FOOD GRADE WAREHOUSE MONITORING SYSYTEM

A report submitted for evaluation of SCE through Problem Based Learning (PBL) in the course Internet of Things for

Third Year Bachelor Of Technology

AY-2022-23, Sem-V

By

Group No.: A13

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VISHWAKARMA INSTITUTE OF INFORMATION TECHNOLOGY, PUNE

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

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Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute Of Information Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

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Certificate

This is to certify that the following students of Third Year Bachelor of Technology,

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Have sucessfully completed the PBL titled:

FOOD GRADE WAREHOUSE MONITORING SYSYTEM.

in the laboratory course **Internet of Thing** in department of Electronics and Telecommunication Engineering, Vishwakarma Institute Of Information Technology, Pune 411048, for AY 2022-23.

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FOOD GRADE WAREHOUSE MONITOR-ING SYSYTEM

1.1 AIM

FOOD GRADE WAREHOUSE MONITORING SYSYTEM.

1.2 OBJECTIVES

- 1 Food Warehousing needs to be regulated at all times to keep products in safe conditions for consumption.
- 2 If the environment factors in a warehouse become too extreme, food and beverages can be compromised which can lead to making consumers very sick.
- 3 Environment monitoring allows warehouses to stay aware of the conditions of environmental factors.
- 4 Environment monitoring with Room Alert takes the safety and urgency of food warehousing a step further by allowing users to receive immediate notifications when changes in the environment occur.
- 5 It is crucial for certain foods and drinks to stay at specific temperatures, especially perishable foods as the growth rate of potentially harmful bacteria slows down drastically below specific temperatures.

1.3 REFERENCES

1 Bartholdi, John J; Hackman, Steven Todd (2006). Warehouse distribution science. Atlanta, GA: The Supply Chain and Logistics Institute, School of Industrial and Systems Engineering, Georgia Institute of Technology. p. 34. OCLC 938330477.

2 Faber, Nynke; de Koster, René (Marinus) B.M.; van de Velde, Steef L. (2002- 01-01). "Linking warehouse complexity to warehouse planning and control struc- ture: An exploratory study of the use of warehouse management information sys- tems". International Journal of Physical Distribution Logistics Management. 32 (5): 381–382. doi:10.1108/09600030210434161. ISSN 0960-0035.

3 Facilities planning. James A. Tompkins (4th ed.). Hoboken, NJ: John Wiley Sons. 2010. pp. 385–386. ISBN 978-0-470-44404-7. OCLC 456838083.

4 "Warehouse Management Systems Market Report, 2021-2028". www.grandviewresearch.com. Retrieved 2022-03-23.

5 Frazelle, Edward (2016). World-class warehousing and material handling (2nd ed.). New York. p. 14. ISBN 978-0-07-184283-9. OCLC 951429325.

6 Ghiani, Gianpaolo (2004). Introduction to logistics systems planning and control. Gilbert Laporte, Roberto Musmanno. Chichester, West Sussex: J. Wiley. p. 159. ISBN 0-470-09165-7. OCLC 54449316.

7 "How to get around the limitations of your Warehouse Management System". datadocks.com. Retrieved 2022-03-23.

1.4 SOFTWARE REQUIRED

• Proteus Proteus is a complete development platform from product concept to design completion • Thinkspeak ThingSpeak™ is an IoT analytics platform service that allows you to aggregate, visualize and analyze live data streams in the cloud • Arduino The Arduino Integrated Development Environment(IDE)

1.5 HARDWARE MATERIAL REQUIRED

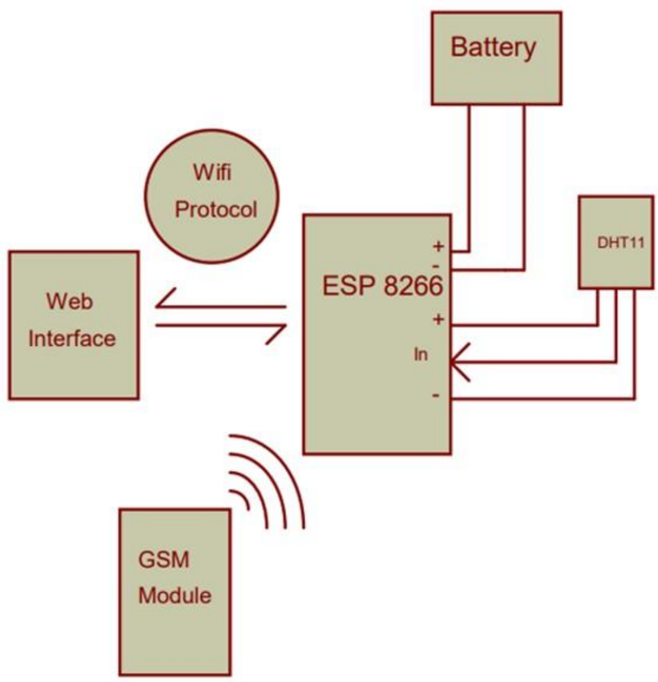
- 1 ESP8266 NODE MCU
- 2 DHT11 TEMPERATURE ANDHUMIDITY SENSOR
- 3 4.5V BATTERY POWER SUPPLY
- 4 Connecting Wires

1.6 PRE-REQUISITE IOT EXPERIMENTS

Students are expected to write the name or modules of minimum four experiments used for implementation of PBL

- Experiment No.4: Programming of ESP8266/ESP01 for interfacing of actuators and controlling using Blynk IOT Cloud patform 2
- Experiment No.5: Build a cloud-ready Home automation using NodeMcu ESP8266/ESP32 with IoT Cloud Platform
- Experiment No.6: Introduction of Raspberry Pi, OS installation on Raspberry Pi and sample python programming for LED interfacing
- Experiment No.7: Interfacing of DHT11 sensor with Raspberry Pi to monitor temperature and humidity by using Thing-speak Cloud.

1.7 DESIGN (BLOCK DIAGRAM)



SCHEMATIC REPRESENTATION OF FOOD GRADE WAREHOUSE MONITORING SYSTEM

1.8 Justification of selection of IOT Board for respective PBL

The ESP8266 module enables microcontrollers to connect to 2.4 GHz Wi-Fi, using IEEE 802.11 bgn. It can be used with ESP-AT firmware to provide Wi-Fi connectivity to external host MCUs, or it can be used as a self-sufficient MCU by running an RTOS-based SDK. The module has a full TCP/IP stack and provides the ability for data processing, reads and controls of GPIOs.Voltage and current restrictionsThe ESP8266 is a 3.3V microcontroller, so its I/O operates at 3.3V as well. The pins are not 5V tolerant, applying more than 3.6V on any pin will kill the chip.The maximum current that can be drawn from a single GPIO pin is 12mA.tHigh Durability

ESP8266EX is capable of functioning consistently in industrial environments, due to its wide operating temperature range. With highly-integrated on-chip features and minimal external discrete component count, the chip offers reliability, compactness and robustness. Compactness

Power-Saving Architecture Engineered for mobile devices, wearable electronics and IoT applications, ESP8266EX achieves low power consumption with a combination of several proprietary technologies. The power-saving architecture features three modes of operation: active mode, sleep mode and deep sleep mode. This allows battery-powered designs to run longer.

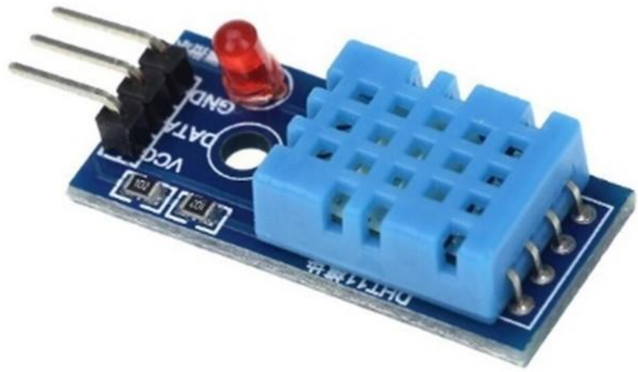
32-bit Tensilica Processor The ESP8266EX microcontroller integrates a Tensilica L106 32-bit RISC processor, which achieves extra-low power consumption and reaches a maximum clock speed of 160 MHz. The Real-Time Operating System (RTOS) and Wi-Fi stack allow about 80

1.9 Justification of selection of IOT Platform for respective PBL

ThingSpeak is an IoT analytics platform service that allows you to aggregate, visualize, and analyze live data streams in the cloud. You can send data to ThingSpeak from your devices, create instant visualization of live data, and send alerts. ThingSpeak, write and execute MATLAB code to perform preprocessing, visualizations, and analyses. ThingSpeak enables engineers and scientists to prototype and build IoT systems without setting up servers or developing web software.

1.10 Selection of IoT sensors

DHT11 is a commonly used Temperature and humidity sensor. The sensor comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data. The sensor is also factory calibrated and hence easy to interface with other microcontrollers. Each DHT11 element is strictly calibrated in the laboratory that is extremely accurate on humidity calibration. The calibration coefficients are stored as programs in the OTP memory, which are used by the sensor's internal signal detecting process. The single-wire serial interface makes system integration quick and easy. Its small size, low power consumption and up-to-20 meter signal transmission making it the best choice for various applications, including those most demanding ones. The component is 4-pin single row pin package. It is convenient to connect and special packages can be provided according to users' request. Single-bus data format is used for communication and synchronization between MCU and DHT11 sensor. One communication process is about 4ms. Data consists of decimal and integral parts. A complete data transmission is 40bit, and the sensor sends higher data bit first.



DHT11 Specifications:

Operating Voltage: 3.5V to 5.5V

Operating current: 0.3mA (measuring) 60uA (standby)

Output: Serial data

Temperature Range: 0°C to 50°C

Humidity Range: 20

Resolution: Temperature and Humidity both are 16-bit

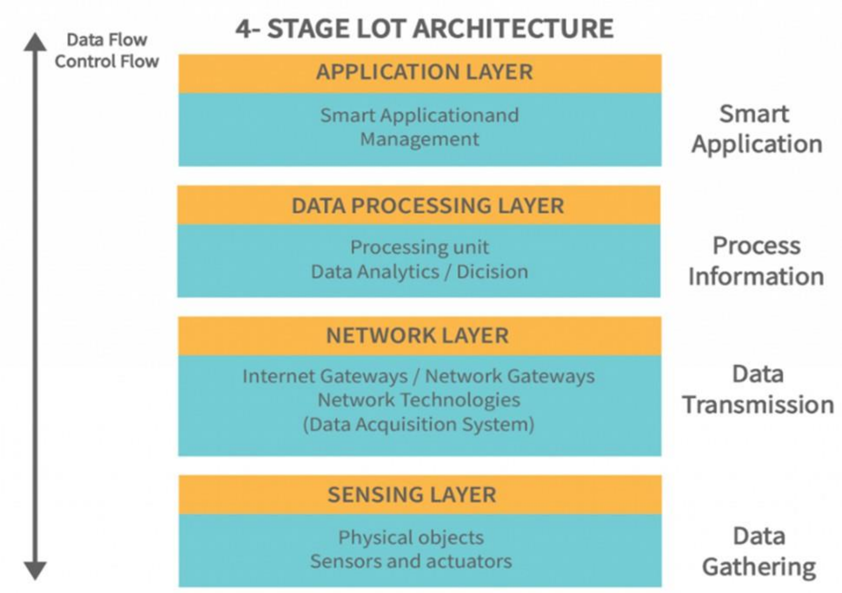
1.11 IoT Layers used for PBL

STAGE 1: Sensors and Actuators The process starts with sensors and actuators, the connected devices that monitor (in the case of sensors) or control (in the case of actuators) some “thing” or physical process. Sensors capture data regarding the status of a process or an environmental condition, such as temperature, humidity, chemical composition, fluid levels in a tank, fluid flow in a pipe, or the speed of an assembly line as well as much more.

STAGE 2: Internet Gateways and Data Acquisition Systems A data acquisition system (DAS) collects raw data from the sensors and converts it from analog into digital format. The DAS then aggregates and formats the data before sending it through an Internet gateway via wireless WANs (such as Wi-Fi or Cellular) or wired WANs for the next stage of processing.

STAGE 3: Pre-processing: Analytics at the Edge Once the IoT data has been digitized and aggregated, it will need processing to further reduce the data volume before it goes to the data center or cloud. The edge device may perform some analytics as part of the pre-processing. Machine learning can be very helpful at this stage to provide feedback into the system and improve the process on an ongoing basis, without waiting for instructions to come back from the corporate data center or cloud. Processing of this type will generally take place on a device in a location close to where the sensors reside, such as in an on-site wiring closet.

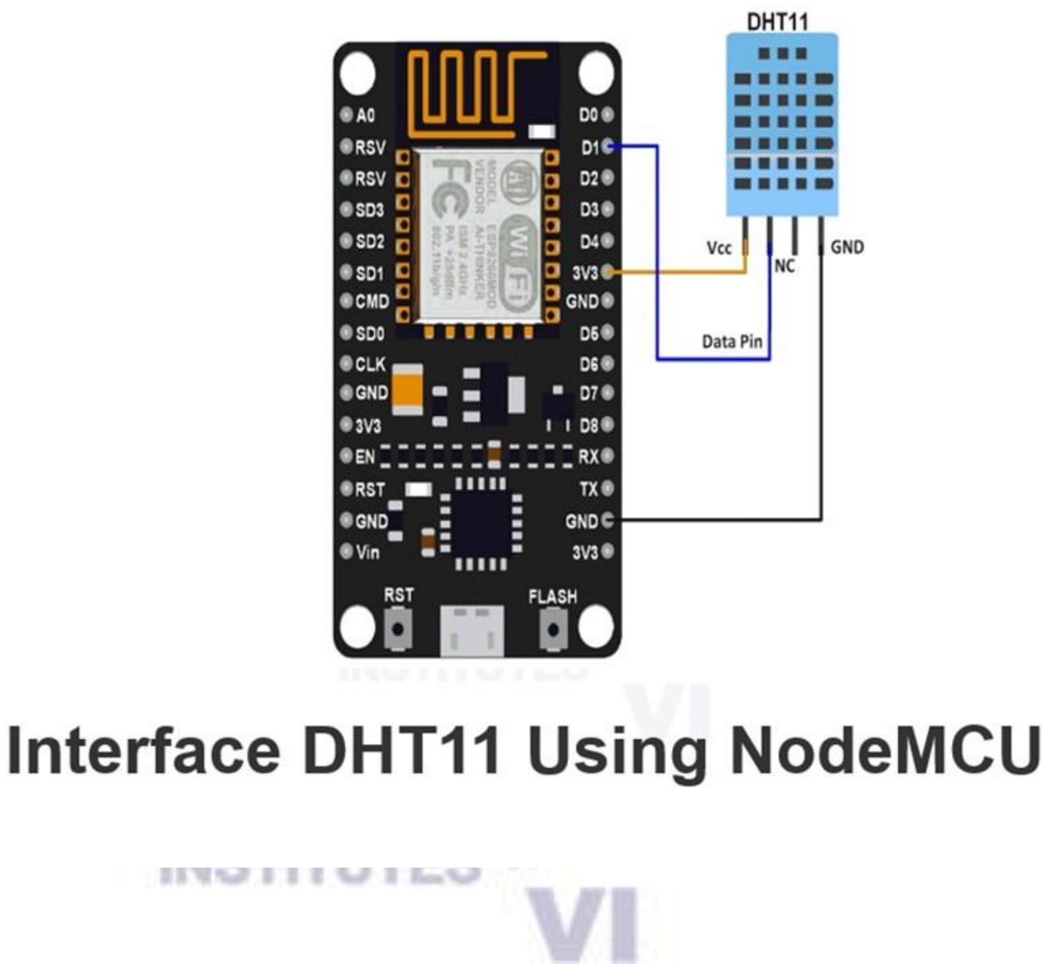
STAGE 4: In-depth Analysis in the Cloud or Data Center At Stage 4 in the process, powerful IT systems can be brought to bear to analyze, manage, and securely store the data. This usually takes place in the corporate data center or in the cloud, where data from multiple field sites/sensors can be combined to provide a broader picture of the overall IoT system and deliver actionable insights to both IT and business managers.



1.12 IoT wireless standards/Protocols used for PBL

Wi-Fi/802.11 The low cost of operating Wi-Fi makes it a standard across homes and offices. However, it may not be the right choice for all scenarios because of its limited range and 24/7 energy consumption

1.13 Actual INTERFACING DIAGRAM



1.14 WORKING

• By using 5v 1A continous power supply will provide the power supply to our ESP8266 NODE MCU

• From the NODE MCU ESP8266 we will directly provide the power supply to the DHT 11 sensor of 3.3 V.

• Temperature and Humidity is being sensed by DHT11 sensor.

• Data acquisition is done by using ESP8266 Node MCU.

• By using 802.11(Wi-Fi) data will be stored on the cloud .

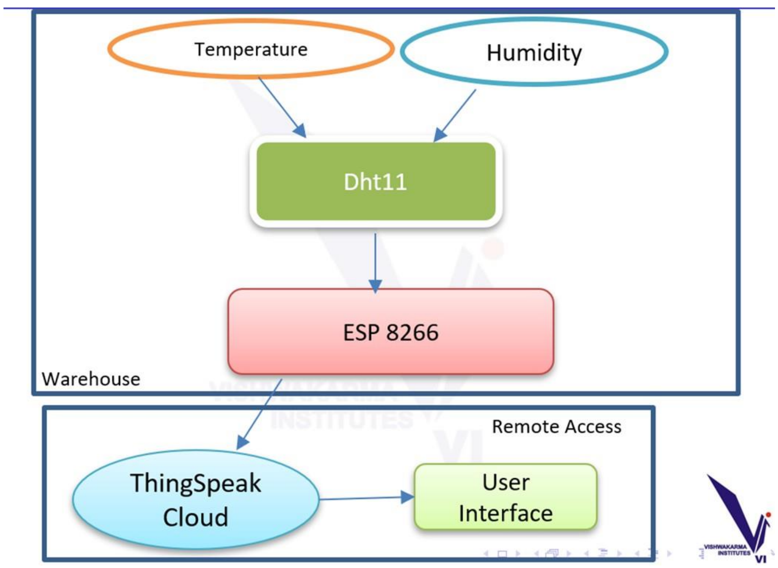
• By using user interface of ThingSpeak cloud computing website data is rearranged with the Data and information visualizations.

• By using the statical data provided by the cloud computing website it is easy to analyse the environmental changes of food category warehouse.

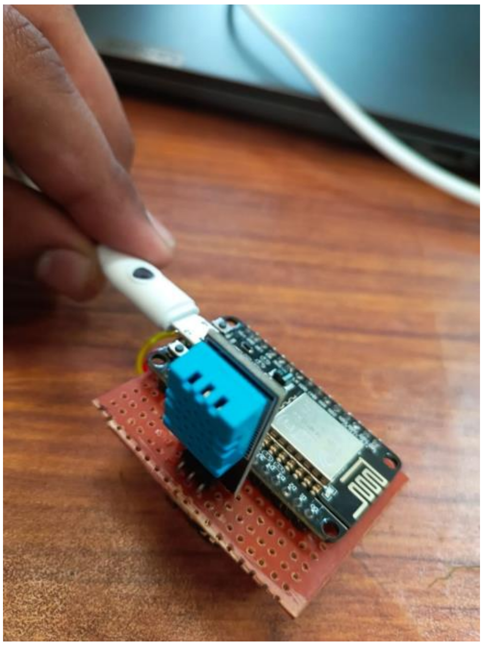
• The sensor will be continuously monitoring humidity and temperature.

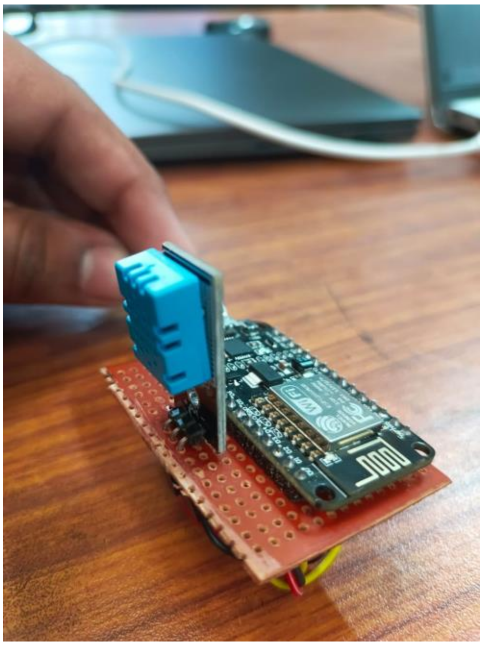
• This in turn helps to have the perfect watch on the humidity and temperature like important conditions in the warehouse.

1.15 ALGORITHM



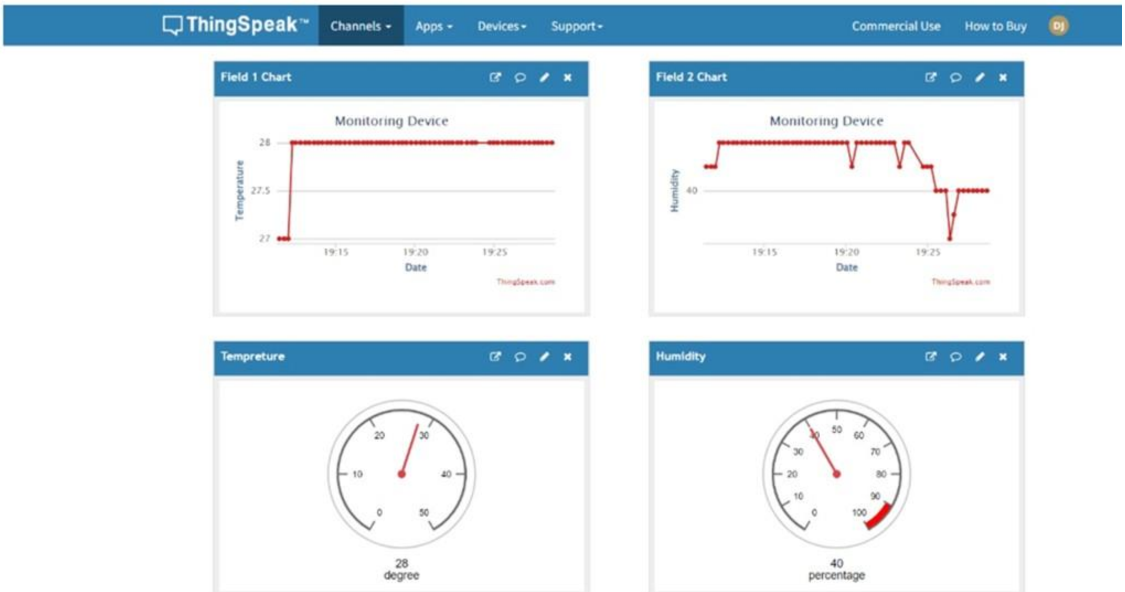
1.16 HARDWARE IMPLEMENTATION





1.17 Group photograph while implementing the PBL

1.18 RESULTS/OBSERVATION



1.19 CONCLUSION/UNDERSTANDING

1 It’s a cost-effective and dependable way to track temperature and humidity inside warehouses without compromising stored items. The devices are simple to set up and save electricity.

2 We have successfully utilized 4 layers (sensing layer ,Network Layer, Data processing layer and application layer).

3 It ensures us to stay aware of the conditions of environmental factors.

4 It is crucial for certain foods and drinks to stay at specific temperatures, especially perishable foods as the growth rate of potentially harmful bacteria slows down drastically below specific temperatures.