PROJECT REPORT

On

Smart Agriculture System Using IoT

By

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Under the Supervision of

Mr. Durga prasad (Faculty of Smart Bridge)

CERTIFICATE OF APPROVAL

This is to certify that the work embodied in this project entitled IoT based "SMART AGRICULTURE SYSTEM" submitted by Lucky Vishwkarma to the Smart Bridge have carried out under my direct supervisions and guidance.

The project work has been prepared as per the regulations of Smart Bridge and I strongly recommend that this project work be accepted in partial fulfilment of the requirement for the internship.

Supervisor
Mr. Durga prasad sir (Smart Bridge)

Acknowledgement

I, Lucky Vishwkarma have successfully completed the project under the guidance of the esteemed faculty of Smart Bridge.

I would like to thank Mr. Durga prasad sir (Faculty of Smart Bridge) for his valuable guidance and advice in completion of the project and providing me all possible assistance.

He has been extremely motivating and helps me during the project work. I am also grateful to him for providing me necessary references and learning resources for every activity regarding the project.

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OVERVIEW OF THE PROJECT

The objectives of this project are to propose an IoT based Smart Agriculture System that uses the advantages of IoT Technologies such as wireless sensor network, Nodemcu and IBM Cloud Service which will help in monitoring soil moisture and climatic conditions to grow and yield a good crop.

IBM cloud service, Node red & Open Weather API technologies can help to overcome the problems of the traditional farming system like farmers working in the farm lands are solely dependent on the rains and bore wells for irrigation of their land. Monitoring environmental conditions is the major factor to improve yield of the efficient crops.

Because of its energy autonomy and low cost, the system has the potential to be useful in water limited geographically isolated areas.

Purpose of The Project

The Main Purpose Of this Project is to develop a Smart agriculture System that uses advantages of cutting-edge technologies such as Arduino, IOT and Wireless Sensor Network Using IoT & IBM Cloud Service.

Node Red Is to Solve the Basic Problems of farmers working in the farm lands are solely dependent on the rains and bore wells for irrigation of their land. Monitoring environmental conditions is the major factor to improve yield of the efficient crops.

This will help us to develop a system which can monitor temperature, humidity, moisture and even the movement of animals which may destroy the crops in agricultural field through sensors.

This Project involves integration of advanced technologies into already persisting agricultural practices with a view to boost production quality and efficiency for farming products. The goal of smart agriculture system is to ground a decision-making support system for farm management.

Existing Problem

Problems:

- Absence of proper crop monitoring process doesn't lead to enhancement in crop output efficiency.

- Insufficient agricultural methods due to absence of technological interface leads to large manpower & high cost.

- Uncertain, unreliable & erratic rainfall leads to water wastage due to lack of modern equipments.

- **Development challenge**: India still being a developing country & farmers mostly being unaware of new technologies still use traditional means of farming which are now ineffective and inefficient.

- **Market need**: Introduction of smart irrigation system will result in an increase of crop productivity, use of renewable sources of energy which will be cost efficient & require less labour.

- **Opportunity identified & how big the problem is**: Farming is the main occupation in India which accounts to more than 60% of Indian economy. Use of ineffective means of farming leads to decrease in crop output requiring large manpower. Many farmers are abstaining from farming as they could not produce enough profit. We being engineers tend to propose innovative means of farming which will be cost efficient & will also boost the economy.

Solution To the problem

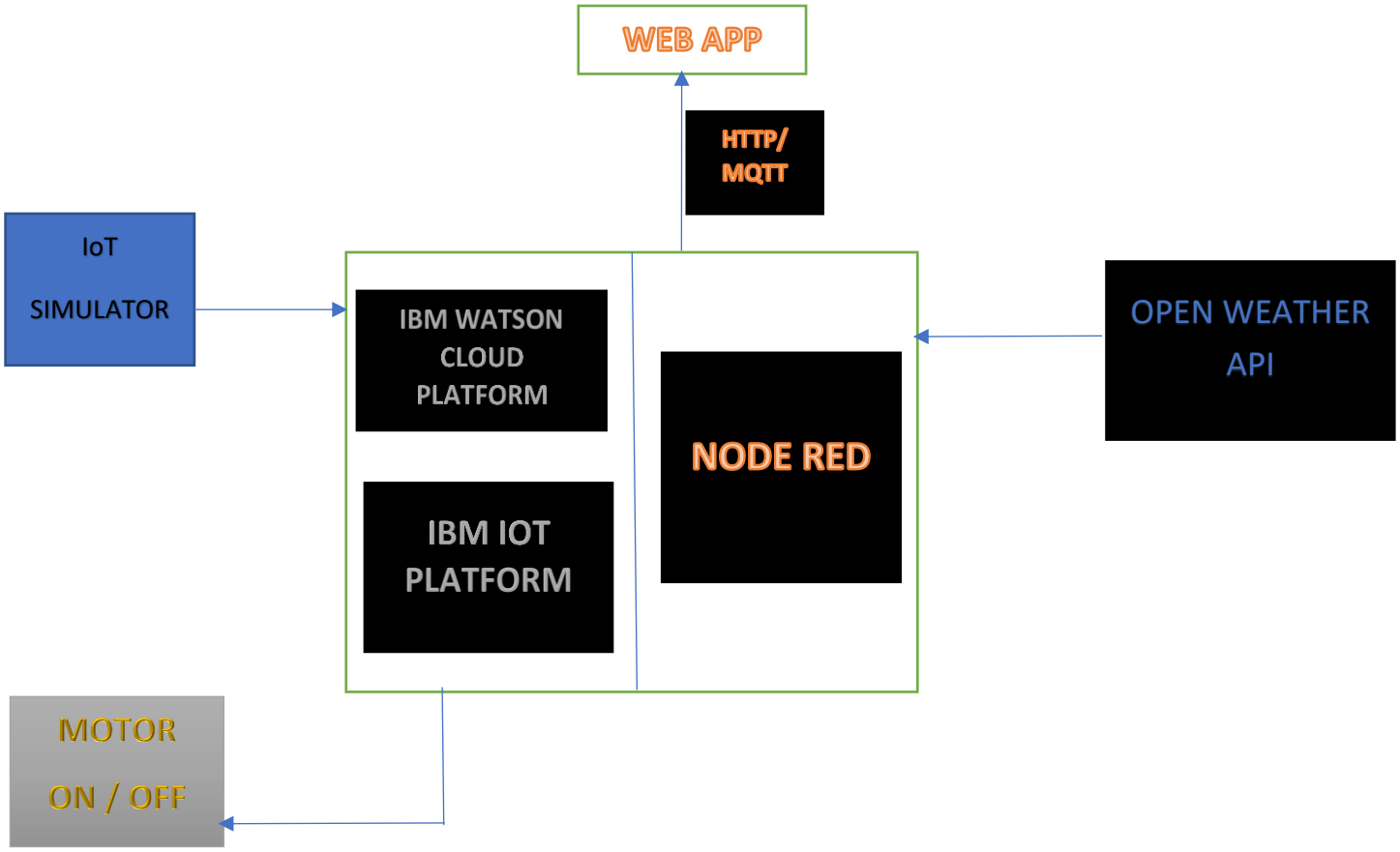
- Using smart irrigation system with IOT & associative technology requirement to make the field cultivation process more efficiently with less cost & human interface. The following points will be covered:
    - Rain Water Harvesting & Solar Power Utilization.
    - Checking About the weather conditions with corrective measures.
    - Effect Irrigation from remote location.

- Development challenge: We tend to make our project user friendly so that common people like farmer can use it very easily also to make the field cultivation process more efficient with less cost & human interface.
- Market need: Our project intends to use IOT , IBM Cloud Services , Open Weather API and variety of sensors to record agricultural and irrigation process and store it in a database, rain water harvesting and utilization, use of clean energy sources along with conventional energy resources which will not only maximize the agricultural

production with minimum cost and better efficiency, remote monitoring with eco-friendly environment.

- Opportunity identified: Engineering application in agricultural land can provide efficient production, remote monitoring, optimum utilization of resources like water, power with minimum manpower.

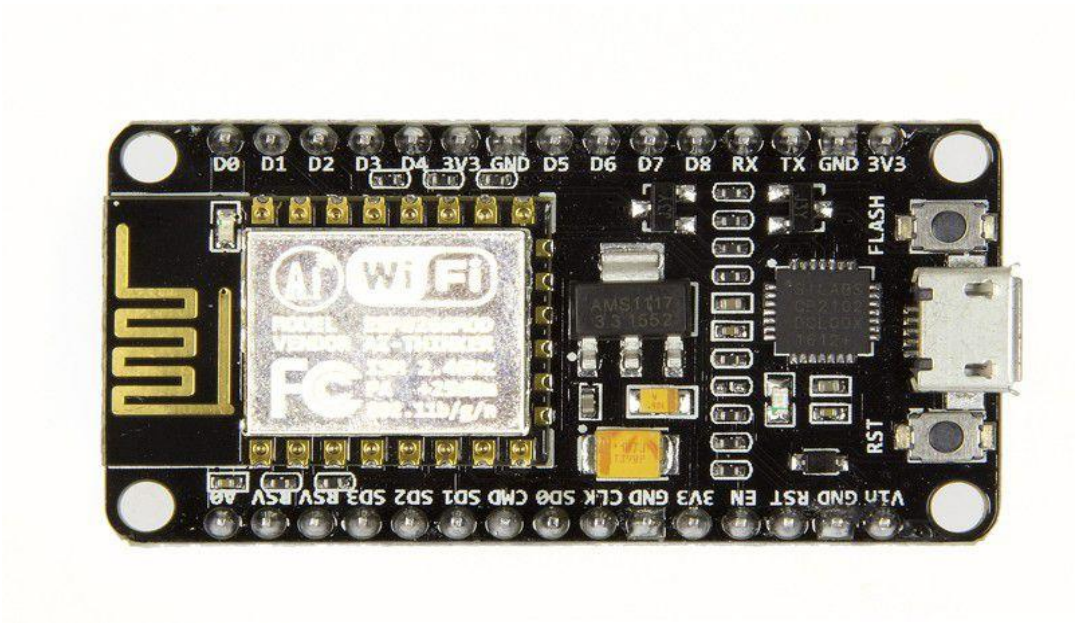
BLOCK DIAGRAM



HARDWARE USED

NodeMCU is an open-source firmware and development kit that helps you to prototype or build IoT products. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The firmware uses the Lua scripting language.

TO activate Arduino with WIFI module a code is required but NODEMCU has inbuilt WIFI module.



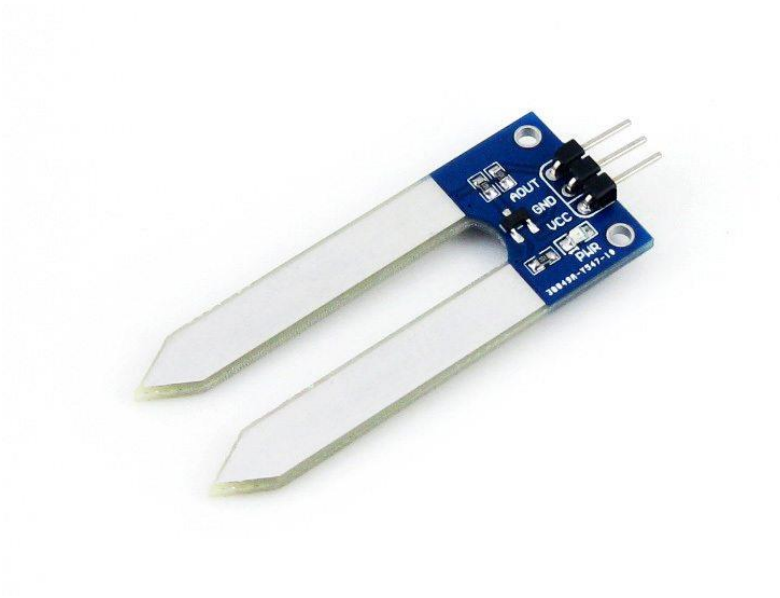
Temperature Sensor: A temperature sensor is an electronic device that measures the temperature of its environment and converts the input data into electronic data to record, monitor, or signal temperature changes. There are many different types of temperature sensors. Some temperature sensors require direct contact with the physical object that is being monitored (contact temperature sensors), while others indirectly measure the temperature of an object (non-contact temperature sensors).

Humidity Sensor: A humidity sensor (or hygrometer) senses, measures and reports both moisture and air temperature. The ratio of moisture in the air to the highest amount of moisture at a particular air temperature is called relative humidity. Relative humidity becomes an important factor when looking for comfort.

Humidity sensors work by detecting changes that alter electrical currents or temperature in the air.

There are three basic types of humidity sensors:

- Capacitive
- Resistive
- Thermal



Motor Driver: Motor drivers acts as an interface between the motors and the control circuits. Motor require high amount of current whereas the controller circuit works on low current signals. So, the function of motor drivers is to take a low-current control signal and then turn it into a higher-current signal that can drive a motor.

SOFTWARE USED

The Internet of Things is simply "A network of Internet connected objects able to collect and exchange data."

An **IoT** system consists of sensors/devices which “talk” to the cloud through some kind of connectivity. Once the data gets to the cloud, software processes it and then might decide to perform an action, such as sending an alert or automatically adjusting the sensors/devices without the need for the user.

IoT makes once "dumb" devices "smarter" by giving them the ability to send data over the internet, allowing the device to communicate with people and other IoT-enabled things.

IOT devices are also enable to have live exchange of data with other connected devices and application either directly or indirectl, or collected data from other devices and process the data and send the data to various servers.

IoT works in the following way:

- Devices have hardware like sensors, for example, that collect data.
- The data collected by the sensors is then shared via the cloud and integrated with software.
- The software then analyses and transmits the data to users via an app or website.

IBM CLOUD

IBM Cloud is a robust suite of advanced data and AI tools, and deep industry expertise to help you on your journey to the cloud.

The IBM Smart Cloud brand includes infrastructure as a service, software as a service and platform as a service offered through public, private and hybrid cloud delivery models. IBM places these offerings under three umbrellas: Smart Cloud Foundation, Smart Cloud Services and Smart Cloud Solutions.[14]

Smart Cloud Foundation consists of the infrastructure, hardware, provisioning, management, integration and security that serve as the underpinnings of a private or hybrid cloud. Built using those foundational components, PaaS, IaaS and backup services make up Smart Cloud Services. Running on this cloud platform and infrastructure, Smart Cloud Solutions consist of a number of collaborations, analytics and marketing SaaS applications.

IBM also builds cloud environments for clients that are not necessarily on the Smart Cloud Platform.

IBM Watson IoT Platform

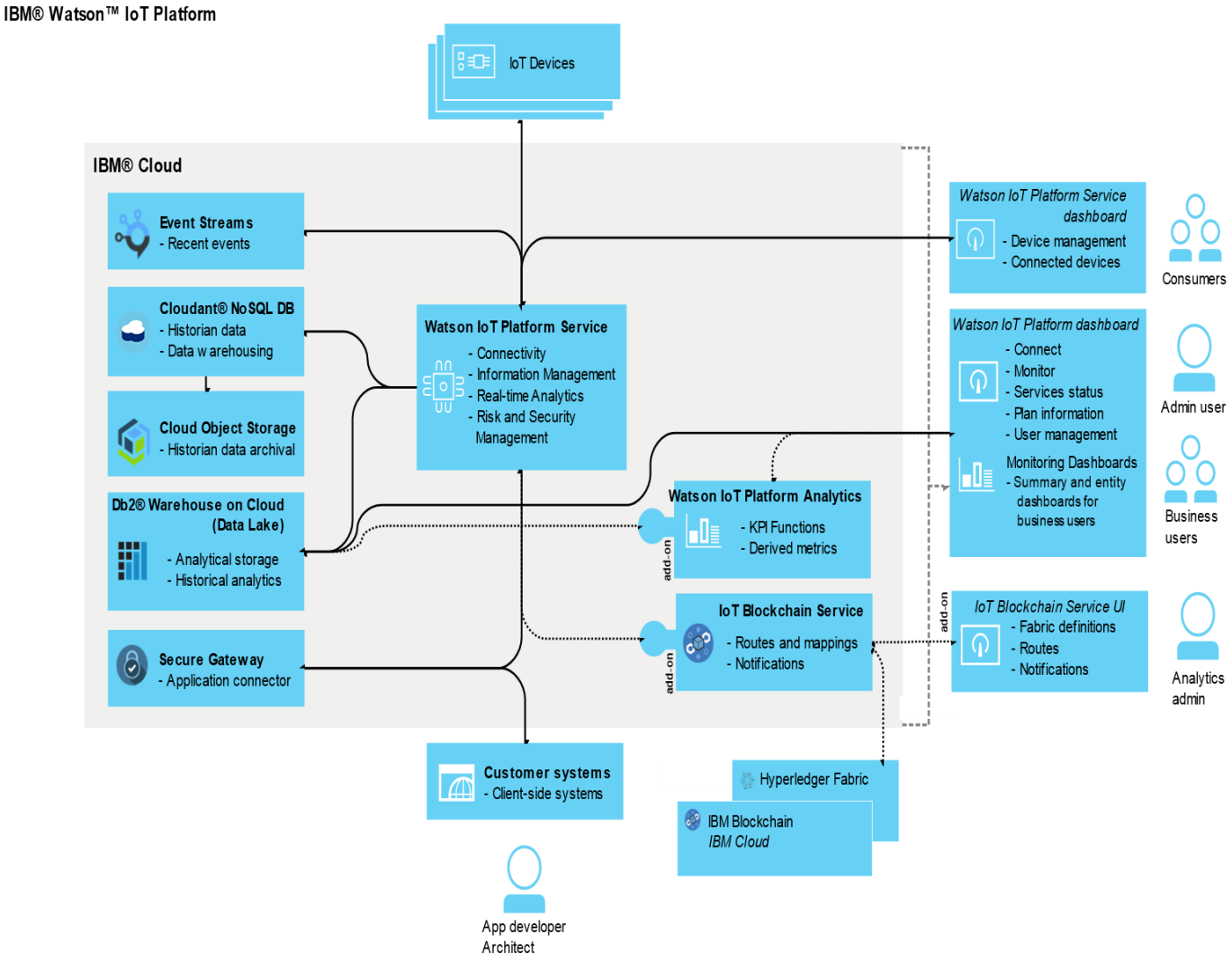
This is the hub of all things IBM IoT. This is where you can setup and manage your connected devices so that your app can access their live and historical data.

The Watson IoT platform is the environment to cognitively act upon the IoT.

IoT Platform is an end-to-end, fully-managed cloud service offering that integrates a bundled set of preselected services to form a public, multitenant SaaS solution on the IBM Cloud framework.

The IBM Cloud services that make up Watson IoT Platform provide the support for the main product functions of connecting, storing, analysing, and managing with further monitoring support through the Watson IoT Platform dashboard.

The IBM Cloud framework, which is managed by the IBM IoT Solutions DevOps team, handles back-end operations, such as security, resource allocation, backup and high availability.



Services Offered by IBM Watson IoT platform.

Node Red

Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways.

It provides a browser-based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its runtime in a single-click.

The light-weight runtime is built on Node.js, taking full advantage of its event-driven, non-blocking model. This makes it ideal to run at the edge of the network on low-cost hardware such as the Raspberry Pi as well as in the cloud.

Node-RED contains the following Watson IoT nodes that helps you to connect your devices, gateways and applications to Watson IoT Platform and create IoT solutions quickly. Watson IoT Node – A pair of nodes for connecting your device or gateway to the IBM Watson Internet of Things Platform.

Usage

Input Node

The input node receives device commands from the IBM Watson Internet of Things Platform.

The node can connect as either a Device or Gateway:

- Device: the node can be configured to either receive all commands for the Device, or just select a specific command type.
- Gateway: the node can be configured to receive commands for all devices connected through the gateway, or to select a subset of them.

- Output Node

Send device events to the IBM Watson Internet of Things Platform.

The node can connect as either a Device or Gateway, in registered mode or using the QuickStart service.

When connecting using the QuickStart service, the connection will use a device type of node-red-ibmwiotp and a randomly generated device id, which can be configured in the node. The events from the node can then be viewed on the QuickStart Dashboard.

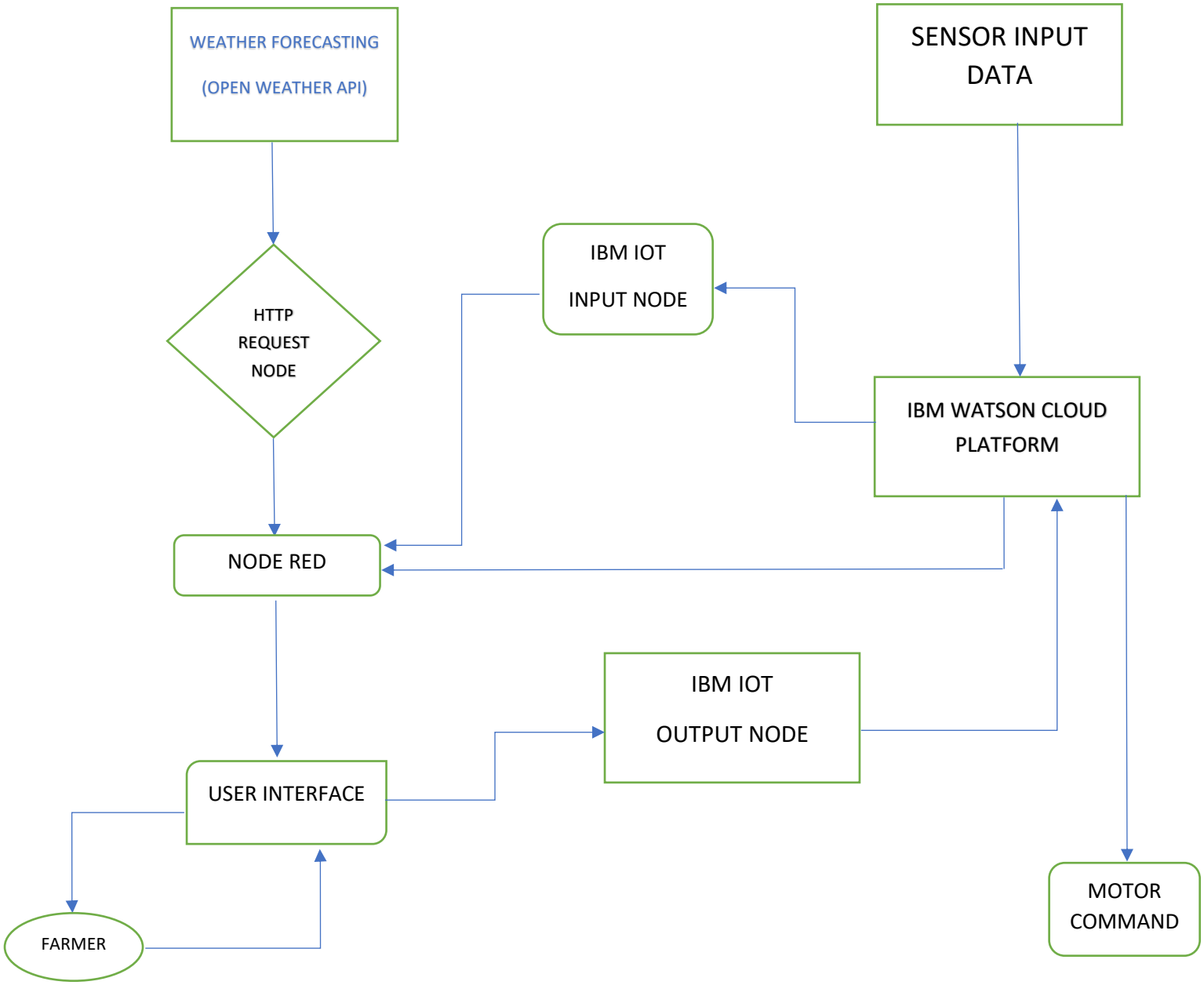
OPEN WEATHER API

The service allows you to regularly download current weather and forecast data in JSON format.

Advantages

- Weather data is open: current weather, forecasts, maps with precipitations, wind, clouds, data from weather stations are available through APIs, maps and other products.
- Coverage is global: weather data is available for any geographic location.
- Weather model: own model of weather forecast calculation, WRF model for regions + global models.
- Advanced technologies for a competitive price: Due to Big Data technology costs of production and support are cheap, a price for a user is affordable.

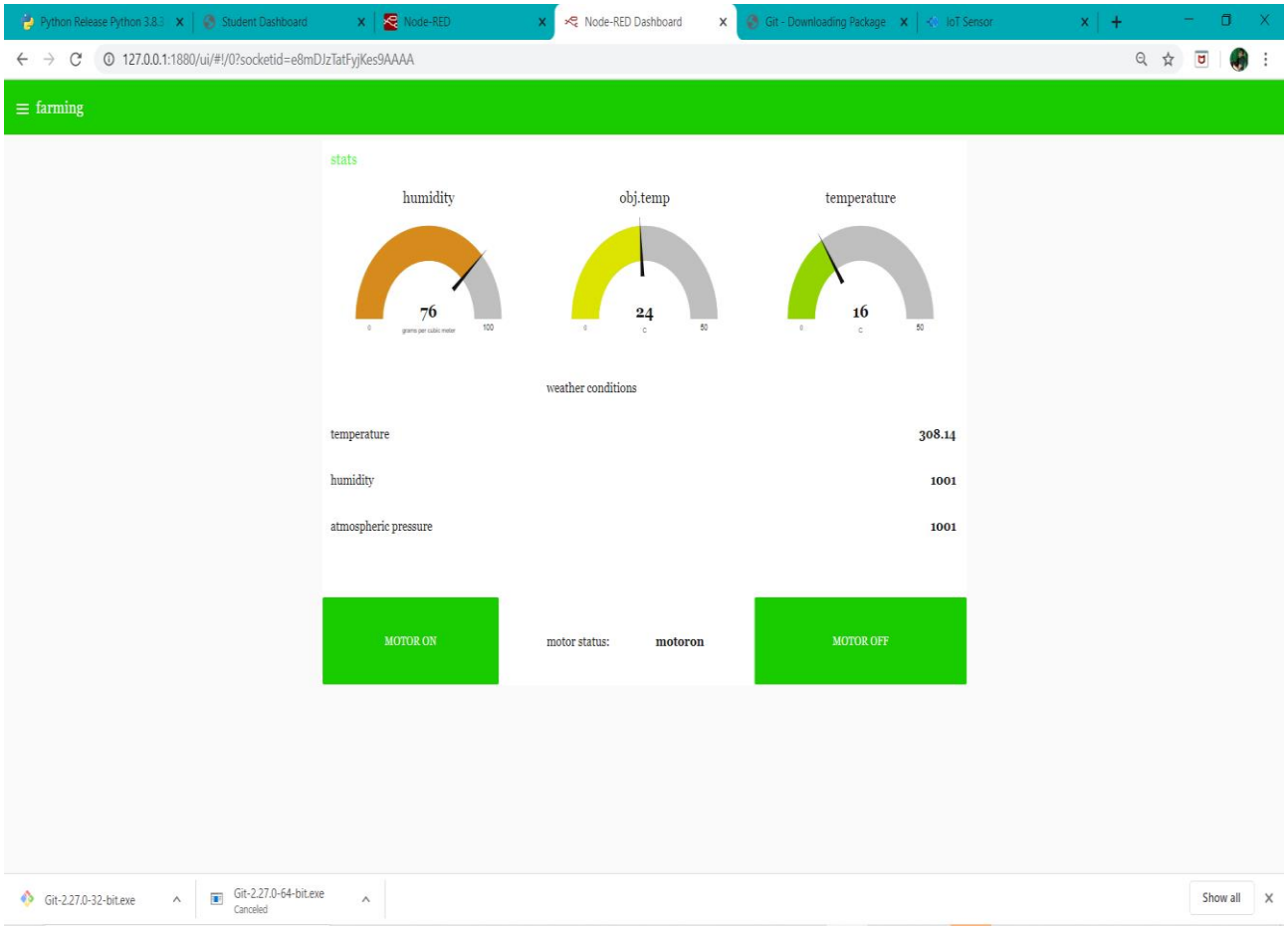
FLOWCHART


WEATHER FORECASTING
(OPEN WEATHER API)
SENSOR INPUT DATA
IBM IOT
INPUT NODE
HTTP
REQUEST
NODE
IBM WATSON CLOUD
PLATFORM
NODE RED
IBM IOT
OUTPUT NODE
USER INTERFACE
MOTOR
COMMAND
FARMER

RESULT

- All the Objectives and the requisites of the project are completed.

- Successfully Completed all the tasks:
  - Automated Watering System
  - Designed the user interface using the open weather API that would display the real weather conditions.
  - Integration of motor control on the user interface.



ADVANTAGES

- Increases agriculture productivity
- Prevents soil degradation
- Reduction of chemical application in crop production
- Efficient use of water resources
- Dissemination of modern farm practices to improve quality, quantity and reduced cost of production.
- Developing favourable attitudes
- Precision farming changing the socio-economic status of farmers

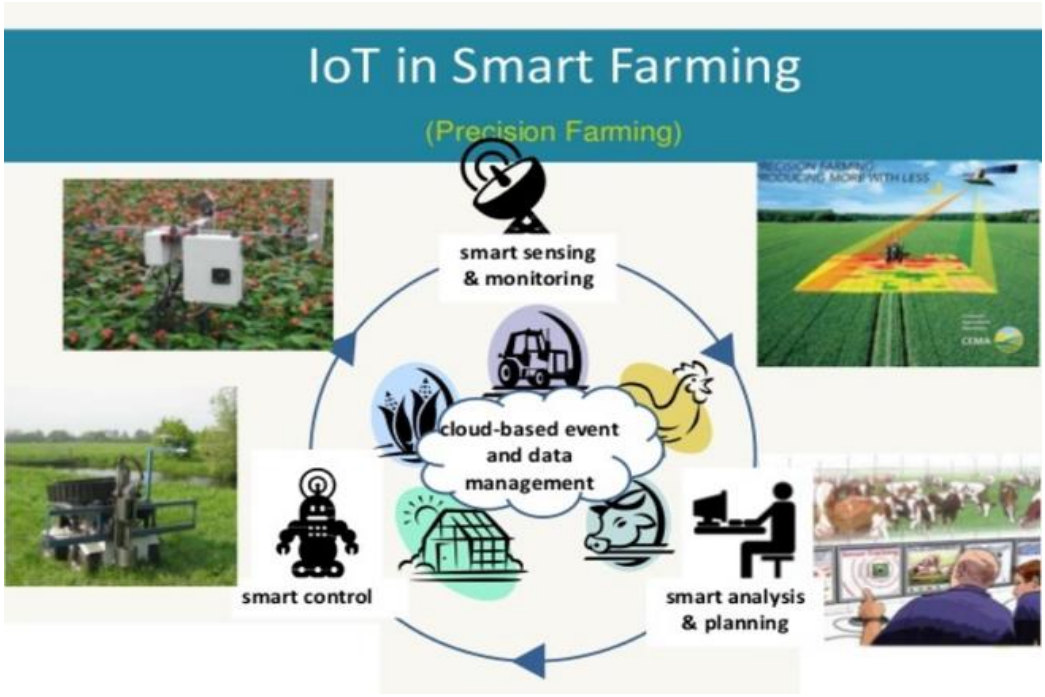
DISADVANTAGES

- High cost
- Lack of technical expertise knowledge and technology
- Not applicable or difficult/costly for small land holdings
- Heterogeneity of cropping systems and market imperfections
- Troubleshooting is difficult

APPLICATION OF THE PROJECT

Smart Agriculture can be thought of as anything that makes farming practice more controlled and accurate when it comes to raising livestock and growing crops. In this approach of farm management, a key component is the use of IT and various items like sensors, control systems, robotics, autonomous vehicles, automated hardware, variable rate technology, and so on.

The application of the Internet of Things in agriculture promises previously unavailable efficiency, reduction of resources and cost, automation and data-driven processes. In agriculture, however, these benefits don't act as improvements, but rather the solutions for the whole industry confronting a range of dangerous problems.



Real Time Applications of IoT In Agriculture And uses Cases

Livestock monitoring

IoT applications help farmers to collect data regarding the location, well-being, and health of their cattle. This information helps them in identifying the condition of their livestock. Such as, finding animals that are sick so, that they can separate from the herd, preventing the spread of the disease to the entire cattle.

Monitoring climate conditions

Weather stations equipped with smart sensors can collect weather data and send useful information to a farmer. Moreover, the information is analysed by special software and the farmer gets ready-made analysis that helps him have a detailed forecast and avoid crop losses.

Greenhouse Automation

In addition to sourcing environmental data, weather stations can automatically adjust the conditions to match the given parameters and to provide the most appropriate condition for each greenhouse.

Crop monitoring

As in the case of weather condition monitoring, sensors for crop monitoring also collect all information like crop health, humidity, precipitation, temperature, and other parameters. If there are any deviations, farmers may identify them beforehand and take appropriate actions. Also, sensors help farmers determine when the best moment to plant crops and harvest them.

Drones

In precision agriculture, drones have a range of uses from soil and crop field analysis to planting and pesticide spraying. Drones can be used with different imaging technologies like hyperspectral, multispectral, thermal, etc. that can provide the farmers with time and site-specific information regarding crop health, fungal infections, growth bottlenecks, etc.

CONCLUSION

The development of agricultural sector will always be a priority especially given the dynamics of the world today. Therefore, using IoT in agriculture has a big promising future as a driving force of efficiency, sustainability, and scalability in this industry.

IoT enabled agriculture has helped implement modern technological solutions to time tested knowledge. This has helped bridge the gap between production and quality and quantity yield. Data Ingested by obtaining and importing information from the multiple sensors for real time use or storage in a database ensures swift action and less damage

to the crops. With seamless end to end intelligent operations and improved business process execution, produce gets processed faster and reaches supermarkets in fastest time possible.

FUTURE SCOPE

Smart Agriculture System is key for the future of agriculture

Smart Farming is a farming management concept using modern technology to increase the quantity and quality of agricultural products. Farmers in the 21st century have access to GPS, soil scanning, data management, and Internet of Things technologies. By precisely measuring variations within a field and adapting the strategy accordingly, farmers can greatly increase the effectiveness of pesticides and fertilizers, and use them more selectively. Similarly, using Smart Farming techniques, farmers can better monitor the needs of individual animals and adjust their nutrition correspondingly, thereby preventing disease and enhancing herd health.

According to a new market intelligence report by BIS Research, the global smart farming market is expected to reach $23.14 billion by 2022, rising at a compound annual growth rate (CAGR) of 19.3% from 2017 to 2022.

A recent Beecham's report entitled Towards Smart Farming: Agriculture Embracing the IoT Vision predicts that food production must increase by 70 percent in the year 2050 in order to meet our estimated world population of 9.6 billion people.