 Introduction to Microcontroller Systems

Embedded systems are controllers with on chip control. They consist of microcontrollers, input and output devices, memories etc., on chip and they can be used for a specific application.

A small computer designed in a single chip is called a single chip microcomputer. A single chip microcomputer typically includes a microprocessor RAM, ROM, timer, interrupt and peripheral controller in a single chip. This single chip microcomputer is also called as microcontroller; These Microcontrollers are used for variety of applications where it replaces the computer. The usage of this microcomputer for a specific application, in which the microcontrollers a part of application, is called embedded systems.

Embedded systems are used for real time applications with high reliability, accuracy and precision, Embedded systems are operated with Real Time Operating systems like WinCE, RT Linux, VxWorks, PSOS, etc.,

Embedded systems are very popular these days Most of the Electrical, Electronics, Mechanical, Chemical, Industrial, Medical, Space and many more areas have the embedded systems in their applications

3.4.3.2 Application of Embedded System

- ❖ Embedded systems are used in the following areas;
- ❖ Robotics
- ❖ Aviation
- ❖ Telecommunication and Broadcasting
- ❖ Mobile Phones and mobiles networking
- ❖ Wires Application
- ❖ Satellite Communication
- ❖ Military Application
- ❖ Medical Instruments

- ❖ Toy industries
- ❖ Blue Tooth
- ❖ Electronic sensors
- ❖ Home Appliances etc

3.4.3.3 Role of Embedded Systems

Embedded systems are compact, smart, efficient, and economical and user friendly, they are closed systems and respond to the real world situation very fast, closed system means, everything required for a specific application is embedded on the chip and hence, they do not call for external requirement for their functioning.

3.4.3.4 Segments of Embedded Systems

Embedded systems basically consists of the following four segments

- ❖ Embedded Controllers (8-bit,16-bit,32-bit,64-bit,128-bit,...)
- ❖ Embedded software's (RTOS)
- ❖ Embedded Memories (DRAM, SRAM, EPROM, Flash etc)
- ❖ Embedded Boards

3.4.3.5 Microcontroller Versus Microprocessors

Microcontrollers differ from a microprocessor in many ways, first and the most important is its functionality. In order for a microprocessor to be used, other components for receiving and sending data must be added to it, In short that means that microprocessor is the very heart of the computer.

On the other hand, microcontroller is designed to be all of that in one, No other external components are needed for its application because all necessary peripherals are already built into, thus, we save the time and space needed to construct device.

The difference can be highlighted as follows:

MICROPROCESSORS	MICROCONTROLLER
Contains ALU,GP registers, SP, PC, clock timing circuit and interrupts	In addition, it contains inbuilt ROM, RAM I/O devices, Timers/Counters, etc.,
Many instructions to move data between Memory and CPU	One or two instructions to move data between memory and CPU
One or two bit handling instructions are available	Powerful Boolean processor instruction set is available
Access time for memory and I/O devices are more	Less access time for inbuilt memory and I/O devices
Requires more hardware, increase in PCB size	Requires less hardware, reduced PCB size and increased reliability
More flexible from design point of view	Less Flexible
Single memory map for data and code	Separate memory Map for data and code
Few pins are multifunctional	More pins are multifunctional
Microprocessor based computers are normally operated with general purpose operating systems like Windows, Unix etc..	Microcontroller based systems are normally operated with RTOS like tiny RTOS, VxWorks, PSOS, RT Linux, etc.,

Table no 3.1 Microprocessor vs Microcontroller

3.4.3.6 Cross-Compiler

Cross-compiler is a software program, which is used to convert high –level language program like C to machine language of a specific Microcontroller, using cross-compiler user can write programs in C language, which speeds up the development process.

3.4.3.7 Simulator

Simulator is software, which implements the features of a specific Microcontroller on PC. It helps in testing and debugging the programs and interfaces that are to be actually implemented on a Microcontroller at a later stage. Using simulator, the program can be executed and tested without using the evaluation kit, usually the program is simulated under pc environment.

3.4.3.8 Emulator

Emulator is an in-circuit Microcontroller emulation probe, which provides the user with substantial control over all of the Microcontroller functions and responsibilities. It provides hardware assistance for debugging the most difficult real time problems. Emulators offer visibility into system initialization, before software based debuggers can function, Emulators can identify the code corrupting a data structure, it can also be used to determine how often a particular function is invoked,

3.4.3.9 Debugger

It is a software tool used to debug the programs. A debugger detects the non-workability of the program by detecting the errors online (i.e. while the program is running in the target it has the capability to detect proper functioning of the application program.

Chapter 4

4.1 RESULTS AND DISCUSSION

IOT OUTPUT



KIT PHOTO

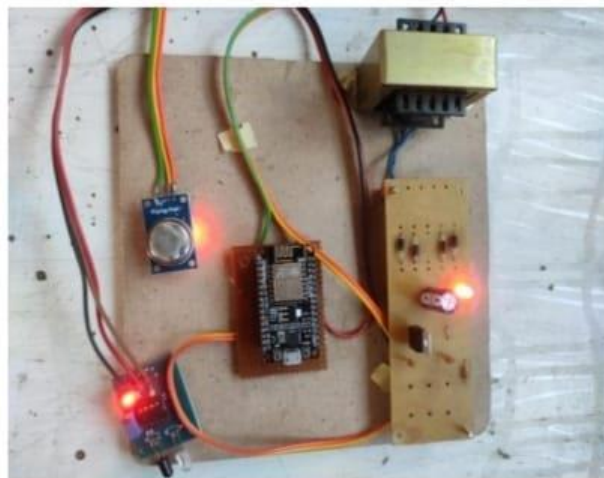


Fig no.3.8 Output Of the Project

Here the storage room contains like gas and spaces of the room will show through mobile phone. Its easy to analysis the status of the cold storage

CHAPTER 5

5.1 CONCLUSION

The warehouses or cold storages fresh food areas generally are divided into several small scale units, which are close to each other. Monitoring nodes consisting of sensors are the leaf nodes of the network, mainly responsible to collect data help prevent food stuffs and food grains from perishing or decaying. All these nodes pass vital environmental information obtained from different sensors to a Central node via wireless communication. The Central node is replicated using Android application based cell phone

This protocol model is planned for checking the environmental conditions of cold storage warehouses. Management of these warehouses is simplified by the use of Internet of Things. These warehouses are consistently monitored in real time by the owner. Wireless monitoring has casted a huge impact on the evolution of new standards and technology in this era of automation. Hence the cold storage monitoring system forestalls the food item stored in it from getting decayed. Automation of schedules is vital for all food safety related task.

5.2 Scope of Future work

Going further, most of the units can be embedded within the controller such as android application, with change in technology thereby improving the detection system. Can be implemented in Real time environmental conditions within cold storage, hence life of food products is extended for a longer period Can be made Easy accessibility for the cold storage using IOT and All the information are stored in database using MySQL.

