SmartFarmer - IoT Enabled Smart Farming Application

Existing problem :

In India there are many cases of crop failures and most of the cases have the same reason behind it and that is lack of water which causes the irrigation system inadequate for the crop filed. There are some other reason as well like regional floods, quality of the seed is poor and out of all the main cocern is inefficient farming practices which leads to crop failures.We can overcome this by providing proper technology to the farmers and for the farming activity, which in turn increases the yield which further increases the income of the farmer and also this plays an important role in country's GDP level growth (GDP: Gross Domestic Product).And the challenge now is to develop a cheap, but accurate system that will provide the farmer with the adequate amount of information related to the moisture of the soil, the temperature, humidity and all required elements which play an important role in the vegetation yield.

Keywords: GDP (Gross Domestic Product), IoT (Internet of Things), AI(Artificial Intelligence), ML(Machine Learning), allMETEO, Smart Elements, and Pycno, Farmapp and Growlink, SCR by Allflex and Cowlar, Arable, DroneSeed, Sensefly.

Things to consider before developing your smart farming solution (Challenges):

1.The hardware

To build an IoT solution for agriculture, you need to choose the sensors for your device. Your choice will depend on the types of information you want to collect and the purpose of your solution in general.That is based on the information required for the Smartfarming.Importantly, the quality of your sensors is crucial to the success of your product: it will depend on the accuracy of the collected data and its reliability.

2. The brain

Data analytics should be at the core of every smart agriculture solution. The collected data itself will be of little help if you cannot make use of it.Thus, you need to have powerful data analytics capabilities and apply predictive algorithms and machine learning in order to obtain actionable insights based on the collected data.

3. The maintenance

Maintenance of your hardware is a challenge that is of primary importance for IoT products in agriculture, as the sensors are typically used in the field and can be easily damaged.
Thus, you need to make sure your hardware is durable and easy to maintain as well it should be user-friendly . Otherwise you will need to replace/repair your sensors more often than you would like. It will become time consuming.

4. The mobility

Smart farming applications should be tailored for use in the field. A business owner or farm manager should be able to access the information on site or remotely via a smartphone or desktop computer.Plus, each connected device should be autonomous and have enough wireless range to communicate with the other devices and send data to the central server.

5. The infrastructure

To ensure that your smart farming application performs well (and to make sure it can handle the data load), you need a solid internal infrastructure.
Furthermore, your internal systems have to be secured and should be well fenced with firewall. Failing to properly secure your system only increases the likeliness of someone breaking into it, stealing your data or even taking control of your system.

6. Connectivity

The need to transmit data between many agricultural facilities still poses a challenge for the adoption of smart farming. Needless to say, the connection between these facilities should be reliable enough to withstand bad weather conditions and to ensure non-disruptive operations. Today, IoT devices still use varying connection protocols, although the efforts to develop unified standards in this area are currently underway. The advent of 5G and technologies like space-based Internet will, hopefully, help find a solution to this problem.

7. Data collection frequency

Because of the high variety of data types in the agricultural industry, ensuring the optimal data collection frequency can be problematic. The data from field-based, aerial and environmental sensors, apps, machinery, and equipment, as well as processed analytical data, can be a subject of restriction and regulations. Today, the safe and timely delivery, and sharing of this data is one of the current smart farming challenges.

8. Data security in the agriculture industry

Precision agriculture and IoT technology imply working with large sets of data, which increases the number of potential security loopholes that perpetrators can use for data theft and hacking attacks. Unfortunately, data security in agriculture is still, to a large extent, an unfamiliar concept. Many farms, for example, use drones that transmit data to farm machinery. This machinery connects to the Internet but has little to zero security protection, such as user passwords or remote access authentications. Some of the basic IoT security recommendations include monitoring data traffic, using encryption methods to protect sensitive data, leveraging AI-based security tools to detect traces of suspicious activity in real-time, and storing data in the blockchain to ensure its integrity. To fully benefit from IoT, farmers will have to get familiar with the data security concept, set up internal security policies, and adhere to them.

IoT use cases in agriculture(with examples):

1.Climatic conditions should be monitored

The most popular smart agriculture gadgets are weather stations, combining various smart farming sensors. Located across the field, they collect various data from the environment and send it to the cloud. The provided measurements can be used to map the climate conditions, choose the appropriate crops, and take the required measures to improve their capacity (i.e. precision farming).

Some examples of such agriculture IoT devices are allMETEO, Smart Elements, and Pycno.

2.Greenhouse automation

Typically, farmers use manual intervention to control the greenhouse environment. The use of IoT sensors enables them to get accurate real-time information on greenhouse conditions such as lighting, temperature, soil condition, and humidity.
In addition to sourcing environmental data, weather stations can automatically adjust the conditions to match the given parameters. Specifically, greenhouse automation systems use a similar principle.

For instance, Farmapp and Growlink are also IoT agriculture products offering such capabilities among others.
GreenIQ is also an interesting product that uses smart agriculture sensors. It is a smart sprinklers controller that allows you to manage your irrigation and lighting systems remotely.

3.Cattle management and monitoring

Just like crop monitoring, there are IoT agriculture sensors that can be attached to the animals on a farm to monitor their health and log performance. Livestock tracking and monitoring help collect data on stock health, well-being, and physical location.
For example, such sensors can identify sick animals so that farmers can separate them from the herd and avoid contamination. Using drones for real-time cattle tracking also helps farmers reduce staffing expenses. This works similarly to IoT devices for petcare.

For example, SCR by Allflex and Cowlar use smart agriculture sensors (collar tags) to deliver temperature, health, activity, and nutrition insights on each individual cow as well as collective information about the herd.

4.Crop management

One more type of IoT product in agriculture and another element of precision farming are crop management devices. Just like weather stations, they should be placed in the field to collect data specific to crop farming; from temperature and precipitation to leaf water potential and overall crop health.
Thus, you can monitor your crop growth and any anomalies to effectively prevent any diseases or infestations that can harm your yield.

Arable and Semios can serve as good representations of how this use case can be applied in real life.

5.Agricultrual drones

Perhaps one of the most promising agritech advancements is the use of agricultural drones in smart farming. Also known as UAVs (unmanned aerial vehicles), drones are better equipped than airplanes and satellites to collect agricultural data. Apart from surveillance capabilities, drones can also perform a vast number of tasks that previously required human labor: planting crops, fighting pests and infections, agriculture spraying, crop monitoring, etc.

DroneSeed, for example, builds drones for planting trees in deforested areas. The use of such drones is 6 times more effective than human labor. A Sense Fly agriculture drone eBee SQ uses multispectral image analyses to estimate the health of crops and comes at an affordable price.

6.Smart farming using Analytical prediction

Precision agriculture and predictive data analytics go hand in hand. While IoT and smart sensor technology are a goldmine for highly relevant real-time data, the use of data analytics helps farmers make sense of it and come up with important predictions: crop harvesting time, the risks of diseases and infestations, yield volume, etc. Data analytics tools help make farming, which is inherently highly dependent on weather conditions, more manageable, and predictable.

For example, the Crop Performance platform helps farmers access the volume and quality of yields in advance, as well as their vulnerability to unfavorable weather conditions, such as floods and drought. It also enables farmers to optimize the supply of water and nutrients for each crop and even select yield traits to improve quality.

Proposed Solution:

Every aspect of the traditional farming method can be changed from roots by adopting the latest technologies of IoT in agriculture practices. Integrating of sensors and the IoT in smart agriculture can raise agriculture to levels which were previously un-imaginable.

Every land cannot support the growth of every crop so by simultaneously measuring soil parameters like the nutrient presence, flow of irrigation, soil type, temperature of the milieu, etc.We can create a report, based on that report a farmer may crop seeds which are suitable to that land.And also aerial vehicles can be arranged to monitor the crops without the use of a man. Temperature and humidity sensors would be buried under the soil and the device reports it to the farmer through phone application on live basis. A dashboard kind of UI can be displayed to the user/farmer through the web app or a application specially designed using MIT App Inventor. The IoT device is also integrated with the weather forecast services so that user, farmer in our case always updated with the weather in that location.

And now the farmer should be a experienced person so as to use the data's collected and plant crops accordingly. And also we can use AI (Artificial Intelligence) to suggest the farmer with the crops which can be sown. Flow of water can also be controlled using the data acquired from the IoT sensor (Soil moisture sensor). Switching the motor can be done with the help of relay and also in case of many valves we can have an array of relays. And this can be done from any place as the application is available online and can be connected through the internet. And also ML (Machine Learning) can be used and implemented to smoothen the process of farming for the farmer.

Conclusion:

By using this system farmers can effectively produce more yield and can save water from wastage. With help of weather forecast service farmer can water their land as per

weather. Farmer can also turn ON/OFF motor whenever required based on the water content in soil.

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