

Auto Climate Monitoring System

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Abstract: Warehouse is used in almost every nation worldwide mainly for the storage of perishable food items and food grains. In India, Central Warehouse Corporation is the sole authority that is managing the task of storing agricultural products, finished goods and variety of perishable and hygroscopic items and the problem faced by the Central Warehouse Corporation is storage loss of food grains and other perishable food items due to sudden changes in environmental conditions. It seems that the current granary management systems are not efficient enough to keep the food products safe. To make the management work easier and to reduce the loss, a smart warehouse is implemented which is enabled with several sensors and technologies. This project aims to provide a low-cost IT solution to this problem with the use of Internet of the things (IoT) sensor and IoT data integration to existing application software. The idea is to capture real time information regarding temperature, moisture and fire using sensors and send alerts using IoT technology. Sensors are used to record the atmospheric moisture and temperature (automatically) inside the warehouse. Based on the readings so obtained, the software performs appropriate data analytics and sends timely alert to concern officials of CWC for mitigation and remedial actions arising due to moisture and temperature inside the warehouse. Not just that, IoT sensor also captures fire/gas and alerts the respective nearest authority like Fire Station, Hospital, Police besides alerting CWC officials for mitigation.

Keywords: Fluctuation, IoT, Microcontroller, Mitigation, Real-Time

1. Introduction

In India, crops are grown seasonally and after harvesting, grains are stored for short or long periods as food reserves, and as seeds for next season. But apparently poor food grain storage and resultant food wastage has been a persistent problem in India. Storage plays a vital role in the food supply chain, and several studies reported that maximum losses happen during this operation. In most of the places, every year we face considerably huge loss of harvested grains just because of inefficient storage techniques. Thus, every year we lose tons of food grains. So in order to bring down India's problem of food grain scarcity we need to enhance the food grain storage system. And for that we need to look properly for the root cause. Apparently fluctuation in the weather pattern is the major cause of damage to the stored grains. And currently we use manual ways of warehouse management that are not efficient enough to serve the purpose.

Hence we need a system that can efficiently manage the storage of food grains and perishable goods through quality control practices by tracking parameters like moisture, temperature and fire/gas. We need a solution capable of handling this situation smartly and efficiently. So, as a solution to the above stated problem, we have an IoT based system.

This system has two parts:

- 1) Hardware
- 2) Software

Both software and hardware are connected to each other. Hardware is installed inside the warehouse and software is installed in the computer or mobile with internet connection.

Hardware collects the real-time data from the warehouse and the Software comprehends it and takes appropriate steps as per the data feedback.

Required Tools

- 1) Hardware: It comprises of several smaller devices as follows:
 - a) Gas Sensor
 - b) Temperature Sensor
 - c) Humidity Sensor
 - d) Arduino-Uno
 - e) Wi-Fi Module
 - f) Power Supply
 - g) Display
- 2) Software:
 - a) Mobile Application
 - b) DBMS
 - c) Cloud
- 3) Dependencies:
 - a) Structured Warehouse
 - b) Hardware Availability
 - c) Internet Connectivity

Work Plan: The entire work plan is divided into two categories:

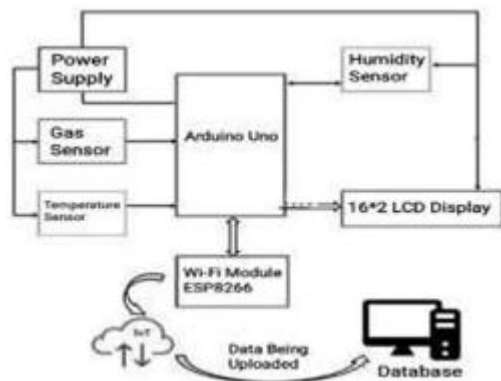
- 1) **Hardware Working:** Hardware setup includes many sensing devices connected together with the help of Arduino-Uno board. Further the Arduino board is connected to the Mobile App through Wi-Fi Module. Microcontroller located at the centre of the block diagram is the control unit for each node. It helps sensors to collect data from the environment and upload

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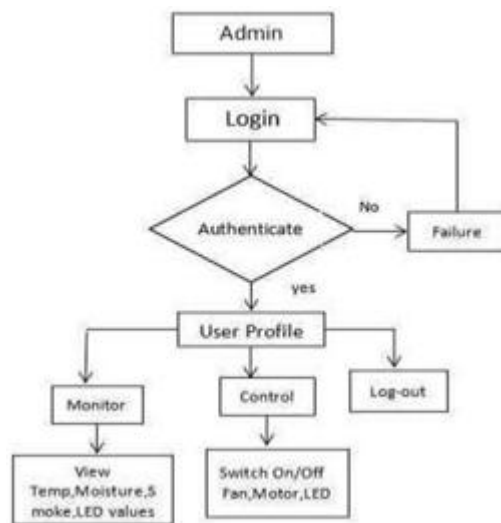
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it to the cloud. A web application is created which receives all data through cloud and is being displayed. Here we have a login system for the manager wherein he can view and monitor the environmental conditions of warehouse as shown in flow chart below. The software checks if there is any change in temperature and humidity within the warehouse or cold storage facility. Also it checks for smoke/fire and then as per the analysis it generates alarms and notifications.



2) **Software Working:** Software part is for direct accessing the data uploaded by the sensors. This software/application is open source and so programmed that it will check the data, analyse it and then provoke alarms immediately if required.



One can have this software downloaded in the smartphone and simply login to the software. Login to the system using valid ID and password. After getting into the system you can track the real time data related to the physical factors of the warehouse and control the system. One can also track and compare the readings of the past few hours. This application gives you a proper graphical view of the readings. After you are done, do not forget to logout of the system.

2. Future Scopes

With cost effective design, this project possesses enormous potential and can be used in various other ways. Not only in food storage grains but also it can be used in other agriculture related storage and management.

Currently this project is totally IoT based and uses real time data and takes decision based upon certain conditions only. But in the coming future, in addition to the current architecture, implementing Artificial Intelligence and Machine Learning along with data analytics may help to predict the events or the atmospheric changes inside the warehouse. Thus providing the authorities sufficient time for mitigations against predicted threats.

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