**Assignment No. 2**

**Topic: “Take a real time IOTs based working system. What are the pros and cons of that IOT’s base system?”**

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**Agriculture Field Modernized by Internet of Things (IOT)**

Internet of things is a network of smart physical objects interconnected with the virtual objects to formulate a digital web of connected things. In agriculture area data capturing techniques and sensor devices have the capability to communicate with each other which can be remotely accessed, monitored through Internet. The IOT based agriculture is designed to help farmers monitor vital information like humidity, air temperature, pest control and soil quality using remote sensors. This application helps farmers improve yield, plan more efficient irrigation and make harvest forecasts. This presents a future projection of smart connected agriculture objects and processes and the scope of the internet driven applications in agriculture field. Internet of things applications that have the potential for exponential growth.

According to the UN projections, world population will rise from 6.8 billion today to 9.1 billion in 2050 that signifies food production has to be raised to feed the one-third more mouths. And, the agriculture industry is accountable for fulfilling humans’ need for food, energy, and shelter (To a great extent). Furthermore, the agriculture industry composes less than 5 percent of the combined GDPs of the world. But, there is one more distressing fact revealed by Bureau of Labor Statistics, employment of agricultural workers is projected to decline 3 percent from 2012 to 2022. Why is this employment supposed to reduce? And, what farm owners or farmers would do to sustain the productivity, increase yield and feed additional 2.3 billion people by 2050.

The only solution to all these problems is **Agriculture Modernization** that has already started by some of the tech-savvy farmers. For the next generation agriculture fields, data collected from sensors would become the fertilizer to grow crops. It’s really perplexing but true.

Now, take a look how IoT can make agriculture more profitable and crop healthier at every step. (a) Strength:

* **Decide which crop is the best to grow on a piece of land.**

Every crop requires different atmospheric conditions and land to grow, but concluding the same is tricky. How could farmers find which land or other conditions are the best fit for their crop? It can be identified by conducting a survey for the agricultural land combining the power of artificial intelligence and IoT in unmanned aerial vehicle (UAV).

UAV, a small airplane used for the in-flight observation and monitoring that gathers data like- visual, thermal, and multispectral imagery, air pressure, humidity, the weather condition at resolutions up to 1 cm/pixel. This data is really helpful for the farmers to take the decisive step.

Moreover, UAV also helps farmers in knowing plant height, weed detection, plant-counting, crop health and changes in the plant in different seasons.

* **Making irrigation smarter**

Water supply at the right time, in right quantity and at the right place plays a vital role in the plant’s growth. Water management remotely is also challenging task, especially the management becomes more difficult during the shortage of water, which may otherwise damage the crop.

Connecting humidity sensors, water valves and monitoring system, water supply for irrigation can be managed easily. Humidity sensors smartly measure the soil moisture and based on that data, water valves provide water to the field automatically without any human interventions. Also, any leakage in the water pipes can also be identified. The complete data is accessible to the farmers at distance on the mobile.

With smart irrigation, there will be the least wastage of water, water consumption in the field can be tracked, in drought areas the crop water management could be done efficiently and unauthorized water consumption (If any) is detectable.

* **Know weather forecast information in advance**

Climate and weather influence the crop production at large scale. This dependency on weather and frequent changes in the climate sometimes damage the crops and ultimately farmers suffer from a great loss. How about if the farmer knows weather information before they decide plantation or harvesting of crops. It’d be great. Isn’t it?

With IoT farmers would get accurate weather forecast in real-time and based on this information, they can pre-plan the different activities. Also, in case of future contingency, right steps could be taken beforehand to prevent the loss to happen.

* **Evaluate the growth performance of produce**

Despite having right irrigation facility, perfect weather and optimum pest management, plants won’t grow well. Constant performance measurement and evaluation is necessary, but for that regular visit to the field is arduous. Smart technology makes this work done from a distance with sensors.

Implanting remote sensors would check the soil temperature, humidity, air temperature, pressure and pretty more! Getting this data, farmer can plan accordingly like- change the harvest time, irrigation time, determine heat events and improve plant health.

When plant breeding is done in such a perfect environment, the better would be the food quality and increased production.

* **Check the level of nutrient in the crops**

Presently, getting a good quality food is essential, but having the right level of nutrients is vitally important. Now, farmers can manage the level of nutrients in the produce. Bewildered? As, how is it possible to check, control or manage the level of nutrients in the food. But, yes skyrocketing technology has made it possible.

The nutrient analyzers are built where sensors monitor the level of nutrients in the crops. Every sensor relates to a specific ion that would sit on one side of the membrane and when water passes through, these sensors detects the ion presence and its quantity. Simultaneous measurement of six ions can be done in the real-time. The analyzer is synced with mobile phone where all the data is displayed.

During plant’s growth, farmers knowing the ion level, they can change the mix of nutrients and improve the plant’s yield. Moreover, changing the proportion of nutrients, color and maturity rate of produce can also be altered.

* **Control the pest at the fingertips**

Yes, the healthy crop becomes a prey to pests effortlessly and farmers have to suffer from a great monetary loss. It’s very crucial in the whole crop production cycle to identify when these pests would attack and what quantity of pesticides need to be used.

Here pest control sensors would help. The sensors monitor the pest behavior, pest’s population, and analyzes environmental parameters and plant growth. Based on this data the pesticides are automatically sprayed into the field at the place where it requires and in the right amount so that pests are disrupted initially.

The complete record of the pest’s attack on the crop, the amount of pesticides sprinkled and how much crop production is affected could be tracked. Implementing IoT reduces pesticide usage in the field and keep crop healthier.

* **Monitor the food storage safety**

Once the crop is harvested, farmer’s work is not done. If you are thinking so, you are mistaken. As, crop storage is an essential part of the crop production process. Employing the correct grain storage techniques includes maintaining the accurate temperature, humidity, air control and pressure in the warehouse. But, getting real-time information is difficult and info received lately would result in the severe damage.

Integrating different IoT sensors at storage place would allow farmers to monitor the crop storage in real-time, control the storage temperature, humidity and a lot more. Plus, they would receive the alerts, in case any set parameter in the grain storage changes.

* **Bring coordination in logistics**

Transferring the yield from storage to the market at the correct time through right means of transportation is very crucial. By optimizing the supply chain, farmers can reap good monetary benefits and reduce losses or overhead expenses.

With GPS sensors, the owner can easily track where the transport vehicle is and exact its location in the real-time. It helps in monitoring the vehicle and providing help to the vehicle in any emergency. Plus, installing the thermostat sensors in the vehicle would sense the change in the set temperature and if any fluctuation is found, then the owner would be informed.

* **Expected outcome**

With the potential IoT innovations in the agriculture industry at large scale would certainly bring a global shift in the way farming is done and yields are produced.

(b) Weakness:

* Forms entities share one and foremost common point, internet. Centrally connected network is majorly vulnerable to threats digital, manual both kinds of threats.
* Cloud services are vital to smart farm architecture, as number of applications; equipment and database are connected together.
* IOT Technology's success relies on effective sensors based environment. Whole farm has to be equipped with network sensors and actuators, which increases setup and maintenance cost.
* Multiple technologies with different platforms require a higher degree of integration. Compatibility among platforms is quintessential.
* Smart Farm requires effective knowledge and technical training to handle these next generation equipment.
* Limited land area is available to farmers and its gradually decreasing, in such conditions all the digital equipment setup acquire area that eventually decrease the area available to farming.
* For larger farms, larger network bandwidth is required for all the equipment to successfully interconnect to the equipment architecture.
* Network equipment layer must support and be compatible with huge amount of data produced by wireless sensors and smart devices.