IoT-Farm: Efficient and Smart Farming

Abstract

Smart farming, precision agriculture, and Agriculture 4.0 all involve the integration of advanced technologies into existing farming architecture. The goal is to increase production efficiency and product quality, as well as reducing overall costs. To this end, the inclusion of Smart technologies into Irish agriculture has been inevitable with increased pressure being placed on farming practices to remain profitable, as well as adhere to environmental regulations.

The global Smart Agriculture Solution Market is said to have stood at around US $10.2 Billion in 2016 and is projected to reach a valuation of US $38.1 Billion by the end of 2024. The growing adoption of advanced technology in farming, from agricultural drones, precision seeding systems, auto-steering, automatic feeding systems and fruit-picking robots (amongst others), have all incentivized traditional agri-companies to invest in smart agriculture technology. The deployment of advanced agri-tech has the potential to allow for an increased focus on non-profitable tasks, such as farm maintenance and environmental practices. The reduction of heavy labour and tedious tasks can also lead to improvements in the health and work/life balance of farming staff

BENEFITS OF IOT IN AGRICULTURE

The following are the benefits of IoT in Agriculture:

1. IoT enables easy collection and management of tons of data collected from sensors and with integration of cloud computing services like Agriculture fields maps, cloud storage etc., data can be accessed live from anywhere and everywhere enabling live monitoring and end to end connectivity among all the parties concerned.

2. IoT is regarded as key component for Smart Farming as with accurate sensors and smart equipment's, farmers can increase the food production by 70% till year 2050 as depicted by experts.

3. With IoT productions costs can be reduced to a remarkable level which will in turn increase profitability and sustainability.

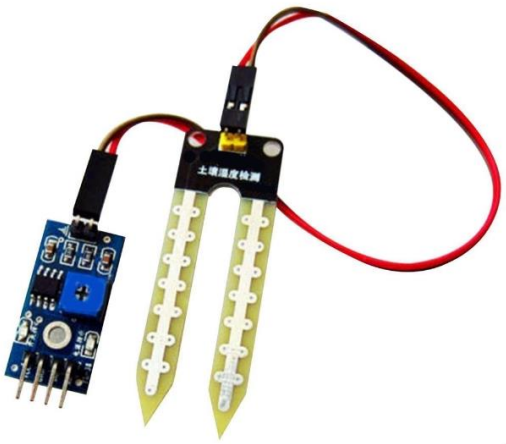
4. With IoT, efficiency level would be increased in terms of usage of Soil, Water, Fertilizers, Pesticides etc.

5. With IoT, various factors would also lead to the protection of environment.

COMPONENTS AND MODULES

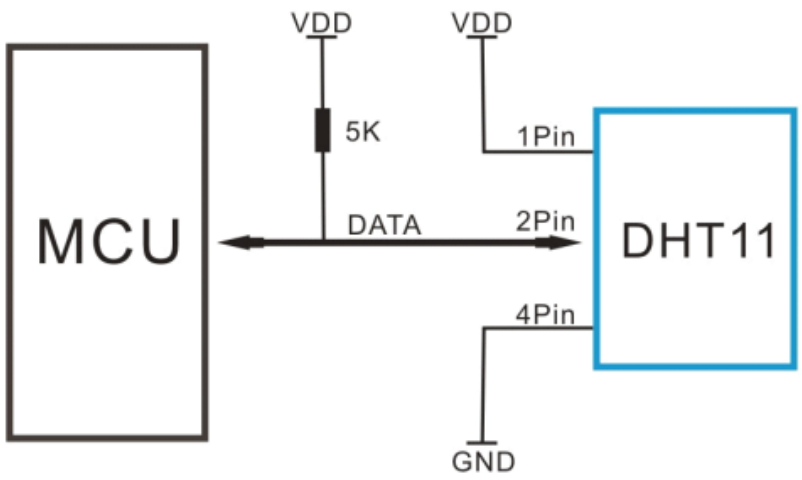
1 SOIL MOISTURE SENSOR

Soil Moisture Sensor is used for measuring the moisture in soil and similar materials. The sensor has two large exposed pads which functions as probes for the sensor, together acting as a variable resistor. The moisture level of the soil is detected by this sensor. When the water level is low in the soil, the analog voltage will be low and this analog voltage keeps increasing as the conductivity between the electrodes in the soil changes. This sensor can be used for watering a flower plant or any other plants requires automation.

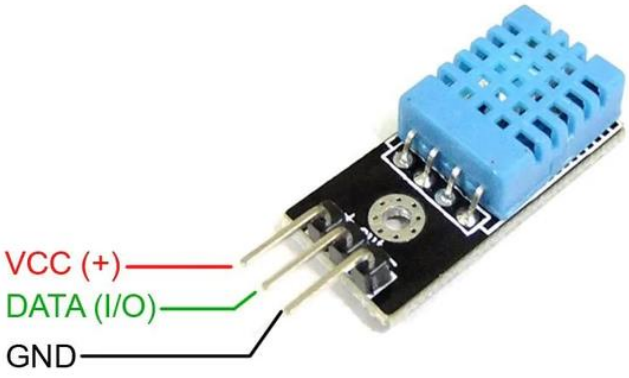


2 DHT 11 Sensor

The **DHT11** is a commonly used **Temperature and humidity sensor that** 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 DHT11 Sensor is factory calibrated and outputs serial data and hence it is highly easy to set it up. The connection diagram for this sensor is shown below.



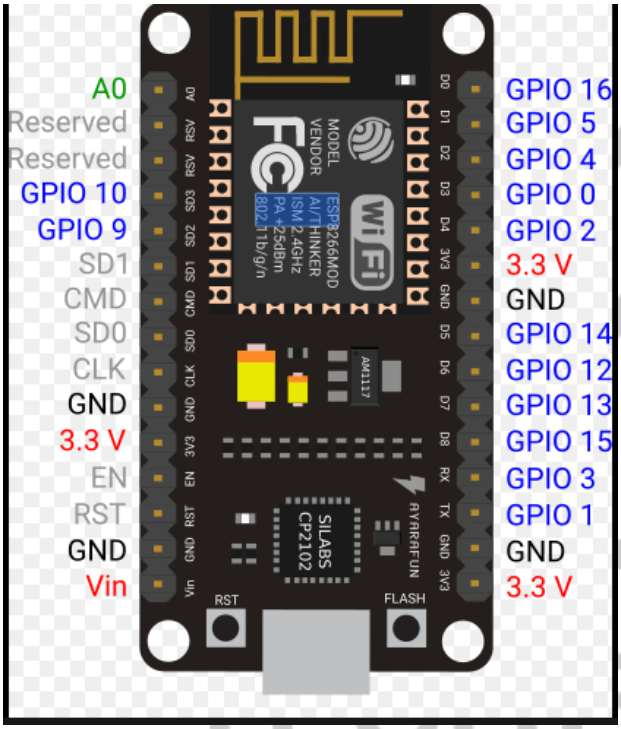
As you can see the data pin is connected to an I/O pin of the MCU and a 5K pull-up resistor is used. This data pin outputs the value of both temperature and humidity as serial data. If you are trying to interface DHT11 with Arduino then there are ready-made libraries for it which will give you a quick start.



DHT11:
• Ultra-low-cost
• 3 to 5V power and I/O • 2.5mA max current use during conversion (while requesting data)
• Good for 20-80% humidity readings with 5% accuracy
• Good for 0-50°C temperature readings ±2°C accuracy
• No more than 1 Hz sampling rate (once every second)
• Body size 15.5mm x 12mm x 5.5mm • 4 pins with 0.1" spacing

3 ESP8266 Controller

The ESP8266 WiFi Module is a self-contained SOC with an integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all WiFi networking functions from another application processor.



4 Water Pump

The water pump can be defined as a pump which uses the principles like mechanical as well as hydraulic throughout a piping system and to make sufficient force for its future use. They have been approximately in one structure otherwise another because of early civilization. At present these pumps are utilized within a wide range of housing, farming, municipal, and manufacturing applications.

4 Relay Module

A power relay module is an electrical switch that is operated by an electromagnet. The electromagnet is activated by a separate low-power signal from a micro controller. When activated, the electromagnet pulls to either open or close an electrical circuit.

2.2 Circuit Diagram

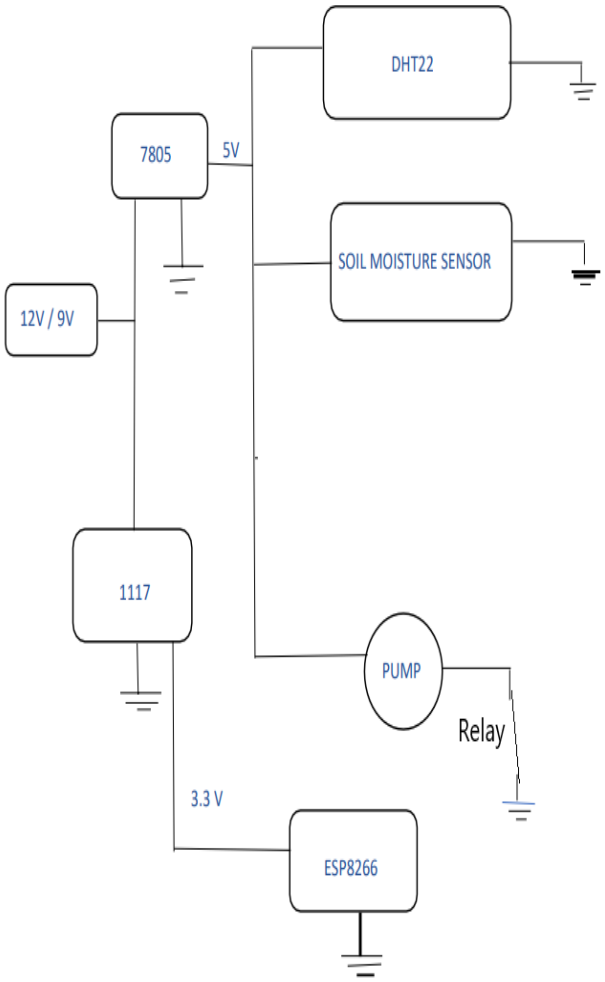
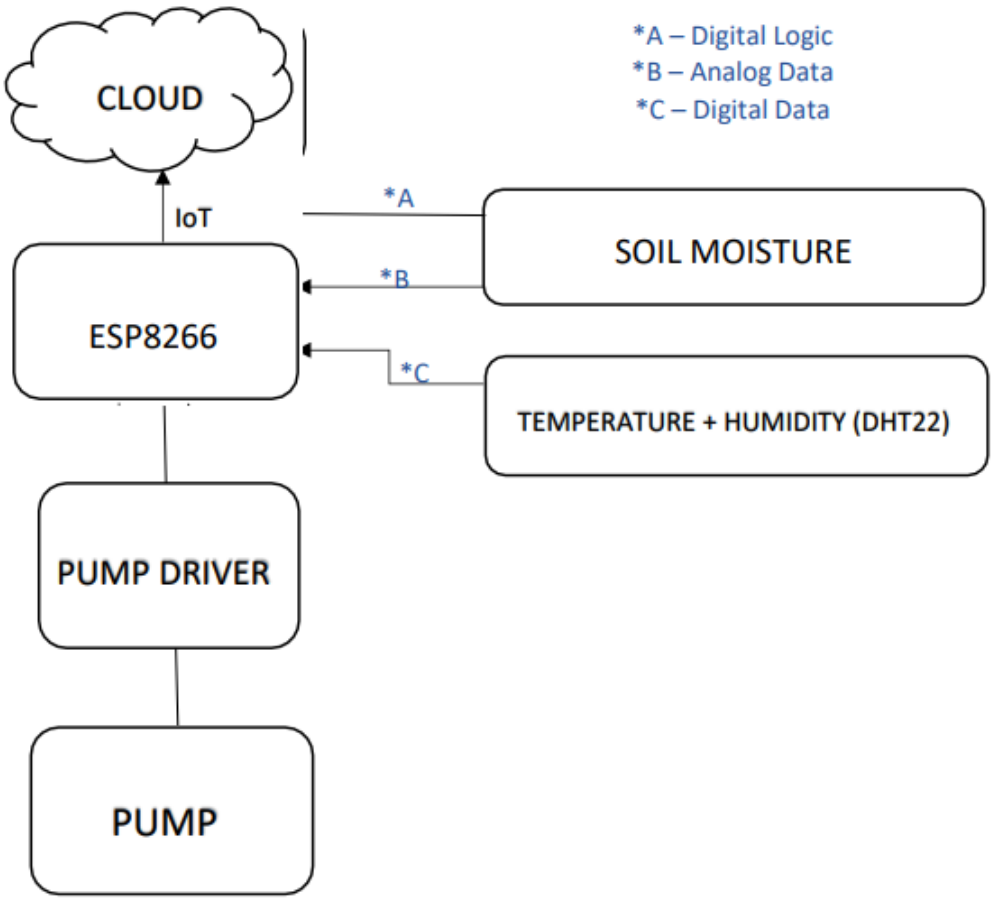
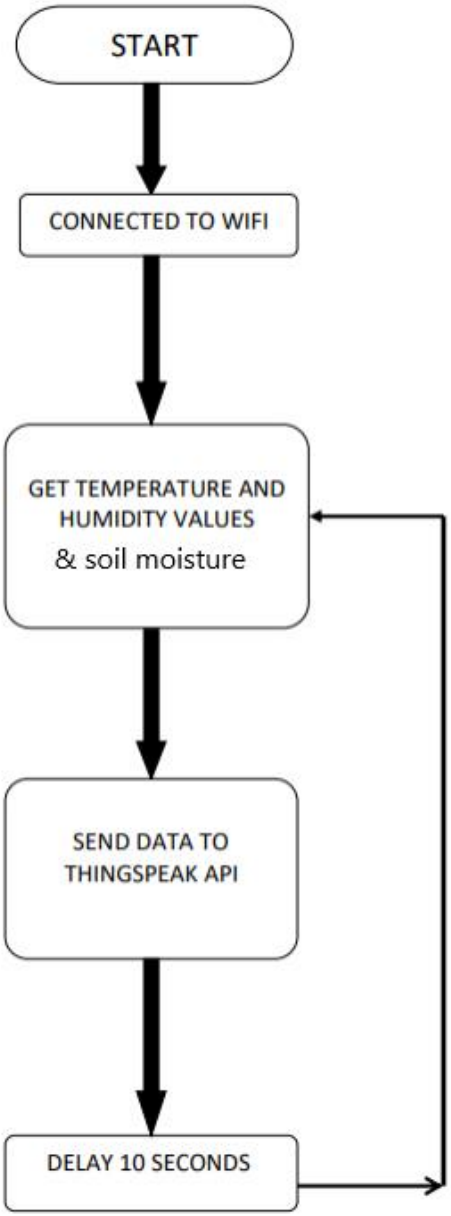


Fig. 7 Circuit Diagram

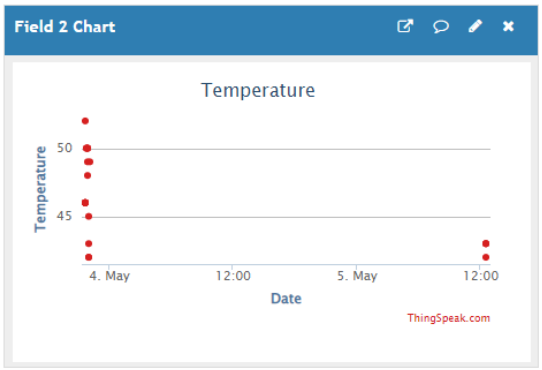
2.1 Block Diagram

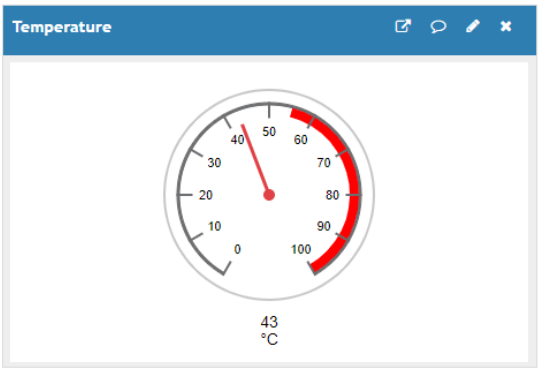


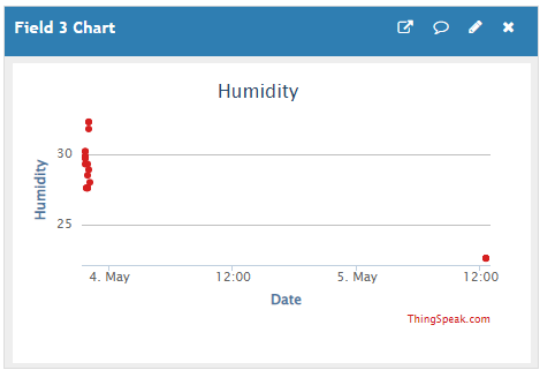
: FLOWCHART

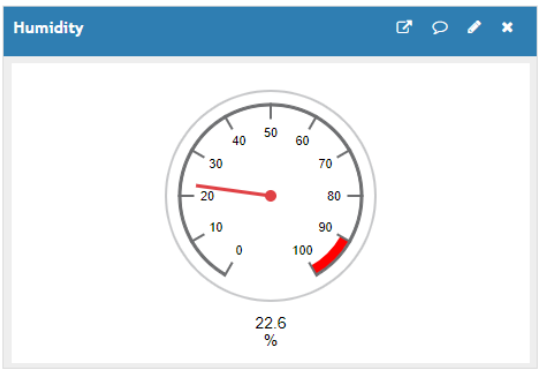

START
CONNECTED TO WIFI
GET TEMPERATURE AND HUMIDITY VALUES
& soil moisture
SEND DATA TO THINGSPEAK API
DELAY 10 SECONDS

Operation 1: Temperature and Humidity Reading The DHT-22 helps us to get the temperature and humidity values at any particular time. Keeping a check in the temperature and humidity value will help the user in taking care of livestock and special plants. From DHT22, the signal gets passed to ESP8266 which further passes the signal to the website from where the user can get notified even when away from the field.

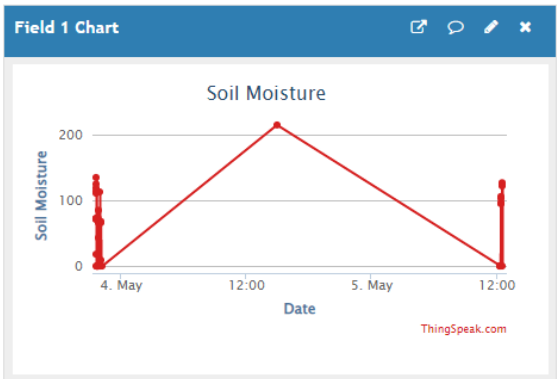








Operation 2: Soil Moisture Determination The soil moisture sensor determines the moisture content of the soil. If the value is below the threshold value, it sends a signal to the DC motor i.e., the pump, and automatically the pump gets on and waters the field.



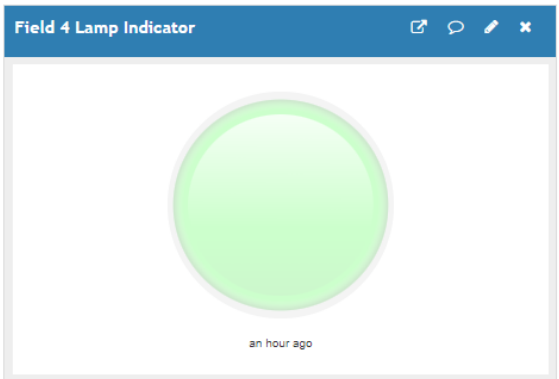


Fig. 21 Moisture content of the field along with the graph

Fig. 22 Pump automatically gets on when the soil moisture content is below the threshold level.

CONCLUSION

The Farm Monitoring System can be used for destiny factors of agriculture. This would be a relief for farmers since it decreases the load of manual efforts A gadget to screen moisture levels within the soil changed into construction and the assignment furnished a possibility to take a look at the prevailing structures, at the side of their features and downsides. The stated gadget may be used to turn on/off the water sprinkler in keeping with soil moisture levels thereby automating the technique of irrigation that is one of the most time ingesting activities in farming. Agriculture is one of the most effort-consuming hobbies. The device makes use of statistics from soil moisture sensors to irrigate the soil. The proposed assignment may be further greater with the aid of including a pump to the machine to facilitate computerized irrigation. The automated irrigation device may be triggered when the moisture content of the soil is going under the brink stage. The threshold degree can be decided in the code written for Arduino. So, whenever the fee for moisture goes under the brink degree, the pump gets mechanically on and irrigation is performed to an ok degree. To improve the efficiency and effectiveness of the machine, the noted recommendations can be placed into attention. Alternative of controlling the water pump may be given to the farmer by way of which they are able to turn on or off the pump to be able to start or prevent the manner of irrigation without being there on farm at that gift time. The farmer can know earlier about the negative climate situations. In such instances farmer might also want to forestall the machine remotely or routinely. The concept of the usage of IOT for irrigation can be prolonged in addition to other tasks in farming together with farm animals' management, fireplace detection and climate manage. This could limit human intervention in farming sports

FUTURE SCOPE

Future work would be focused more on increasing sensors on this system to fetch more data especially with regard to Pest Control and by also integrating GPS module in this system to enhance this Agriculture IoT Technology to a full-fledged Agriculture Precision ready product.

Techeonics

Smart ioTFarm
git- https://github.com/gauravk5/ioT-Farm

By Gaurav Kumar (Techeonics)
thetecheonics@gmail.com
Youtube- https://www.youtube.com/c/THETECHEONICS
See https://www.techeonics.com for details.

REFERENCE & SOURCES

1. https//:www.researchgate.net
2. https//:www.wikipedia.org
3. https//:www.Techeonics.com
4. https//:www.schematics.com
5. https//:www.batteryuniversity.com
6. https//:www.thingspeak.com
7. https//:www.youtube.com