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IoT Based Cold Storage Automation

Ramesh Diggewadi[1], Shreays Aaglave[2], Harsh Pandharpatte[3], Sandesh Patil[4], M. N. Patil[5]
Students, Sharad Institute of Technology, Polytechnic Yadrav, Ichalkaranji, Maharashtra, India[1,2,3,4]
Faculty, Sharad Institute of Technology, Polytechnic Yadrav, Ichalkaranji, Maharashtra, India[5]

Abstract: *Across the globes, food and medicine worth billions of dollars are wasted every year primarily because of improper storage and transportation of temperature, humidity, and various gas sensitive goods. To overcome this problem the proposed system is designed to monitor as well as control cold storage parameters. So, the system provides an end-to-end IoT solution to monitor and control using wireless sensors system. The system solution monitors temperature, humidity and various gases like LPG, CO, and Methane, whereas also provide the location coordinates of the warehouse in real time to keep food, vegetables, medicines, and vaccines safe in addition to reduce wastage. This IoT compromises of most advanced sensors and Particle cloud software. The sensor data is sent from node to the base station then will process and displayed on LCD. The data is pushed and stored on particle cloud and can be accessed remotely using a mobile application Blynk. The software allows the control action that is relay to be configured remotely using a mobile application. The device monitors the temperature in cold rooms, refrigerators trucks, restaurant freezers, medical storages, and warehouses in real time. It alerts immediately in case of any temperature excursion. This alerting helps the business to act proactively and eliminate waste and stay compliant to view temperature and location data, whereas the client can set the alert limit using a mobile application. The device also updates data into an excel spreadsheet on time intervals and send a daily email notification. The device is battery operated, dust proof and robust for environmental conditions.*

I. Introduction

Any production or trading has a want to keep their reserves or any useful stuff somewhere. This feature is performed by the means of warehouses or storages in maximum cases. The warehouse can be an open platform, that is used for material storage, or it could also be complicated system, where the products are stored, which calls for observance of certain conditions. With a growth inside the range of warehouses, cold storages, and factories the need for tracking diverse attributes in such factories has turn out to be a thing of exquisite necessity. Automation has become an inseparable part of nowadays for which IoT has emerged as an exceptional platform providing connectivity among various sensors, controllers and internet that allows far-flung tracking and controlling of various environments concern to automation. Approaching IoT design and sensing element permit real-time far-off monitoring and evaluation of a system as well as the opportunity to take instant remedial actions if necessary. This system offers various solutions for such monitoring purposes with serial terminal output on putty, cloud events dashboard, mobile blink dashboard, excel spreadsheet, and email notification. Various warehouse used for storing medicine, food, veggies, etc. have temperature and humidity-controlled environments. Realtime monitoring result will frequently monitor the temperature and humidness of the location. The device will constantly report the statistics on itself and display on the LCD display show in addition to over the cloud, excel spreadsheet, and blink application. The controlling and tracking system will work automatically and will also generate alerts for alert situations. The device will generate alerts if the temperature is going above or under the programmed limits. The system can send day by day or weekly information precise document from excel spreadsheet to email. Each sensor could have one-of-a-kind alert levels as in step with the requirement.

II. Literature Review

1) Remote Monitoring System for Cold Storage Warehouse using IoT: R. K. Yadav, Soumya Gupta, Mehak Singh, Arushi Verma, ISSN: 2321-9653.

This paper outlines a remote monitoring system of temperature, humidity, gas and light control for cold storage warehouses. In these warehouses, it is significant that homestead produces should stay fresh. Lamentably when an

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administrator goes out from the cold storage, the temperature and other ecological factors like humidity, gas and light could be changed because of the different reasons, for an instance a valve of cooler is broken. This temperature change can bring about a major issue about the nature of farm produce.

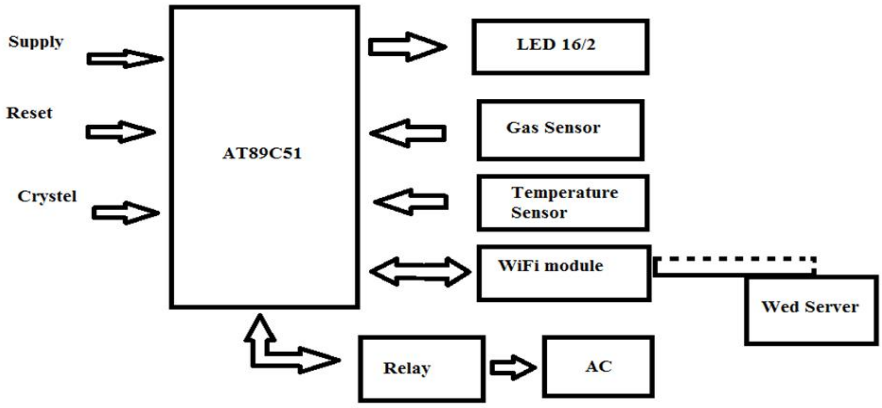
To overcome this issue, the owner needs to look to the present condition of the temperature and different ecological factors of the cold storage, even when he is far away. In this way, a monitoring system is required to display and control the ecological factors, for instance, temperature, humidity, gas and light when the owner is not present in the warehouse. Hence, this paper depicts the remote checking of warehouse, where this monitoring system is put on line follower robot setup to ensure complete tracking of the environmental condition of the warehouse. The owner of the cold storage warehouse will get a SMS alert. This SMS alert is based on the preset threshold data values fetched by the sensors, as the data value goes beyond the threshold a SMS is prompted. The proposed system is designed upon to support the cold storage warehouse, and maintain quality of food item stored in it.

2) Cold Storage Management System for Farmers using IoT: Technology Project Reference No.: 40S_BE_1424, HKBK College of Engineering, Department of Information Technology and Science, Prof. Syed Mustafa. A, Mr. Sharavana, Mr. Deepak V., Ms. Megha Tatti, Ms. Prithvi G. Hardikar, Mr. Syed Saqlain Ahmed

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 various parameters of yield such as (degeneration time, temperature parameter, etc.) 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 ence enhancing the crop obtainability all through the year.

III. PROPOSED METHODOLOGY

3.1 Block Diagram



Explanation: When the installation is done and powered on, it links with the internet by means of inbuilt Wi-Fi module and begins to fetch information from the interfaced sensors which are DHT-11, MQ3 and LDR sensors. DHT11 is a sensor comprising of inbuilt capacitive humidity component for measuring humidity and thermistor for measuring temperature. It reads an ongoing temperature and humidity reading at regular intervals. This sensor works on 3.5 to 5.5 Volts power supply and can measure temperature in the range of 0° C to 50° C and relative humidity in the range of 20% to 90%. The standard library for DHT11 sensor is accessible to the raspberry pi. The read11() method from the DHT class is called to read the data from the sensor. The LDR sensor is associated in a potential divider circuit and intakes a voltage at the analog input pin of the controller. The in-built ADC channel is used to read and digitalized the voltage.

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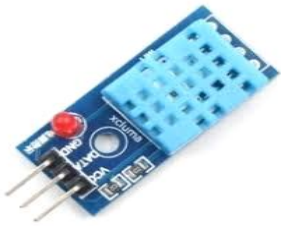
The MQ3 sensor is used to detect the outflow of ethanol gases. The ethanol sorts of gases are emanated when the food/organic product get ruined. The MQ3 yields an analog voltage relative to the concentration of the gas.

3.2 Components Used

1) DHT 11 Humidity & Temperature Sensor



This DF Robot DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effective

2) ESP8266 Wi-Fi Module

The ESP8266 requires 3.3V power–do not power it with 5 volts. The ESP8266 needs to communicate via serial at 3.3V and does not have 5V tolerant inputs, so you need level conversion to communicate with a 5V microcontroller like most Arduinos use.

3) IC 89c52

The AT89C52 is a low-power, high-performance CMOS 8-bit microcomputer with 8K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high density non-volatile memory technology and is compatible with the industry standard 80C51 and 80C52 instruction set and pinout.

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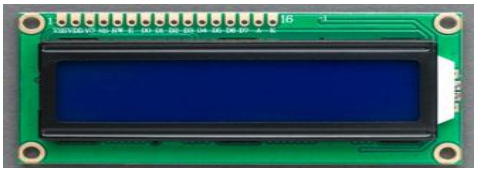
4) 16x2 LCD Display



Wanna add an interface to your project? Use the 16x2 standard alphanumeric LCD display, they are extremely common and is a fast way to have your project show status messages. An LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix.
The 16x2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data.
Command registers stores various commands given to the display. Data register stores data to be displayed. The process of controlling the display involves putting the data that form the image of what you want to display into the data registers, then putting instructions in the instruction register. In your Arduino project Liquid Crystal Library simplifies this for you so you don't need to know the low-level instructions. Contrast of the display can be adjusted by adjusting the potentiometer to be connected across VEE pin.

5) Gas Sensors

Gas sensors (also known as gas detectors) are electronic devices that detect and identify different types of gasses. They are commonly used to detect toxic or explosive gasses and measure gas concentration. This type of sensor employs a chemoreceptor which comes in contact and reacts with target gasses.

6) Relay

A relay is an electrical switch that uses an electromagnet to move the switch from the off to on position instead of a person moving the switch. It takes a relatively small amount of power to turn on a relay but the relay can control something that draws much more power. Ex: A relay is used to control the air conditioner in your home. The AC unit probably runs off of 220VAC at around 30A. That's 6600 Watts! The coil that controls the relay may only need a few watts to pull the contacts together.

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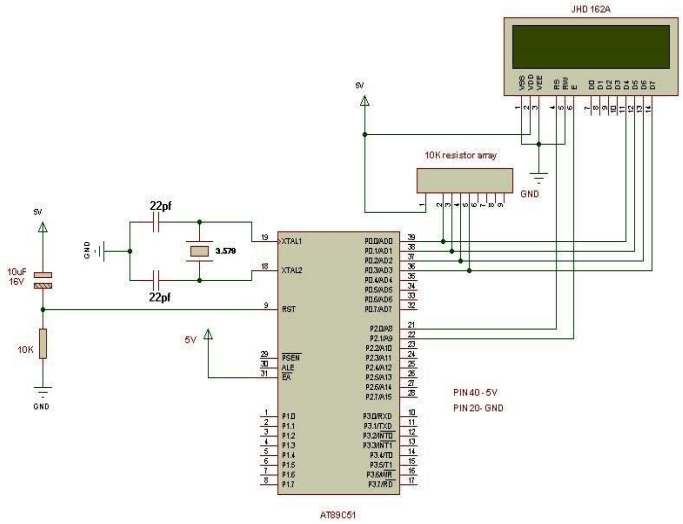
3.3 Circuit Diagram



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