A Survey on Latest Iot Sensors Used in Agricultures on Non Food Crops

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ABSTRACT

The objective of Precision Agriculture is an method to farm control that uses records era to develop the crops and how the IOT sensors are getting used for the enhancement of agriculture to get profit as a result. It makes use of technology like GPS, GNS, Remote sensors, drone and many others. To domesticate non-food crops. Our paper focus on the identification of critical factors of non-food crops Improvisation using IoT sensors. Non-food crops are business crops and also business crop which has a call for in big quantity due to the fact improvement in these crops ends in the improvement of nation's economy. So, our paper concentrate on the enhancement of the production of non-meals plants by analyzing the crucial factors and it's related no longer sensors used in agriculture. In this paper, WHAT exactly the IOT sensors used in non-food crops? And what are the essential factors affecting the increase of crops especially non-food vegetation, because it's a source of earnings. How it's miles used in farms and their limitations and demanding situations. Also identification of sensors for the crucial factors of non-food crops, a specific necessities of the device and wireless communications technologies related to IoT in NON-FOOD agriculture practices.

Keywords—**Internet of things, Smart agriculture, Precision agriculture, Electronic product code (EPC), Thermostats, Climate smart agriculture, Sensor agriculture.**

I. INTRODUCTION TO IOT

IOT is a dwelling network or a device of interrelated computing gadgets, mechanical and digital machines, objects, gadgets which can be supplied. With a completely unique identifiers (UID's) and it has the potential to switch statistics over a network without a human to human or human to laptop interaction. IOT [1] extends its connectivity beyond traditional gadgets like desktop, pc, smartphones, tabs to a massive variety of devices. Here, embedded generation is used to talk and engage with the external surroundings through the net. Examples for IOT – security system, thermostats, electronic packages. IOT works with the help of sensors. The introduction of IoT gives upward push to the new direction of modern research in agriculture sectors. Being on the nascent level, IOT desires to get widely experimented so, as to get more uses in various agriculture applications.

Sensors are developed for outdoor use. They use the same technique that is used in lab instruments.
Example: Soil sensors: used to test soil, all they need is to be calibrated using lab analyzed soil samples. And they hoping can be of practical use in smallholder forming system to enable smallholders to get easier access to information on their soil. Others Sensors take the responsibility of measuring a physical quantity like speed, pressure and converts it into a signal that can be measured electrically.

Here IOT system utilizes sensors to make conversation (sending the request to solve the problem) with the cloud via some connectivity. When the request or the data gets into the cloud, software process it and decide to perform an action like sending an alert or automatically adjust the sensors without the help of user perform an action like sending an alert or automatically adjust the sensors without the help of the user. IoT is used in different applications as shown in Fig 1.

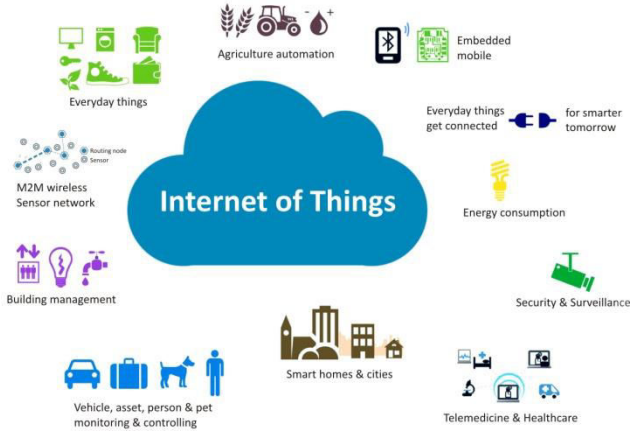

Fig 1: Applications of IOT

Few examples of IOT Sensors are Accelerometer sensor, Proximity sensor, IR sensor, Gas sensor, Temperature sensor, Chemical sensor, Smoke sensor, Motion detector sensor, Laser sensor, Water quality sensor, Image sensor, Gyroscope sensor.

IoT system or any application comprises of many components/things. When these things/components are interconnected with other things, communication happens and actions will be taken. An IoT Application comprises different components shown in Table-1.

Table-1 Components of IOT Sensors

IoT Components	Description
Physical objects	Things
Sensors	A device that modifications a bodily parameter to an electrical output. Sense the physical environment EX: optical sensors, electromagnetic sensors and many others.
Actuators	A device that adjustments an electrical signal to bodily output. The mechanism for turning strength into motion, Affect the bodily surroundings. EX: Mechanical actuator, hydraulic, electric powered actuator and many others.
Virtual gadgets	Electronics tickets, agendas, books, wallets
People	EX: humans can manipulate the surroundings via mobile apps
Services	EX: cloud offerings - may be used to: Process big information and turn it into valuable facts, Build and run progressive applications, Optimize business tactics through integrating tool data.
Platforms	Type of middleware used to connect IOT additives (items ,people ,provider and so forth)to IOT .Provide numerous capabilities: • Access to devices, Ensuring right set up/conduct of a tool, Data analytics, Interoperable connection to a nearby network, cloud or other gadgets.
Networks	IOT components are tied together via networks, the use of numerous wi-fi and wireline technologies, requirements, and protocol to provide pervasive connectivity.

II. RELATED WORK

A. *About Non-Food crops*

A business crops are not anything but non-meals plants, the vegetation which are grown to fabricate the best that aren't used to eat as food. These non-plants used for the economic use. Good production of non-food crops outcomes in improving countries monetary stage. These plants are exported to many countries who're in want. So, by using the good manufacturing of non-food plants, demands and ratings might be expanded for you to mirror on countries financial degree.

EX: cotton – used to produce the clothes in place of food consumption. [2] other Non-food plants includes

- Oilseeds - Groundnut, linseed, rapeseed and mustard.
- Fiber crops - Cotton, Jute and Mesta, sugarcane, tobacco
- Plantation crops - Tea, Coffee and rubber etc.

B. *Importance of non food crops*

Many plants are harvested handiest for food eating cause however the non-food crops are used by the industries to fabricate the products like garments and many extra. It includes horticulture, floriculture, oil crops and industrial vegetation. From this crops it also helps in growth of country's economic system. Environmental elements influence plant increase and development. Climatic factors consist of rainfall, a water, mild, temperature, relative humidity, air and wind. We can divide elements as outside factors and internal elements:

INTERNAL FACTORS:

Genetic elements (or heredity): The genetic make-up of flora consist of increase in crop yields and other proper characters which are associated with genetic factors.

- High yielding ability.
- Early maturity.
- Quality of grain.
- Quality of straw(sweetness and juiciness)

These are a few characters which are not prompted through environment elements, given that they're ruled by genetic factors.

EXTERNAL FACRTORS:

These thing aren't trusted genetics of plants. It simply relies upon on environmental weather situation, climate and other factors.

- Climate.
- Temperature.
- Precipitation.
- Atmospheric humidity.
- Wind pace.
- Edaphic elements (soil) -Soil air, Soil moisture, Soil temperature. Soil natural be counted, Soil reaction

III. IDENTIFICATION OF SENSORS IN NON FOOD CROP CULTIVATION

IOT in agriculture is designed to help formers reveal critical data like humidity, air temperature and soil quantity the use of far flung sensors and to enhance yields, plan greater efficient irrigation and make harvest forecast.

- Utilizing IOT sensors in agriculture is very crucial because agriculture is the main supply of livelihood of many humans in extraordinary parts of the sector. Many families in India are dependent on land, 60% of the land can be ploughed and used to grow plants.
- By the implementation of IOT sensors technology in agriculture, it effects in SMART AGRICULTURE or PRECISION AGRICULTURE.
- It gives a manner for a former to benefit maximum yields by using making an investment minimum aid together with water, fertilizer and seeds.
- IOT sensors facilitates the formers in gaining the information approximately crops. By the use of this era, formers can self-determine for which crops what fertilizer have to be used to advantage maximum yields and they can understand the ratio of useful resource.
- In weather clever agriculture (CSA) that gives guidance about the weather, climate and it gives information of developing non-meals crops in specified weather a good way to provide extra yields.

C. Sensors used in cultivation of non-meals vegetation

Electromagnetic sensors: used for measuring soil texture, salinity, natural count number and moisture content. [3]
Airflow sensors: degree soils permeability.
Acoustic sensors: used to determine the soil texture.
Optical sensors: used for predicting clay, organic be counted and moisture content in soil
Mechanical sensors: used to estimate soil compaction.
Electrochemical sensors: measures soil nutrients levels and Ph.

Example-1: Crop sensor agriculture

Crop sensor is a small sensor and it isn't always like complete frame sensors, its miles smaller than 35mm movie frame. Shown in Figure: 2 and Figure 3. These sensors are utilized in sensing for soil moisture and nutrients, controlling water usage for top of the line plant growth, determining the most excellent time to plant and harvest and additionally in reporting climate conditions. It includes APS-C and Micro four/3 gadget (sensors). [4]

Fig 2: Crop Sensor

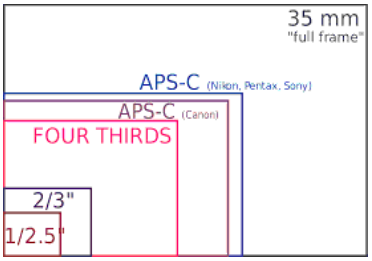

Fig 3: Structure of crop sensor-Space used

Example-2 NPK sensors

Fertilizers play vital role in improvising the quality of the soil. The major fertilizers used are N, P, K. To discover N, P and K nutrients of soil we use optical transducer. In optical transducer is used to degree and come across the presence of nitrogen (N), potassium(K) and phosphorus of soil and this measure are wanted to investigate how much greater content of those vitamins are delivered to the soil to increase soil fertility. By this, it is able to improve the best of the soil which results in the wealthy yields. And reduces the undesired use of fertilizers which can be delivered to the soil, shown in fig 4.

The dedication of NPK values of the pattern is accomplished with the aid of absorption light of each vitamins. Optical transducer is used as detection sensors which consist of three LED's as light source and photodiode as a mild detector. The wave period of LED's is chosen to match the absorption band of every vitamins. The nutrients absorbs light from LED's and the photodiode converts the final mild this is reflected with the aid of reflector to modern. The machine makes use of an Arduino micro controller for information acquisition, therefore the output from the transducer is converted right into a virtual show analyzing. Testing on various samples of the soil, shared that the optical transducer can evaluate the NPK soil content as excessive, medium and low.

Fig: 4 NPK SENSOR

IV. USING REMOTE SENSOR PROCESS

The far off sensor is described as technological know-how and era wherein the traits of objects of interest may be diagnosed, measured and analyze the traits without direct contact. Electromagnetic radiation which is contemplated or emitted from an object is the standard supply of faraway sensor facts. The far flung sensor collects the facts with the aid of the detection of energy that is pondered from the earth. This sensor may be

satellites or mounted on aircraft. Remote sensors [6] are of types-

- Passive sensor: it's miles responding to outside stimuli. They record natural electricity that is reflected or emitted from the earth surface. The maximum commonplace source of radiation detected by way of passive sensors is contemplated sunlight.
- Active sensors: it makes use of inner stimuli to gather the statistics approximately the earth. For example, laser beam remote sensing device projects a laser into the floor of the earth and measures the time that it takes for the laser to reflect again to its sensor[7].

D. How remote sensors are used in agriculture.

Land mapping: far flung sensors are used for mapping the land which is beneficial for diverse purposes together with crop developing and landscaping. This technology enables in PRECISION AGRICULTURE [5] wherein precise land soil is used for a specific purpose, shown in Fig 5.

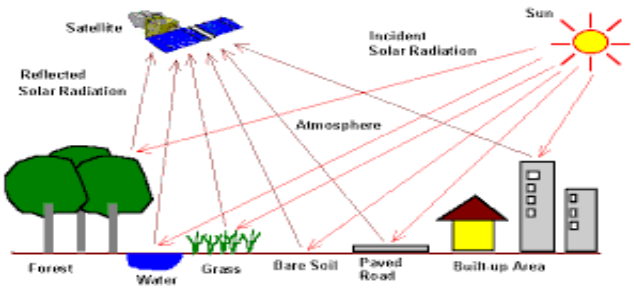

Fig 5: Land mapping

Some of the programs encompass Crop production forecasting, Assessment of crop damage and crop progress, Horticulture, cropping system evaluation, Crop identity, Crop acreage, Crop situation evaluation and strain detection, Identification of planting and harvesting dates, Crop yield modelling and estimation, Identification of pests and disorder infestation, Soil mapping,, others include crop monitoring[8] and irrigation system[9] if required.

Detecting nutrients non-destructively (best 3)

- Optical sensors: Using reflectance spectroscopy to come across the level of power inside the shape of reflectance (or) absorbance by way of soil debris and nutrients ions.
- Electromagnetic sensors: Using ions selective membranes that produced voltage output in reaction to ion interest of selected ions particularly focused on H, NO3, K, NO and so forth frequently multi-ion measuring device for proximal sensing the usage of ion-selective electrodes are also used.
- Laser sensors: It takes the 3-D picture of a subject to decide whether or not conditions are precise for vegetation growing .3D pictures show the plants increase, the researches stumble on the plant's biomass from its heights and take random guide readings to test the effects. They can then inform how tons the plant grow in unique sectors.

E. NON-FOOD CROPS AND ITS CRITICAL FACTORS

Non-food crops	Critical section
TEA	About: Tea could be very clean to develop because it is able to provide properly yields in a variety of soil and additionally in a special climate. Plus, we are able to make numerous sorts of tea from the feel plant depending on the way you manage the grown leaves. Tea plantation is in particular discovered in Asia, Africa, South America and around the black and Caspian seas. The 4 largest tea-generating countries for these days are China, India, Sri Lanka, and Kenya. In India, the very best yields are obtained from June- September where climate is hot and wet. Climatically tea belongs to monsoon lands in which excessive temperature, lengthy growing season and heavy rainfall help the growth of tea flora. Types of tea: Green tea, yellow tea, dark tea, puer tea, white tea, black tea, oolong tea **CRITICAL FACTORS:** **Temperature -** 21^0 C to 29^0 C. **Lowest temperature** -16^0 C. **Rainfall** - 150-250cm. **Atmospheric humidity**- Constantly around 80% **Time duration** - 8 to 10 months to grow. **Land Type:** Slop land is the high-quality to develop tea flora, soil erosion is often a problem, this could be reduced with the aid of planting tea trees in traces alongside the contours. Frost harm the plant life, stagnant water harm plant. **Soil:** Tea is grown in a diffusion of soil, however the first-rate soil is light, friable loam with porous sub soil which lets in a unfastened percolation of water. The maximum appropriate soil is barely acidic and without calcium. **Sensors used :** • Remote sensors are utilized in tea plantation to map and reveal the plantation • Electromagnetic sensors: used for measuring soil texture, salinity, organic

	matter, and moisture content. • Airflow sensors: measure soils permeability. • Acoustic sensors: used to decide the soil texture. •Optical sensors: used for predicting clay, organic remember and moisture content in the soil. Mechanical sensors: used to estimate soil compaction. Electrochemical sensors: measures soil vitamins levels and pH.
SILK	About: It is more influenced by means of commercial use. The technique of silk manufacturing is called sericulture. The silk production procedure begins with cultivation of silkworms from eggs and the main procedure encompass silkworm rearing, cocoons production and extraction of silk from cocoons (reeling manner). Steps worried in silk production: Step1: elevating silkworm and harvesting cocoons. Step2: threading extraction. Step3: dyeing Step4: spinning Step5: ikat (binding) **CRITICAL FACTORS** **Temperature:** silkworm temp 20^0 C and 28^0 C. **Soil fertility** – natural soil rich and vitamins. **PH of soil** – acidity, and alkalinity – 6.2 – 6.8. **Soil temperature** – 23C to 30C **Atmospheric moisture** – Relative humidity 70 – 75% **Fertilizer** – (CH+CG-CN)*100/R. Others: It has a completely unique habitat, the silkworm is mainly fed. It eats only the leaves of mulberry bushes. LIFE STAGE Silkworm goes through 3 ranges after hatching: 1. Larvae – white worms with a big head. 2. Pupae – spun into cocoons. 3. Adult – white with brown spots and 4 wings. At the adult stage, they've a number of strength to fly. Silkworm is photosensitive and that they have to tendency to move slowly closer to the dim light. They do now not like both sturdy mild or whole darkness. All they need is moderate mild. SENSORS used: To realize the non-stop commentary of silkworm improvement we want a wi-fi personal region network (WPAN) gadget.
	The above-proposed model is hired by using making use of Arduino software program and sensors to gauge the environmental circumstances in the arrangement of silkworms consistent with the requirement of silkworm in each stage. The entire version is utilizing Arduino board stack incorporated with moistness and temperature sensors in the organization of a camera to catch the photographs and to study it utilizing a image getting ready strategies to affirm the circumstance of sericulture progression.
COTTON	About: Cotton is a commercial and non-meals crop which has a huge rely in textile industries to provide the clothes. Cotton may be very durable. Cotton is grown in tropical and subtropical place. **CRITICAL FACTORS** **Temperatures:** 18^0 C and 30^0 C. **Water:** Minimum 500mm of water between germination and boll formation and ample sunshine and pretty dry conditions. **Duration:** Long vegetation periods (a hundred seventy five to 225days) without frost. **Soil:** Deep, well-tired soil with top nutrient content. Regur or black, clayey soil containing lime and phosphates SENSORS USED: • Tensiometer: It measures how tightly the water is bonded to the soil. • Capacitance sensors, time domain reflectometer (TDR), Neutron manner. It measures the quantity of water in keeping with quantity of soil.

V. CONCLUSION

The paper focus on the survey of the non-food crops and sensors used for it. Also identification of the critical factors of the non-food crops. We have discussed about 3 non-food crops such as tea, cotton, silk. Where each crop is commercial interested crop, Identification of the parameters and identification of the sensors. Evolution of the new sensor may be required in future to have eye monitor on the crop growth.

ACKNOWLEDGMENT

The authors express their sincere gratitude to our Honourable Chancellor Dr. P. Shyama Raju Sir and our Director Dr. S Senthil sir, and REVA family for giving constant encouragement and support to carry out research at REVA University.

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