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A Survey on Advancements in Agriculture and Food Technologies

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Abstract*: Before some year maximum percentage of Indian economy used to come from agriculture. But since few years economic contribution of agriculture to India's GDP (gross domestic product) is declining slowly with the country's broad based economic growth. Despite of that agriculture is still demographically the broadest economic sector and plays a significant role in the overall socioeconomic fabric of India. The paper presents various techniques that can be used by the farmer in order to increase the productivity of their crops and there in an increase the capital. One of which is an agricultural application which can help farmers to take profitable decision's and provides a farmer important information which is needed during the entire farming cycle. Usually along with some static information like some primary knowledge of the crop, there is also need of dynamic information such as market price of products and current production level, this can be provided with the help of agriculture application. Now a day's world is getting automated by using advancement's in technology same is needed in agricultural field. This paper presents the use of ICT (Information and communication technology) in the agriculture sector which shows the way to the farmer in rural areas to change some of the traditional techniques. This paper presents some technologies which reduces the flaws of conventional agriculture by using advanced water resources like various irrigation techniques and reduce the cost of labour.

Keywords: GDP (gross domestic product), ICT (Information and communication technology), irrigation techniques.

I. INTRODUCTION

Presently the main issue in ongoing agriculture domain is the utilization of resources such as water and manpower is missing in various parts of the nation. There are very few technological advancements made in the agricultural sector in comparison with other sectors. The whole agriculture system needs to be automated in order to avoid wastage of resources and get fruitful outputs.

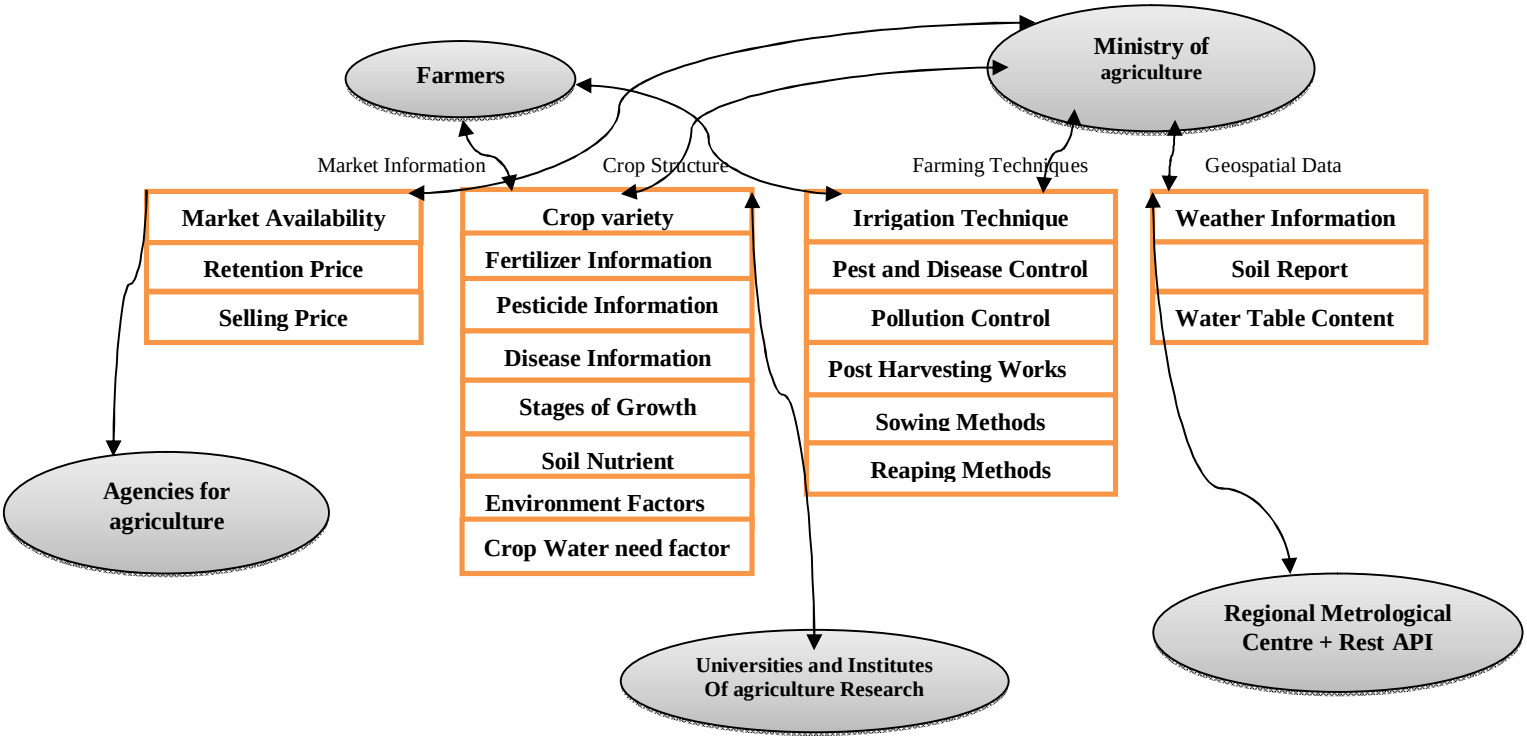

Fig. 1 Basic Phases involved in agriculture

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A. Market Information

It includes the services involved in moving agriculture products from farm to consumers. There can be price drops or huge inflations depend on availability of products. Selling price of product may vary depending on the availability of products in market. Also retention price of products need to be taken in consideration.

B. Crop Structure

It includes all the crop related information such as variety, fertilizer pesticides needed by specific crops, diseases based on type of crop, soil nutrients that a specific crop needs, environmental factors that needs to be considered and water requirement of that crop.

C. Farming Techniques

It includes how pollution should be control, what different sowing and reaping methods can be used, post harvesting works needs to be done for some crops. What are different irrigation techniques that can be used for effective farming this is basic part covered in this paper.

D. Geospatial data

This paper focuses on three important factors such as weather information soil report and water table contents.

II. LITERATURE REVIEW

Mohanraj I, Kritika A and Naren J. [1]proposes an e-Agriculture Application based on the framework consisting of KM-Knowledge base and Monitoring modules. They have demonstrated Monitoring modules using various sensors for which the inputs are fed from Knowledge base. A prototype for this mechanism is carried out using TI CC3200 Launchpad interconnected sensors modules with other necessary electronic devices. he system overcomes limitations of traditional agricultural procedures by utilizing water resource efficiently and also reducing labour cost. Knowledge base is structured with various crop details which speak about knowledge acquisition, flow, various input like market availability, geospatial data and weather prediction. Monitoring contains modules like remainder, monitoring plant growth in various stages, irrigation planner, crop profit calculator, calamity check and problem identifier. Evapotranspiration method is used to calculate the water need of a plant per day with devised algorithm's help. A comparative study was made between various application available with current developed system taking various aspects into account like knowledge base, monitoring modules, efficiency and reliability[1].

TABLE I
COMPARISON TABLE OF VARIOUS EXISTING SYSTEMS

	KM-System	Agro Advisory System	Expert Knowledge System	Agricultural Information Retrieval System	Knowledge Management System Development	IOT Monitoring System
Knowledge Base	This contains crop parameters like crop and field details acquired from various sources	Its design is based on the advices needs to be given to the farmer	Knowledge repository was created supporting first order logic to solve the complex nature of the concepts	Knowledge base was created as to retrieve or extract information from the web.	Knowledge base is designed in such a way that can evaluate user centered context.	Monitoring systems include knowledge about geospatial information.
Group of people working behind	No	Yes	No	No	No	No
Monitoring System	The field is monitored real time based on the knowledge base to increase the yield and reduce man power.	No	No	No	No	The system is designed in such a way to reduce man power.

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Technique Used	IOT and Cloud Computing.			Semantic web Retrieval.		IOT
Efficiency and Reliability	More efficient because offline monitoring is also possible.	Reliable since people working behind the system	Not reliable because, it can't serve to farmer's knowledge.		Efficient to provide all knowledge on user centred.	The more we dependent on the internet cloud leads to a more catastrophic event when it crashes.
Disadvantages		Advisory systems lack the procedure oriented approach. It can't build the complete bridge between farmers and computers. It needs an expert group of people working behind to answer the queries.	Search queries help the farmers to get the desired result and it is not sure of the intensity of the result.	Multi Matching retrieval process is difficult.	It also developed on user centered which suits only for a particular set of farmers which are categorized on a subject like over crops or region.	It increases greater complexity by over reliance of technology like GPRS, GPS, 3G, Wi-Fi and others. Next hurdle is downtime of cloud is possible.

Mahir Dursun and Semih Ozden[2] proposed an application of a wireless sensor network for low-cost wireless controlled irrigation solution and real time monitoring of water content of soil. They performed data acquisition by using solar powered wireless acquisition stations for the purpose of control of valves for irrigation. The system they designed has 3 units namely: base station unit (BSU), valve unit (VU) and sensor unit (SU). The obtained irrigation system not only prevents the moisture stress of trees and salification, but also provides an efficient use of fresh water resource. Also the developed irrigation method removes the need for workmanship for flooding irrigation. The irrigation automation system developed can be proposed to be used in several commercial agricultural productions since it was obtained in low cost and in reliable operation. They have chosen RF module as soil moisture sensor. This application of sensor-based site- Specific irrigation has some advantages such as preventing moisture stress of trees, diminishing of excessive water usage, ensuring of rapid growing weeds and derogating salification. The system they developed can also transfer fertilizer and the other agricultural chemicals (calcium, sodium, ammonium,zinc) to the field with adding new sensors and valves.

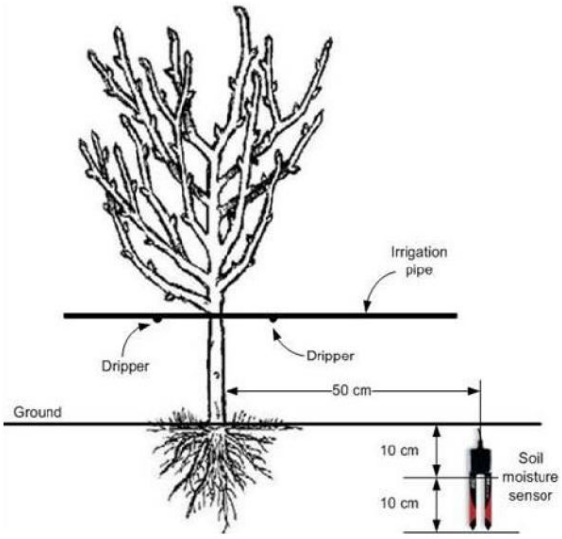

Fig. 2 Position of soil moisture sensor

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Manohar S Chaudhari, Rahul Jaiswal, Chandrakant Birhade, Vishal Bhapkar [3] proposed Precision irrigation system that is based on a detailed monitoring of information and data that are necessary for successful decision making in farm production. They used Wireless Sensor Networks (WSNs) for collecting, storing and sharing sensed data. The WSN system developed by them is use in precision irrigation system, where real time data of environment and climate are sensed and according to the sensed data a control decisions are taken so that we can modify them. The architecture of WSN consist of a sensor node placed in a field which sends the sensed data to the base station so that a global decision can be taken about the physical environment as shown in fig 2. This irrigation system promises to give a higher yield and lower input cost by real time monitoring of the field soil and environment conditions using different sensors and thereby improving crop cultivation, reducing time and labor costs. A precision irrigation system they developed needs following basic functionalities:

A. To develop a monitoring system that collects data using a wireless sensor network, and then relays this data through a gateway to a server.

B. At the server side the data are stored and analyzed in order to provide the user with useful statistics and alerts so that user can take various decision.

C. The irrigation system should be capable of supporting different types of sensors such as sensors measuring moisture, temperature, electric potential, light etc.

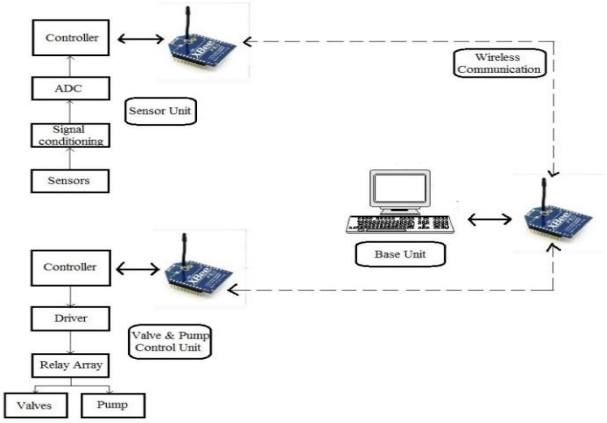

Fig. 3 Block diagram of precision irrigation using WSN

Alexandors K, J Wolfert, Tim V, Carlos M, Chrostopher B, Robbert R andHarald S [4] presented the specific characteristics of the agri-food sector focusing on how information management in this area will take place under a highly heterogeneous group of actors and services, based on the EU SmartAgriFood project. They presented how a new dynamic marketplace will be realized based on the adoption of a number of specialized software modules, called “Generic Enablers” that are currently developed in the context of the EU FI-WARE project. They also presents the overall vision for data integration along the supply chain as well as the development and federation of Future Internet services that are expected to revolutionize the agriculture sector.

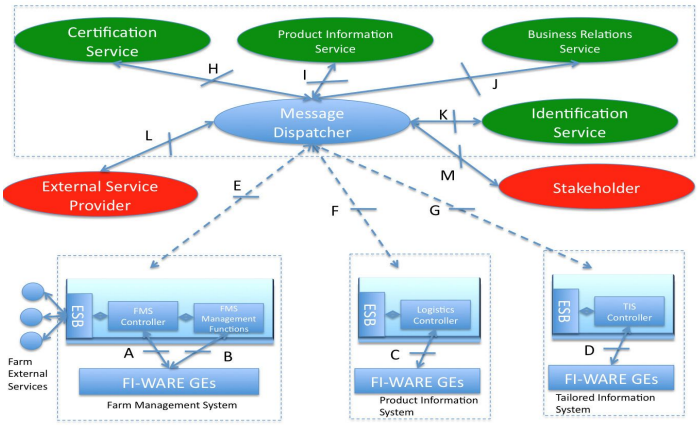

Fig. 4 Overall Smart agrifood architecture

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The main goal of the SmartAgrifood Project (SAF) is to link the various areas by integrating FI-WARE's GEs and introducing appropriate tools and services that are specialized to perform specific tasks such as monitoring and advising greenhouse owners for their crop, monitoring and recording the environmental conditions of fruits and vegetables, providing tailored information to end consumers. In this SmartAgrifood Project, they have defined three subsystems, one per each already described sub-domain. The first one, called Farm Management System (FMS), deals with management and control of tasks undertaken by farmers . The second one deals mainly with logistics issues as well as business relations and product information, and it is called the Product Information System. The third one, called TailoredInformation System (TIS), undertakes the task to provide food awareness information to the end consumers. These systems are illustrated in Fig 4. These systems provide solution for specific functionalities to their users in the food chain[4].

III. CONCLUSION

This paper provides guidance to the farmer at the right time about different stages of crop growth, different irrigation techniques. Since some years, farmers have been borne by many political, social and economical problems. A Study has shown many challenges are keyed out in agriculture domain, so this paper presents a study of different aspects of agriculture. Just by using advancement in one particular aspect won't help the overall development of agriculture, it is needed that the technology has to be adopted in all aspects like advanced irrigation system can prove as better managed water resource, the soil monitoring system should be used to have a proper study of soil depending on which the requirement of fertilizer can be identified. Along with it weather forecast report should also be taken into consideration depending on which farmer can decide which crop will yield more output in which season. All such factors can combinely help to develop Indian agriculture. This paper provides the survey of all these technologies.

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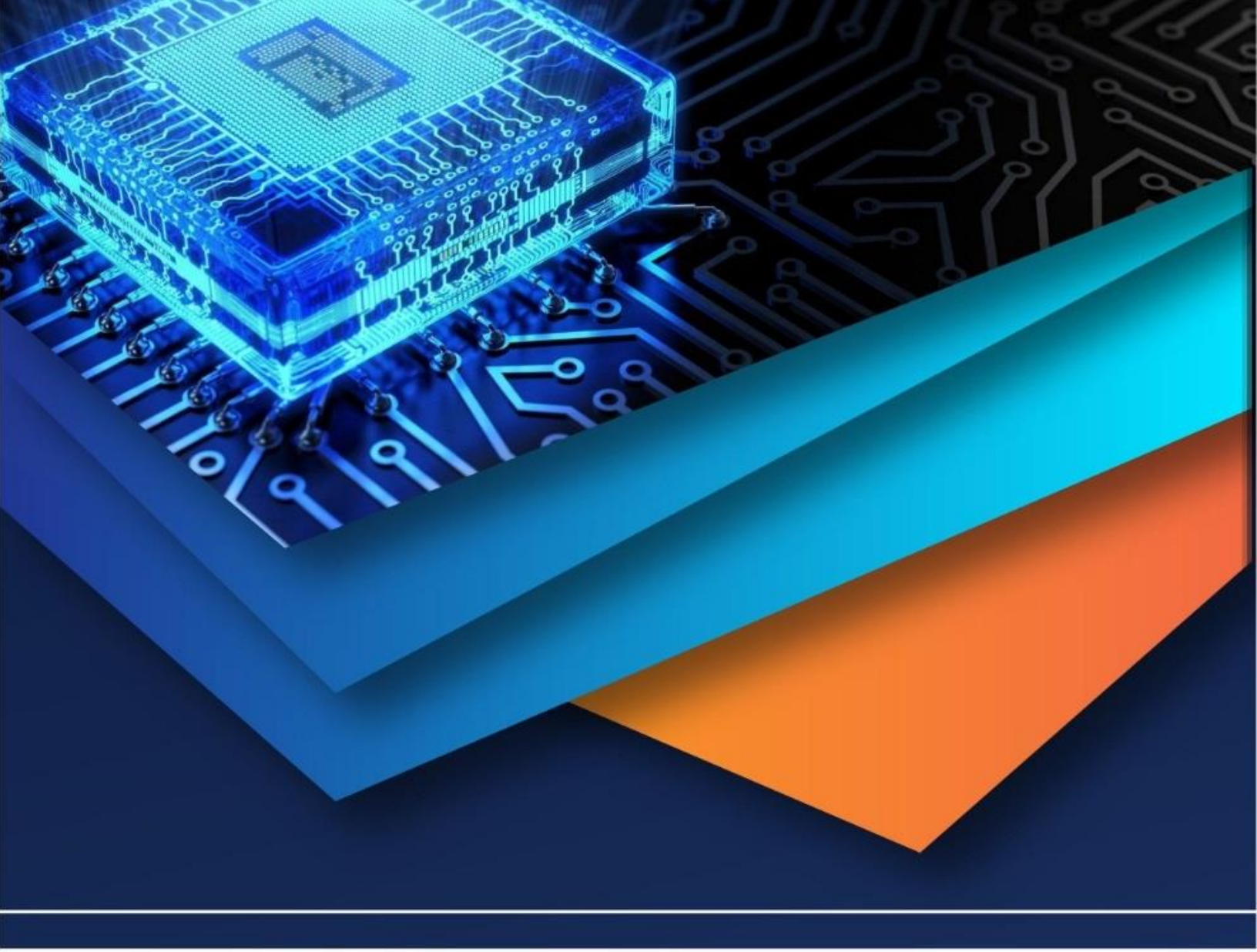

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