

## A Survey on Smart Desert Farming

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### Abstract

*With the exponential growth of the human race that means the growth of population, the conventional or ancient farming methods are becoming unable to cope with the growth with satisfaction. Hence advanced farming methods are much needed to approach the necessity of foods of this growing number of people. In the recent few years, smart farming systems based on embedded systems and the Internet of Things (IoT) getting attraction and popularity among people to enhance food production for people. This paper has prescribed farming systems based on the embedded systems, IoT and wireless sensor networks for Agri-farm field and livestock farms. This paper includes the description of systems with the electronic circuitry of the systems, used network protocols and smart distant monitoring systems for PCs and Smartphones, etc. Later it includes some propositions and finally, the paper concludes with describing the future scopes of relevant technologies in smart farming. Even fertile land is hand full, despite being handful the limited fertile land is also getting barren. Alternatively, if we use the barren land in a fertile approach to meet our ever-excessive need of land to grow our food to meet the land then the demand will be at par with food need.*

*Keywords - Smart Desert Farming, IoT, Cloud Computing, Pods Technology, Bonsai, Big Data., Single Pods, Multiple Pods.*

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### 1. Introduction

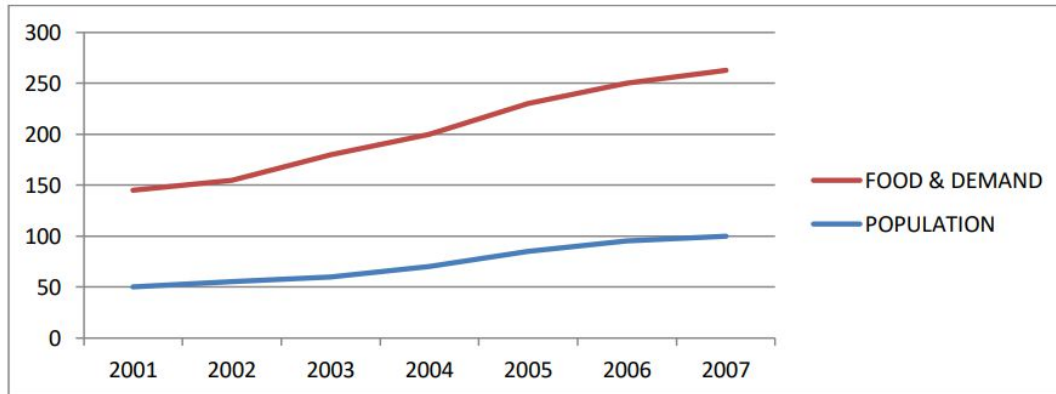
According to estimation by 2050, the world population will be around 9.1 billion. The FAO (Food and Agriculture Organization) of the United Nations has declared that to feed this increased population, food production will require to be increased by approximately 70%. In the year 2018 according to the declaration by the U.S. Global Change Research Program, due to climate change, plenty of challenges arise against crop productivity, health condition of livestock, and the rural economy. We all know agriculture is one of the fundamental sites of the human race. In the entire world, around 60% of the populaces are occupied with cultivating. The ongoing advancement in communication and information technologies has enabled farmers to gather an immense measure of site-explicit information Agri-fields. Our farmers still depending on the traditional strategies like the manual circulation of seeds and furrowing, two in a year method, unscientific frameworks of cultivation. The monsoons are unpredictable, and the unevenness of accessibility of water throughout the year represents a significant problem. Additionally, the farmers are relying upon the conventional strategies for watering the Agri-field, fertilizing the field, spraying pesticides without precisely observing the definite state of the cultivating field. All this leads to inadequate growth and low productivity of crops.

The execution of scientific strategies in the field of agriculture can drastically enhance the productivity of crops, because of the improved efficiency in the farming procedures. To ensure better farming and food production adequate watering, fertilizing and pesticides are vitals. It is much easier if we make an automated system to do all of these tasks automatically. The prescribed systems in this paper consist of Agri-field moisture monitoring and automated watering, automated insect detection and pesticide spraying, pH monitoring and fertilizing with quad-copters, intruder or animal alert system for the Agri-field, monitoring the greenhouse temperature and its related parameters.

Now if we do all this in a desert land then the situational circumstances will be in our favor to turn it into a land favorable for agriculture. The Agri-sector achieved enormous improvement. These improvements have introduced an automated system in which the growth of crops can be observed

and gadgets are controlled by utilizing WSN (Wireless Sensor Network). The fundamental operation of WSN is to sense the information from a remote area and transmit the sensed information over wireless networks which can be monitored by the receiver. The WSN technology can be utilized in Agri-sector especially for dealing with distributed data collection from farming environments and importantly for directing farmers with real-time information of the farming field. The prescribed system has also implemented WSN equipped with all the dedicated detecting sensors for monitoring a large Agri- environment.

**This is the graph trend showing the growth of food demand with ever increasing population**



## 2. IOT Concepts

IOT means interrelated correlation of computing devices, mechanical and digital machines provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. Summing up all this together we get a system, this is known as IOT. Agriculture is done in every country from ages. Agriculture is the science and art of cultivating plants. Agriculture was the key development in the rise of sedentary human civilization. Agriculture is done manually from ages. As the world is trending into new technologies and implementations it is a necessary goal to trend up with agriculture also. IoT plays a very important role in smart agriculture. IoT sensors are capable of providing information about agriculture fields. IoT makes use of wireless sensors network that collects data from various sensors deployed at various location of the fields and sends it to the server room through the wireless protocols. IoT based smart farming improves the entire agricultural system by monitoring the field in real-time with the help of sensors and interconnectivity, the internet of things in agriculture has not only saved the time of the farmers but has also reduced the extravagant use of resources such as water and electricity. The core of IoT is the data we draw from things, "T" and transmit over the internet "I" to optimize the farming process IoT devices installed on a farming should collect and process data in a repetitive cycle that enables farmers to react quickly to emerging issues and changes in ambient condition.

## 3. Objectives

Achieving near about four harvests in a year using IoT and greenhouse and pods. Implementation in desert as Desert Farming and uplifting the barren land for farming as it will wipe off the constraint of limited fertile land for farming.

#### 4. The PODS :

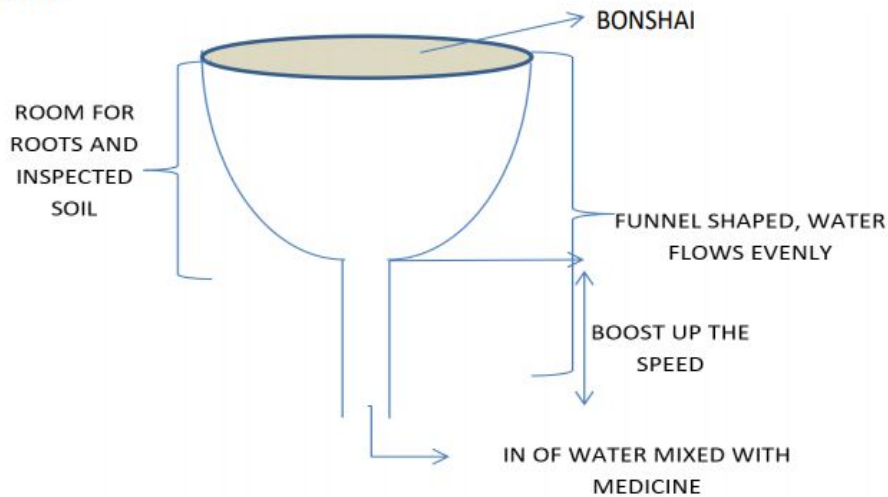
A physical container replicating the needed soil and underground condition that will be suitable for growing the crops that human wishes to. This is just to tap the desert area. We all know that the desert areas are not at all suitable for farming naturally so using IOT we can tap it for farming in an artificial approach. The pods clubbed with sensors and IOT algorithms will definitely give us an edge to flourish the niche of farming in the desert to get rid of hunger demand. Farming in desert has two perspectives it will not only give us farm produce but also help the deserted country to have a hike in their GDP by exporting their produce to different country.

Now, desert farming has two challenges , one is weather; the weather is not at all suitable for farming but IOT makes it possible by the concept of greenhouse. Using IoT we can clearly control the atmospheric conditions and make it suitable for farming, next is the fertility of soil and irrigation this very thing will be taken care of by the pods. Pods are basically an IOT device. Types of PODs: (1) Single pods (2)Multi pods.

##### a) Single POD :

The single pods are mainly used holding bonshai for growing fruits and multi pods are used to grow pulses basically cash crops. Now, how a pod is going to look like. The body length PODS enough to hold the excess soil and the roots. To hold the bonshai the diameter has to be medium. The watering mechanism will be from under the pods with connected pipe line. Figure 2 shows how the single pod will look like; this single pod will be mainly used to grow fruit trees, mainly the trees that are not easy to grow at desert conditions or areas.

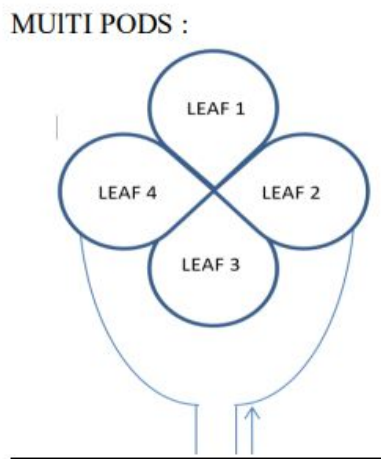
SINGLE POD :



Single pods will consist of a medium size diametric opening to hold the tree; the funnel will hold the soil and the roots. This soil can be changed as per our requirement, giving us the optimal grab to metric the fertility of the soil. The reason why the pod is of funnel shaped is to make the water flow evenly throughout the region and the joining of the funnel and the water pipe will boost up the speed of the flow of the water.

**b) Multi PODS :**

1. The U shaped structure gives room for roots and fertile soil that is replaceable according to need.
2. The reason for it being funnel shaped is to ensure that water flows evenly.
3. The small pipe shows the path for inlet of water.
4. This has multiple leaves to cater the need of growing a handful amount of cash crops.
5. The multi pods is mainly used to grow cash crops ,this will help in the growth of economy as well as meet the deficient need of food
6. The above diagram shows four leaves this individual leaf will held cash crops, underneath it house the funnel that holds the soil and below it is the water pipe line.



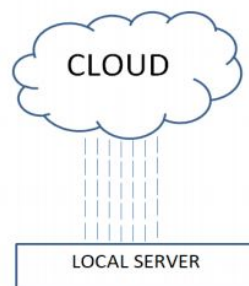
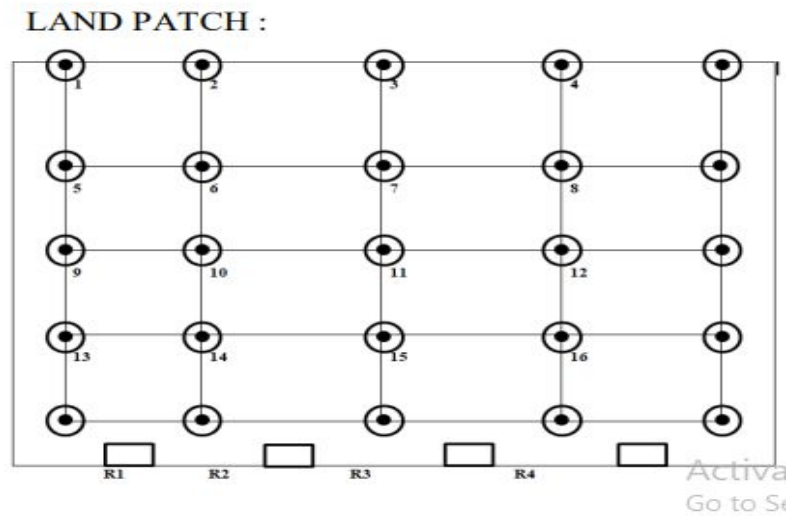
**c) Uplifting the Barren Land for Farming:**

The diagram below shows how we can convert a barren land in to fertile land using IOT. the whole land is divided into sections as per the convent and availability of the land then sensors are fitted in a square faction; the specialty of this sensors is that it can monitor the soil conditions and the atmospheric conditions as well thus the sensors are fitted as per the diagram. Each and every sensor can communicate with each other over a Bluetooth network; this ensures that the data that are collected are in coordination and in synchronization avoiding any kind of wrong data collection. Now the sensors in the column fashion forms a virtual network that is connected with the relays R1, R2, R3 thus ensuring individuality. These relays are connected to the local servers and then further necessary steps are taken using IOT algorithms.

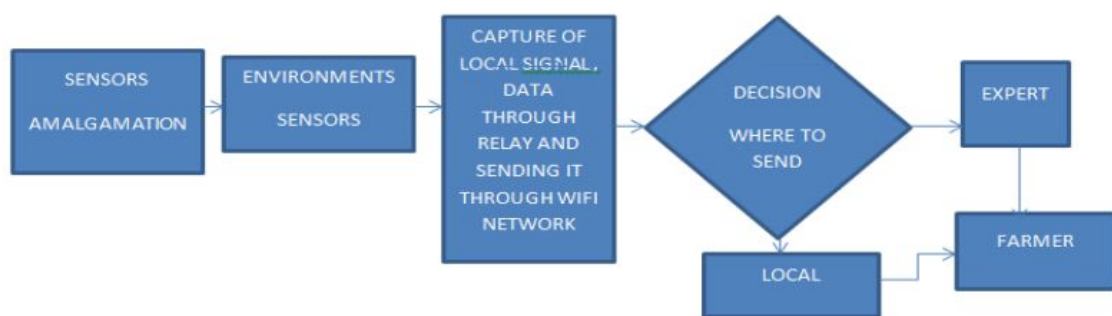
**d) Land Patch:**

The sensors are fitted in the ground replicating an amalgative fashion this whole amalgation is attached with a relay R1 and so on with a Wi-Fi network and the sensors are themselves connected with Bluetooth among each other. The relay collects the data and sends it to the local server then decision are made weather it is to be send to the local tower or the cloud; if it is send to the local tower then the farmer is informed about the local need on this tab, Mobil devices on any dedicated

system and if it is send to the cloud then it is fired to the expert system and from then expertise is delivered to the farmers and according the need in satisfied.



**e) External connection of the Farmer with EXPCITS:**



**f) Viewing mechanism of the farmer:**

The farmers can view their data either in the web technologies or in the mobile devices.

**Table 1: Comparison of Smart Agriculture**

<b>Applications</b>	<b>Services</b>	<b>Sensors</b>
Water and nutrition monitoring	irrigation	leaf sensors
Diseases and bug monitoring	pesticides	Stem sensors
Soil monitoring	Fungicides	Temp sensors
Crop health monitoring	Herbicides, fertilizers	Humidity sensors
Machinery	Soil preparation	Fruit Sensors
Environment	Yield condition and storage	

**g) Challenges in technology implementation**

- 1> Standard infancy : Nascent stage of technology when new technologies are released.
- 2> Untrained Manpower : Only a handful number of people are trained in new technologies.
- 3>Fear of New Technologies : basically people are fearful of technologies.
- 4>Hier investment : With the implementation of new technologies huge investment has to be done.

**Table 2: Major hurdles for technology implementation of smart farming**

<b>INPUTS</b>	<b>PROCESSES</b>	<b>OUTPUTS</b>
Crop data	Land preparation	Quantity
Soil data	Sewing	Quality control
Crop standards	Irrigation	Economy
Weather forecast	Fertilization	Future prediction
Best practice	Pesticides	Update standards
Government policies		Policies
Market Demand	Harvest	Best practices

## 5. Conclusion

“Third Green Revolution” IoT farming is leading us towards the “third green revolution” following the plant breeding and genetics revolutions, the “third green revolution” is taking over agriculture. The revolution draw upon the combined application of data-driven analytics technologies, such as precision farming equipment, IoT “big data” analytics unmanned aerial vehicles and robots. In the future this smart farming revolution depicts pesticides and fertilizers use will drop while overall efficiency will rise. IoT technologies in turn will lead to increased food safety. It will also be beneficial for the environment, for example more efficient use of water or optimization of treatments and inputs. Hence, smart farming has a real potential to deliver a more productive and sustainable form of agricultural production, based on a more precise and resource-efficient approach. New farms will finally realize the external dream of mankind. Smart farming is an emerging concept that refers to managing farms using modern information and communication technologies to increase the quantity and quality of products while optimizing the human labor required.

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