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SMART WAREHOUSE AUTOMATION

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Abstract - *A real-time warehouse database that can handle a company's huge inventories is called the Warehouse Management System. This can be used to manage the stock distribution across numerous stores of a larger franchise or to track the inventory of a single store. One of the crucial and significant factors that the majority of businesses and organizations struggle to effectively manage is inventory or stock management. A few of the issues dealt with by these organizations include the use of machinery to organize the stock, sorting the pile of raw materials, purchasing essentials based on the current market demand, and delivering the orders with the aid of Service partners. For example, sustenance perishable goods such as fruits, vegetables and groceries and its packaging etc. Management and corporate capital are interested in the highly significant subject of inventory management. Owing to its impact on the organizational performance, increasing or decreasing the count of commodities in the inventory causes a problem. The proposed inventory management system fulfils these organization requirements and deals with the mentioned problems. This technique saves all information of the materials and the entire process in a private data base system over a IoT network. It is employed to establish the balance of the materials currently in the warehouse and streamlines the procedure to determine the stock balance, manages the daily motions of materials and their levels.*

***Key Words*:** **Arduino Mega board, RFID module, DTH11 sensor, PLX-DAQ Excel Sheet.**

1.INTRODUCTION

Automation reduces manual procedures by using data and software. Mobile barcoding and automated identification and data capture (AIDC) technologies are two examples of digital automation techniques used in the warehouse. One benefit of digital process automation is its ability to integrate with business resource

From the perspective of the warehouse, it streamlines manual processes and eliminates human errors. However, it also lowers operational and legal hazards, improves safety, and enhances data management and enterprise resource planning (ERP) systems. AIDC technology, such as mobile barcode scanning and RFID, can improve customer service, boost employee satisfaction, and lower operating costs brought on by human mistake. The act of organizing and controlling everything in your warehouse in order to ensure that everything functions as efficiently as possible is known as warehouse management.

- This includes: -
- organizing the warehouse's inventory and space.
- Possessing and keeping up with the necessary tools.
- Controlling the facility's incoming fresh stock.
- Order picking, packing, and shipping.
- Monitoring and enhancing warehouse efficiency.

2. LITERATURE SURVEY

Manufacturers require more effective and efficient methods to track machine operating status and identify process defects due to the complexity and automation of production processes. A sustainable, economical, and environment-friendly production [1],[2],[3]. Energy leakage, such as steam, compressed air, and cool air leakage from broken pipelines or worn valves, is a typical fault in job shops with high-energy consumption. This fault tends to cause enormous economic losses and environmental pollution [4], [5], [6], and hence, its diagnosis becomes an essential requirement for an economical and environment-friendly production. A typical autonomous warehouse system is a segment of autonomous intralogistics. systems.
This study explores how an inventory management system that requires less work, is more effective, and is reliable affects the performance of a supply chain. Before creating a software that can manage the required transactions, the supply chain processes used in the warehouse were examined.
The process by which raw materials are transformed into completed commodities that are delivered to clients is known as supply chain management. The product flow with regard to storage will eventually be referred to as a warehouse. The storage of goods in warehouse can either be raw material or partially finished goods or even finished goods. Each and every process in the flow is measured with respect to the value addition done to the product.
The performance of a sustainable warehouse management system is based on a triple bottom line strategy, which has many facets. It has been challenging to identify the key performance indicators for a sustainable warehouse management system and to develop a methodology for evaluating the direct and indirect indicators.

3.1 BLOCK DIAGRAM AND FLOWCHART

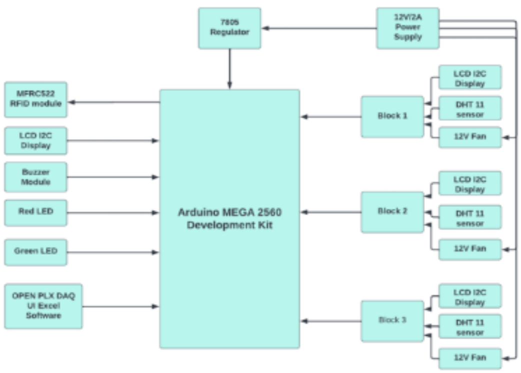

Fig 3.1.1 Block Diagram

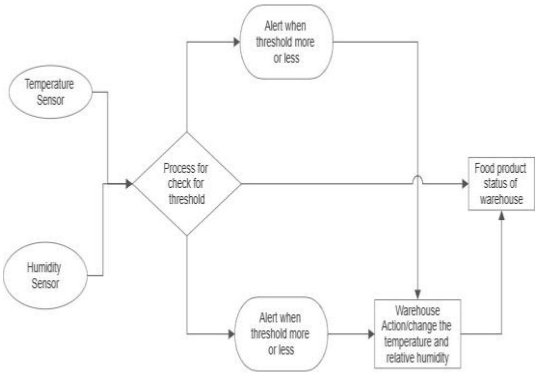

Fig 3.1.2 Flow Chart

3.2 HARDWARE AND SOFTWARE DESCRIPTION

3.2.1 Aurdino Mega Board:

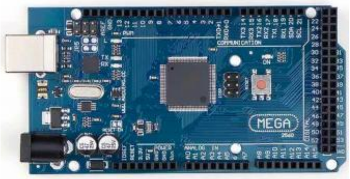

Fig 3.2.1: Arduino Mega board

A microcontroller board called the Arduino Mega 2560 is based on the ATmega2560 (datasheet). It contains 16 analogue inputs, 4 hardware serial ports (UARTs), a 16 MHz crystal oscillator, 54 digital input/output pins (14 of which can be utilized as PWM outputs), a USB connector, a power jack, an ICSP header, and a reset button. It comes with everything needed to support the microcontroller; to use it, just plug in a USB cable, an AC-to-DC adapter, or a battery to power it. The majority of shields made for the Arduino Demilune or Decimal are compatible with the Mega.

Either an external power source or the USB connection can be used to power the Arduino Mega. The power source is automatically chosen. An AC-to-DC adapter (wall wart) or a battery can provide external (non-USB) power. A 2.1 mm center-positive plug can be used to connect the adapter to the board's power connector. The Gnd and Vin pin headers of the POWER connection can accept battery leads. The board can be powered by a 6 to 20 volt external supply. The 5V pin, however, may deliver less than five volts if supplied with less than seven volts, and the board may become unstable. The voltage regulator could overheat and break the board if more than 12V is used. The suggested range is between 7 and 12 volts.

3.2.2 RFID Module:

Fig 3.2.2: RFID module

A tag affixed to the object that needs to be recognized and a reader that scans the tag make up the two primary parts of an RFID system. A reader consists of a radio frequency module and an antenna that generates a high frequency electromagnetic field. Whereas the tag is usually a passive device (it does not have a battery). It consists of a microchip that stores and processes information, and an antenna for receiving and transmitting a signal. The reader produces an electromagnetic field when the tag is in close proximity to it. This causes electrons to move through the tag's antenna and subsequently powers the chip. The chip then responds by sending its stored information back to the reader in the form of another radio signal. This is called a backscatter. The reader picks up and decodes this backscatter before transmitting the information to a computer or microcontroller.

3.2.3 DHT11 Sensor:

Fig 3.2.3: DHT11 Sensor

A cheap digital sensor for detecting humidity and temperature is the DHT11. To instantly detect humidity and temperature, this sensor may be simply interfaced with any micro-controller, including Arduino, Raspberry Pi, etc. Both a sensor and a module are available for the DHT11 humidity and temperature sensor. The pull-up resistor and a power-on LED distinguish this sensor from the module. A relative humidity sensor is the DHT11. This sensor employs a capacitive humidity sensor and a thermistor to measure the ambient air.

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3.2.4 Buzzer Module:

Fig 3.2.4: Buzzer Module

Buzzers, a type of integrated electronic buzzer, are frequently employed in voice devices such as computers, printers, photocopiers, alarms, electronic toys, vehicle electronics, telephones, and timers. Buzzer power comes from DC energy. Buzzers can be categorized as either active or passive (see the illustration below). The buzzer with the green circuit board is an active buzzer when the pins of two buzzers are flipped face up; the buzzer with the black tape is a passive buzzer.

3.2.5 Cooling Fan:

Fig 3.2.5: Cooling Fan

In order to flow air across a heat source, fans are utilized to transfer warm air out of the case and draw cooler air in from the outside.

3.2.6 LCD I²C display:

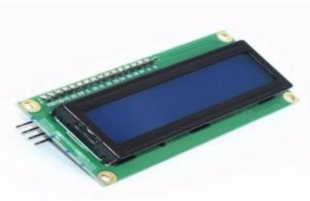

Fig 3.2.6: LCD I²C display

I2C_LCD is a simple-to-use display module that can simplify display. Making it easier to use allows creators to concentrate on the main task at hand. We created the Arduino library for the I2C_LCD; users only need a few components. Code lines can implement intricate graphic and text display elements.
The I2C communication interface is utilized by the 16x2 Arduino LCD screen. It means it only needs 4 pins for the LCD display: VCC, GND, SDA, SCL. It will save at least 4 digital/analog pins on Arduino.

3.2.7 Arduino IDE:

Fig 3.2.7: Arduino IDE

The Arduino Integrated Development Environment (IDE), often known as the Arduino Software, has a text editor for writing code, a message box, a text console, a toolbar with buttons for basic tasks, 4 and a number of menus. A connection is established in order to upload programmers and communicate with the Genuine and Arduino hardware. Using 12 C and C++ routines, the cross-platform Arduino Integrated Development Environment was produced. It allows for the creation and upload of programmers to Arduino-compatible boards.
Computer programmers produced 14 sketches using the Arduino Software (IDE). The 10 text editor was used to produce these graphics, which were then saved as files with the .ino extension. The editor offers functions for text replacement and text searching. When saving and exporting, the message section provides feedback and shows errors.

3.2.8 PLX-DAQ Excel Sheet:

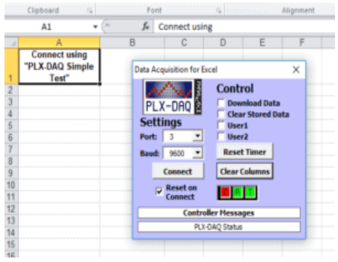

Fig 3.2.8: PLX-DAQ Excel Sheet

PLX-DAQ is a short form for Parallax Data Acquisition and that's an add-on tool for Microsoft Excel. This software enables easy communication between Microsoft Excel on a Windows Computer and any device that supports serial port protocol. We can now be able to send data directly to Excel from any microcontroller connected to any sensor and the serial port of a PC although PLX-DAX was intentionally written to allow communication between Arduino and Excel. Using the PLX-DAX platform you can be able to take measurements for data like temperature, humidity, light intensity and a lot more using Arduino, and then send the results to Excel where this data can be printed on a spread sheet and analysis done using graphs and charts.
Other major features of PLX-DAQ include ability to record up to 26 columns of data, read or write any cell on a worksheet, support for up to 128k Baud rates and support for COM port 1 to 15.
All this communication is done using simple serial commands like the ones used when sending data from Arduino board to the Arduino IDE serial monitor.

4. METHODOLOGY

The agricultural products such as vegetables and fruits are kept inside the blocks. Each block contains the sensor for humidity and temperature (DHT11 sensor), LCD I2C display, fan. Each block attaches to the Arduino UNO and the data of each block is stored in RFID tags. RFID tags are scanned using RFID module to know the information of the each block which are displayed in PLX Excel sheet. Consequently, the products are placed in suitable blocks according to their range of temperature. Consequently, the inside temperature the fans will run to maintain the required temperature suitable for the Products. The variations of temperature and humidity are displayed with the help of graph in the PLX Excelsheet.

5. RESULTS

The fans in the blocks will automatically turn on and off based on the temperature and humidity in the blocks. This information will store in the PLX-DAQ data sheet. The below image is showing what is the fan status how much is humidity temperature and threshold voltage.

Fig 5.1: Block 2 Display showing Temperature, Humidity and fan status.

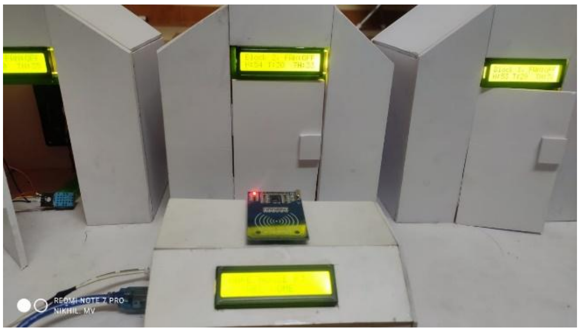

Fig 5.2: Showing all 3 blocks

6. CONCLUSIONS

IoT is rightfully regarded as among the most promising digital technologies that will definitely become more widespread and useful in the nearest future. Even at the current state, the capabilities of IoT solutions are impressive, and their advantages are tempting.

By using this model, we can maintain the suitable conditions required for the perishable goods, by safeguarding it from factors in the environment, such as high temperatures and Relative humidity. The suggested inventory management system addresses the issues and satisfies organizational criteria. Proper warehousing of agriculture produce is inevitable for an efficient supply chain.

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