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Smart Warehouse Using IoT

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ABSTRACT : In any supply chain, the warehouse is a main component in linking the chain partners and nowadays it acts as a competitive factor. Hence, it has become very necessary to manage warehouses effectively and allocate their resources efficiently.Smart Warehouse Using IOT System have been developed for monitoring, tracking and controlling the warehouse operations, but with the increasing dynamicity of the market, traditional systems have become less efficient and unsuitable for today's market requirements, that is why new technologies have started to emerge to be used for such applications. Internet of Things (IoT) is a promising technology that can be used in the context of Industry.In the warehouse, a large amount of the harvested grain is lost during storage. The inability to precisely monitor and control the internal conditions of a storage house is one of the major factors leading to this loss. Timely, relevant and accurate information regarding the internal status of the thing helps in maintaining the quality of the grains as well as in storage loss reduction.To mitigate the manual labour work and to make the work easier, a smart warehouse is implemented which is enabled with several sensors and technologies.This paper intends to develop an IoT based smart warehouse system.The network of sensors includes humidity, temperature, fire sensors. It is done with the help of current technology (IoT). So this system uses Arduino which acts as a microcontroller as well as server for sensors like MQ-2 sensor, DHT-11 Temperature Humdity Sensor,Flame Sensor.All these sensors can be easily controlled with the web application.Some sensors such as DHT11, MQ2 and Flame sensors are used for monitoring the environmental parameters in the inventory and takes necessary actions if needed. The module notifies the users with the updated messages regarding the products.It will help us to monitor in real time temperature and flame data and also allows the user to control the changes.To reduce fire accident level in warehouse using flame sensor fix them. Once the abnormal occurs, the IOT gets the alarm signal immediately sends the fire detected information to authorized person, and the system controls the fire Extinguishers automatically.The Relay is used to Light On/off and Fan On/off status in the warehouse.The sensed values from the different sensor are viewed on an web application.Based on the sensor's data the appropriate data is captured and manipulated based on the limit given in the software and send timely information to the concern Manager through Buzzer Notification Alert for moderation and corrective actions arising due to atmospheric conditions inside the warehouse.The system developed has great advantages compared with the traditional model in terms of cloud storage of the warehouse data.This project will helps us to monitor in real time temperature, Humidity, smoke and a light data and also allows the user to control the changes.Moreover, this proposed system has main advantages which are minimize the human effort for the manual monitoring and loss due to uncontrolled environment.

KEYWORDS:.Arduino, MQ-2 sensor, DHT-11 Temperature Humdity Sensor, Flame Sensor, Buzzer,Relay,LDR Sensor LED,Fan,IOT,Warehouse.

I. INTRODUCTION

Internet of Things (IoT) is widely used in connecting devices and collecting data information. Internet of Things is used with IoT frameworks to handle and interact with data and information. In the system users can register their sensors, create streams of data and process information. Applications of IoT are agriculture ,Smart Cities, Smart Environment, Smart Water, Smart Metering, Security and Emergency, Industrial Control, Smart Agriculture, Home Automation, e-Health etc. 'Internet of Things' is based on device which is capable of analysing the sensed information and then transmitting it to the user.Along with the development of new technologies, new ways of smart warehouse using IOT are being developed. Internet technologies have made it possible to connect physical elements to the network, which is the basis for development of the IoT (Internet of Things).The IoT is a network that interconnects physical elements capable of collecting performance information that evolves the process or its components such as machines and devices

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as well as enabling their management. Accordingly, this paper is based on the secondary research with the aim to present current trends in the development of technological innovations of industry which can minimize the human effort for the manual monitoring and loss due to uncontrolled environment.The need for this warehouse Monitoring System,it is very challenging to track, identify products or objects in big industries. To track any product in a precise span of time it is very difficult. The section where goods or products are stored is called the Warehouse. The prime goal of the Warehouse is to control the flow of products or items. The products must be managed cautiously otherwise it may affect on time, cost.In the globalization of industries, the warehouse inventory management system has its own significance because of the profits it is persuading. Warehousing cites to the activities engaging in the storage of products on a huge scale in a precise way and accomplishing their availability whenever required. The need for a warehouse to store different types of products or goods to maintain seasonal production, seasonal demand, quick supply, continuous production, price stabilization.The warehouse inventory management system is a requisite approach for every warehouse. A computerized warehousing system provides us less effort, more efficient and stable results are correlated with hand held manual system. In Warehouse there may be many zones, those zones are also called as Stockrooms. Depending upon the demand of the products, more products have to be stored. So Warehouse requires more number of stockrooms. The urge for automating the warehouses originates from the fact that manual handling systems may lead to human errors which may affect the warehouse utilization.A warehouse is a mercantile architecture for entre pot of stuff. Warehouses are used by producers, dealers, traders, wholesalers, distributors, customs, etc. The use of a smart warehouse using IOT is the cherry on top of all of your smart technology.To mitigate the manual labor work and to make the work easier, a smart warehouse is implemented which is enabled with several sensors and technologies. This project intends to develop an IoT based smart warehouse monitoring system. The network of sensors includes vibration, humidity, temperature, fire sensors. It is done with the help of current technology (IoT). Arduino adopts IoT technology to convey the messages. Based on the sensor's data the appropriate data is captured and manipulated based on the limit given in the software and send timely information to the concern manager for moderation and corrective actions arising due to atmospheric conditions inside the warehouse. The system developed has great advantages compared with the traditional model in terms of cloud storage of the warehouse data.In This System has capabilities to collect information from various sensors like temperature, humidity, light sensors and integrate it together.This project is to capture temperature, moisture, and fire related information using sensors and send alerts using IoT technology. The problem faced by the Central Warehouse Corporation is storage loss of food grains due to environmental changes.In this project we have developed a kit been connected by sensors and controllers and thereby to send the alerts we have used the external source.Some sensors such as DHT11, MQ2 and Flame sensors,LDR Sensor are used for monitoring the environmental parameters in the inventory and takes necessary actions if needed. If the sensors detect any abnormal conditions a fan will be ON.If there is an environmental change, so this IoT sends the alerts by means of messages through application.This system will provide end to end management in smarter and also in innovative manner.

II. LITERATURE SURVEY

This chapter comprises of the literature review and theoretical background of the project. The literature review deals basically with related project written by other researchers, the difficulties they encountered, limitations and modifications that should be made.

1) Nee (2009) studied the impact of adopting WMS on the overall business performance through using wireless barcodes and Management Information Systems (MIS), it was found that adopting WMS helps in reducing costs, making management more efficient, making process more flexible, and making lead-time delivery shorter, thus meeting customer requirements faster, increasing customer satisfaction that improves competitiveness, and also helping in inventory investment reduction. [1]

2) Sahuri and Utomo (2016) presented a system based on web service that can help small enterprises to improve their warehouse management and business, the main idea of this system is to send information about the stock to the mobile phone through Short Message Service (SMS), it helps in supporting faster and easier decision-making

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because it provides accurate data compared to the manual system that depends on recording all items the manually. [2]

3) Adiono et al. (2017) proposed an RFID-based goods locator system that consists of RFID tags attached to the items including information about them, and RFID readers to sense the distance to the location of the purchased item. The reader is connected by Bluetooth to a WMS installed in a smartphone. This system helps in updating inventory in a real-time, shortening the time needed to find the purchased items, increasing the efficiency of the WMS and providing faster delivery. [3]

4) Oner et al. (2017) designed an RFID-based information system framework for a wool yarn industry for the purpose of tracking work-in-progress, counting and tracking inventories, picking, receiving and shipping of semi-finished products. The authors have also performed a cost-benefit analysis for the proposed system that reduced the required workforce by 20% and decreased the lost work-in-progress rate, thus reducing costs and improving the overall performance of the wool yarn industry. Wei et al. (2015) discussed the functional design of the WMS for a pharmaceutical enterprise by using barcode management application, it helped in managing inventories effectively, decreasing workforce costs, and supporting decision making depending on data warehouses. [4]

5) Qin et al. (2017) studied the impact of using RFID on the problem of inaccurate inventory through proposing an assessment model. The inaccurate inventory problem resulted from information distortion through the supply chain is called the bullwhip effect; this problem leads to an increase in holding and shortage costs. The authors founded that utilizing RFID in the downstream results in more benefits and efficiency compared to when utilizing it in the upstream stages. [5]

6) Han and Zhu (2017) analyzed the logistics of warehousing system and analyzed the existing problems for the purpose of finding methods to improve logistics and storage system. The authors have presented an optimization design of logistics and warehousing by establishing a warehouse management information system that can improve the efficiency of the enterprise, strengthen the coordination between all departments, reduce labor size, solve the problem of material confusion and reduce costs. [6]

7) Nikesh Gondchawar et al., proposed work on IoT based smart agriculture. The aim of the paper is making agriculture smart using automation and IoT technologies. Smart GPS based remote controlled robot will perform the operations like weeding, spraying, moisture sensing etc. It includes smart irrigation with smart control and intelligent decision making based on accurate real time field data and smart warehouse management. It monitors temperature maintenance, humidity maintenance and theft detection in the warehouse. All theoperations will be controlled by smart device and it will be performed by interfacing sensors, ZigBee modules, camera and actuators with microcontroller and raspberry pi. All the sensors and microcontrollers are successfully interfaced with three Nodes using raspberry pi and wireless communication. This paper gives information about field activities, irrigation problems, and storage problems using remote controlled robot for smart irrigation system and smart warehouse management system respectively. [7]

8) Rajalakshmi P.et.al., described to monitor the crop-field using soil moisture sensors, temperature and humidity sensor, light sensor and automated the irrigation system. The data from sensors are sent to web server using wireless transmission and JSON format is used for data encoding to maintain server database. The moisture and temperature of the agriculture field falls below the brink, irrigation system will be automated. The notifications are sent to farmers mobile periodically and farmers can be able to monitor the field conditions from anywhere. The parameters used here are soil moisture sensor, temperature and humidity sensor- DHT11, LDR used as light sensor and web server – NRF24L01 used for transmitter and receiver. This system will be more useful in areas where water is in scarcity and it is 92% more efficient than the conventional approach. Automation of irrigation system data was stored in MySQL database using PHP script. Total average power consumption is 2 Ah per day for a single motor pump and water requirement analysis. [8]

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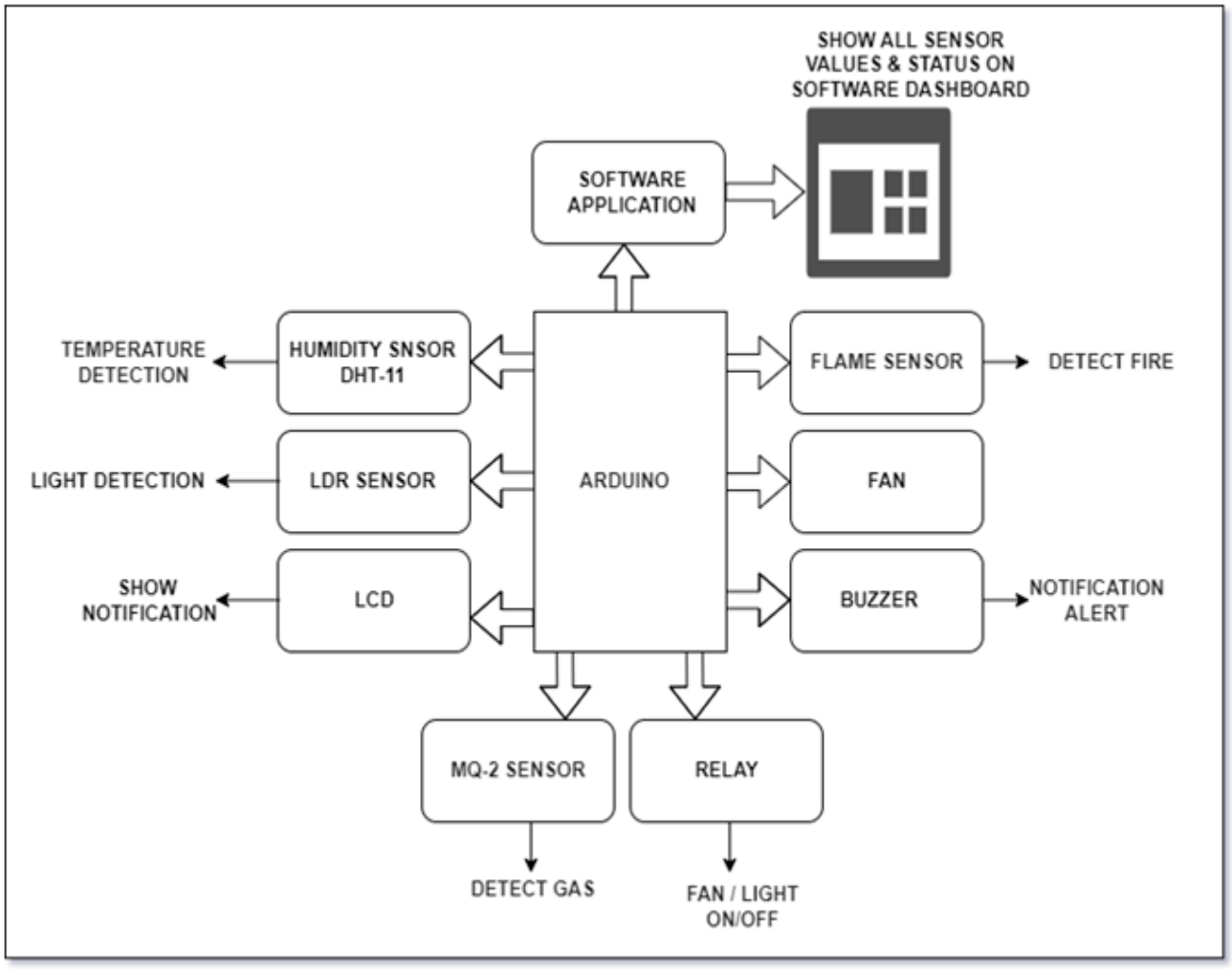
9) Mao et al. (2018) designed a functional framework of intelligent WMS based on cloud model using RFID and GPS and proposed a hybrid genetic algorithm based on bee colony optimization to solve the scheduling problem of the cloud, the proposed system provided a real-time data that helped in making better scheduling and decision making. [9]

10) Patil et al. (2018) proposed a dynamic web application system by using a Software-as-a-Service (SaaS) that provides a cloud-based application of WMS, this helped in converting manual work to a software work that helps the user to access data easily and fast and make work more accurate, the proposed system also helped in managing warehouses effectively, increase visibility, capture real-time data and provide a graphical analysis for product stocks, purchase order, stock in and stock out. [10

III. SYSTEM ARCHITECTURE AND METHODOLOGY



In our design, Arduino board acts as the heart of our system. Our project is solely based upon Arduino.

1. Arduino
2. MQ-2 sensor
3. Flame sensor
4. DHT-11 Temperature Humdity Sensor
5. LDR Sensor
6. LED

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7. Buzzer
8. Fan
9. Relay

In this Block Diagram, the important factors such as temperature, humidity, Light status is measured and detected. With the help of IoT the live data is visualized on the dashboard using Arduino and it can Warehouse Manager.The IoT nodes are designed using Arduino and various sensors. These nodes are located in the warehouse at various location.Warehouse Manager can observe the information using web application. The temperature sensor is used to sense the rise in temperature.The humidity sensor is used to see harmful gas, the gas sensor helps in detecting CO inside the warehouse.If the presence of fire flame detected, to protect grains from fire, fire sensor is being used and a notification is sent to the Warehouse Manager.

The sensors data is being displayed in the dashboard to which a user can monitor the live data results from anywhere and anytime.Dashboard parameters update automatically with the newest sensor data. Moreover, simultaneously the is sent to the Warehouse Manager.

IV. CONCLUSION

In this project we have developed a kit been connected by sensors and controllers and thereby to send the alerts we have used the external source.It will helps us to monitor in real time temperature, fire and a light data and also allows the user to control the changes.This system is helpful to monitor the various parameters of warehouse and also it will inform to the Warehouse manager.

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