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Integration With Moisture Meter For Monitoring Stored Food Grains

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Abstract- **Moisture plays a very vital role in the daily operations of FCI (Food Corporation of India). With a change in moisture value, computation of storage loss/ gain in food grains gets affected. Hence capturing the moisture value is very essential. Food Corporation of India uses a moisture meter (a hardware device) developed by different manufacturers. The readings of the moisture meter are noted manually and are fed into DOS (Depot Online System). Since there is a human intervention, there could be chances that the readings noted are erroneous. FCI is looking for a solution where the readings of the moisture meter are captured directly from the moisture meter into DOS or any other software application what FCI is using. This issue can be addressed by designing a hardware device which consists of a moisture meter and networking device. All of this devices work as a slave and they will send the moisture reading to the master device and this master device will store the captured data in the online system.**

Keywords- **Wi-Fi, Internet of things, Master, Slave, Depot Online System (DOS), Cloud storage.**

I. INTRODUCTION

As the world's population continues to increase, so does the demand for foods and other goods produced by the agricultural industry. However, as the demand for production increases, so does the strain of quality and safety assurance. Farming, handling, and processing of grain and seed commodities require rapid and accurate testing methods for characterization. One parameter often tested in agricultural products is moisture content, as it aids decision making for storage, drying, and processing applications. Moisture plays a very vital role in the daily operations of FCI (Food Corporation of India). With a change in moisture value, computation of storage loss/ gain in food grains gets affected. Hence capturing the moisture value is very essential. Food Corporation of India uses moisture meter (a hardware device) developed by different manufacturers. The readings of the moisture meter are noted manually and are fed into DOS (Depot Online System).Since there is a human intervention, there could be chances that the readings noted are erroneous.

IDEOLOGY:

The basic idea is to provide solution for this problem using a digital Moisture measuring device and configure this with an electronic controller.

- There will be a master device and a slave device connected to each other using wireless communication like Wi-Fi.
- This approach will help to measure moisture of multiple locations within the building and send the data to the master device which is also an electronic controller.
- The master will gather all the moisture data from the slave device. Establish a connection with online server and send all the data's to the server. To perform this action the master device is fully depended on Wi-Fi connection.
- Any FCI official can monitor the real time data online and take action accordingly.
- This idea can be implemented in the existing DOS (Depot Online System) with very little modification.
- The cost of the each slave device will not exceed more the 500 rupees and for master device 600 rupees.
- One master can address all available slave within the range of up to 20 meters this can be extended up to 500 meters with the help of external antenna's.
- In this way the existing manual system will be replaced with automated measurement.
- Since we are using digital electronics components the current requirement is very less and the system can also operate on battery.
- The Entire task can also be achieved with only slave device but it will create a problem for using Wi-Fi for regular purpose since Wi-Fi can address only limited number of devices.

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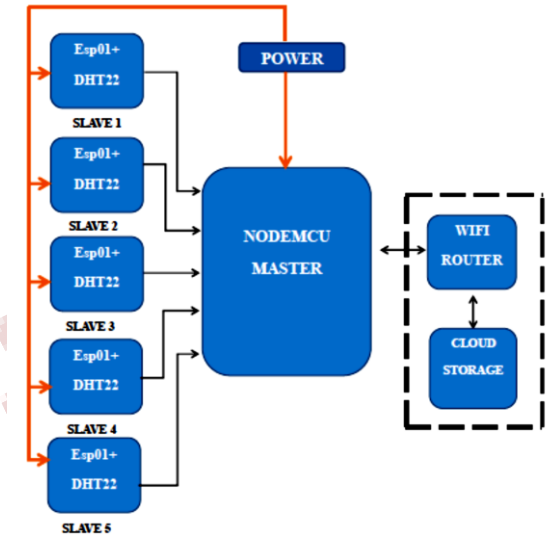
SYSTEM BLOCK DIAGRAM

The block diagram consists of 5 slave devices and one master device. The dependencies are also shown there. All devices are connected to root node called as master and this master is responsible for all data communication between server and moisture meter. This will reduce the overhead of each slave since slave is not worried about data transmission. The master is also used to check the errors in the slave devices. Master slave approach will also reduce the number of terminals directly connected to the server.

This allows user to take real time with more accuracy. The approach is complete end to end solution for the existing manual system and will address the issue with low cost. The cost of system manufacturing can reduce for bulky quantity.

Following components are used to achieve the desired task:



Moisture meter

1. RS 232 to UART converter
2. NODE MCU: Node MCU is an open source IoT platform.
3. DHT 22: The DHT22 is a basic, low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed).
4. EPS-01

Moister Meter

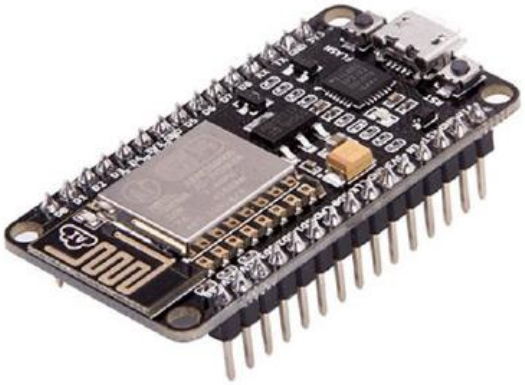
RS232 to UART Converter

SLAVE Devices

DTH22

EPS-01

Master Device



Node MCU

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USE CASE:

Case 1:

The system will work fine when all resources like Wi-Fi connection, power supply is available.

It will perform task of sending the readings to the server at every 20 seconds.

Case 2:

If Wi-Fi connection is not available or due to some problem its not working then the slave device will store maximum of 2-3 previous reading and send it to Cloud when Wi-Fi is available.

Case 3:

Each slave will store at least one single reading into EEPROM. So if power failure happens then system will remain in ideal mode. It won't perform any operation. When power supply is available then it will start performing the regular task but first it will send the last stored reading.

Case 4:

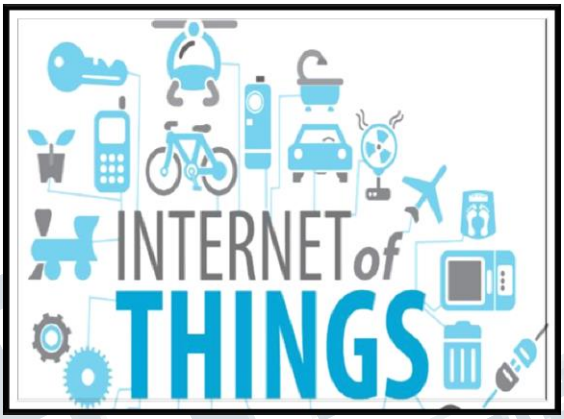
If any hardware problem occurs in the slave device then it will intimate to the cloud with its unique ID. This will help in troubleshooting the problem.

Case 5:

If there is any maintenance activity going on in the server side, then the system will stop sending the data to the server and remain in the ideal mode.

TECHNOLOGY STACK:

- The technology behind this idea is Internet of Things.
- Moisture is a physical quantity which is captured by a sensor and processed by the electronics controller.
- Further the digital data regarding the current moisture value is sent to the server.
- The server will make data visible over the internet.
- This way we are implementing Internet of Things technology to achieve the task.
- It is only possible because it is simplest and cost wise its effective to make this manual task automated
- The master and the slave device are compatible with IEEE standard Wi-Fi protocol 802.11 b/g/n
- This will allow device to connect with the existing Wi-Fi routers.
- There is built-in TCP/TP protocol stack implemented in slave device as well as in master device to avoid all compatibility issues.
- As we are going for Internet of Things technology the existing DOS (Depot Online System) can easily configure with this hardware devices.
- These devices are directly connected to cloud server which can be accessed by FCI official through API (Application Programming Interface).
- Django REST framework is used to create this API. REST framework is Clean, simple views for Resources.



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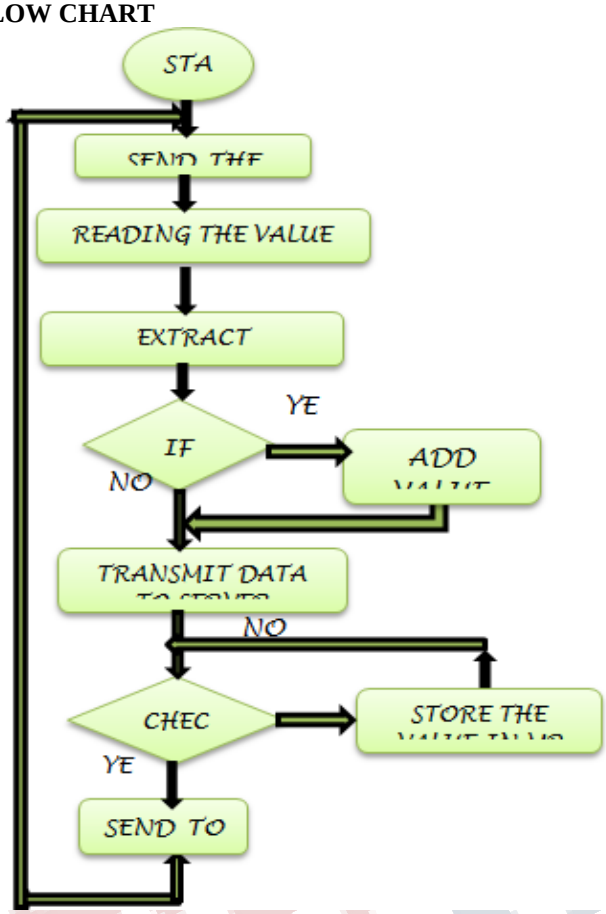
FLOW CHART



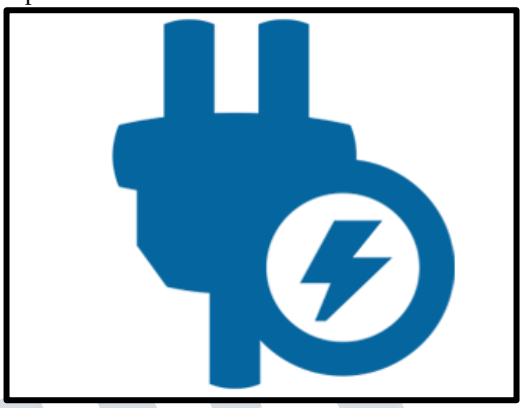
DEPENDENCIES:

1. Wi-Fi network:

Full project is depended on the Wi-Fi network. Since Wi-Fi is most commonly used network device and allows the user to connect wirelessly, so we have chosen Wi-Fi. Otherwise the task can also be implemented using wired LAN connection.

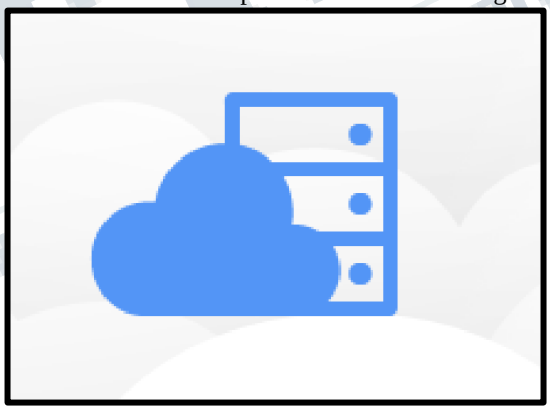
2. Power Supply:

Since the system is working with all active electronics components it is required to have power supply of 3.3v 100mA DC. We are taking this power supply from AC to DC Adapter available in the market.



3. Cloud Storage:

All the moisture readings are stored in the cloud sever. So we need sufficient virtual space to store this reading.



ADVANTAGES:

- It can operates on battery
- Less current consumption.
- It has a unique ID which will helps in resolving the problem in its hardware.
- It remains in ideal mode when there is any maintenance activity going on in the server.
- The devices will be connected by using wireless communication like Wi-Fi.
- No error in reading.
- Will help to measure moisture of multiple location within the building

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DISADVANTAGES:

- There will be delay in work if there is no Wi-Fi connection available.
- The system will remain in ideal mode due to power failure.
- There will be changes in sequential order when power restores.

II. CONCLUSION

With this approach we can replace manual reading process with fully automated IOT based solution. The solution is simple and easy to integrate with existing system. It is economical, low cost and reliable system which is easily accessible. The FCI (Food Corporation of India) can make their work easier and reduces the errors in readings.

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