Precision Water Irrigation System for Agriculture using IoT Framework

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Abstract

The precision agricultural irrigation System has an important impact in overcoming all current challenges in the agricultural sector by replacing the traditional methods of doing agricultural features in a very specific way to help farmers monitor and remotely manage their farms. There are several existing systems integrating the Internet of Things (IoT) for agricultural operations and decreasing the greenhouse effect, but then there is an increasing need to minimize the greenhouse effect for IoT itself, so that people might deploy Green Internet of Things in agriculture, that will help to conserve energy and allow better use of agricultural resources. The call for more food will increase in order to accommodate the growing population, and new strategies should be designed to create more reliable strategies for agricultural production. With the smarter water management point on productivity and rational use of environmental assets, there is a requirement to form novel farming methods. Taking into consideration the requirement to gather novel records regarding the rural cycles, that is the case of opportunities that occur at the crops throughout its life cycle, community of scientists began discovering a fresh era which could be applicable to meet the needs of Accurate Agriculture. Continuous research into low-cost, smaller, extra-energy-green community nodes will result in the need for IoT. One of the distinctive uses of computer systems in farming is watering irrigation control.

Keywords: Agriculture, Irrigation, Cloud, Greenhouse effect, IoT, Precision, Sensor, Crop, Farmer, Production System.

Introduction

The requirement for foodstuff will develop to accommodate a larger community, and novel technique must be planned to generate more well-organized methods of farming manufacture. In addition, the worldwide weather is varying and the increasing condition for farming good are also being exaggerated, so new models of agricultural production need to be developed with a focus on sustainability and the fair use of environmental capital.The growth of the Internet of Things is becoming a developing ground to do smart agriculture. There are also specialized commodity fields (seeds, veggies and floral) where no big machinery are used in the production processes and where peasants should use menial labor in the production processes. There is a shortage of deliver improvements of computerizing the method of controlling the actions of the employee in this particular crop that, as mentioned earlier, can be beneficial in having greater understanding of a farm and crop when combined with other datasets. In order to address uncertainty, farmers need a broader understanding of the types of the plant and agricultural products, one of the greatest obstacles to overcome. Precision Agriculture provides for a deeper collection of agricultural data in the agricultural production process, collecting information in all steps from scheduling to last produce. In addition, accuracy farming system may help farmer make decisions and manage resources while integrating various sources of information such as sensors, satellites and weather forecasts. In view of the need to gather new data on the agricultural cycle, which is the collection of events that occur over its lifespan in a given crop, the science community has started to investigate new innovations that could be used to fulfil Precision Agriculture requirements. These days, customers desire to identify more about the products they eat and this creates a demand for new product identification mechanisms such as the Radio Frequency Identification Electronic Product Code (EPC).For large-scale farms, technology was developed using Global Positioning Systems (GPS), satellite imagery, as well as higher sensor to solve the problem of automated data acquisition. In this kind of crops manufacture there are solution that allow the imaging of information about the tasks, like crop's production or quantity of fertilizer's application, between the performed task in space / time.

IoT SYSTEM FOR ACCURATE IRRIGATING TECHNIQUES

Present IoT-based open source system for the accuracy irrigating are largely hypothetical, with scant evidence of conception experience. They are also too general or too unique, and do not specifically tackle simple system's implementation to encourage replicable and simplify new system employment. There are several independent projects not inherently related to the current systems and architectures when it appears to as long as innovative functionality for water administration. The FIGARO project, for instance, aims to increase water efficiency and enhance irrigating practice by the creation of a framework for accuracy irrigating administration and not explicitly linking IoT. Agricultural IoT is a hypothetical IoT basis platform for information analytic as well as the real-time elegant agricultural production, sharing several similarities with SWAMP.

FIWARE was utilized as a computer stage for various IoT supported smart farming application. Researchers collected a brief overview of the literature and introduced the precision farming platform and introduced FIWARE's implementation for a particular situation of accuracy irrigating in farming in southern Spain, but it focuses on a precise case of usage, including descriptions of the tools and equipment, and also irrigation techniques.Conversely, this article describes an structural design and a FIWARE based platform, and device implementation configuration in 4 scenario.

Fog compute is a relatively novel prototype intended at tackling challenge linked to the enormous quantity of information which will be produced as IoT-based systems are increasingly used. A recent technical development is container-based virtualization to introduce the fog, which offers a less weight substitute to conventional hypervisor. FIWARE Generic Enabler for use in the SWAMP mist measuring strategies are also deployed as Docker containers. FogFlow offers a encoding representation for IoT-based smart city application spread over the clouds and mists found at the edge of the network. Although Fog Flow is incorporated into FIWARE, the SWAMP project take a safe strategy and utilizes the component given by the FIWARE directly in amalgamation with novel parts specially designed for the SWAMP accurate agricultual scenario when required.

The FIWARE Platform

FIWARE have attracted universal awareness as an EU-funded open source solution, consisting of a collection of software's component named Generic Enabler (GE) which carry out the function required for the IoT based elegant application. GE could be utilized to construct various application which swap data using a JSON-based REST-API followed by the OMA-NGSI standards. The core component of knowledge model for FIWARE-NGSI Contexts Managements is the definition of entity and the characteristics. The creation of a Contexts Data Managements API on the basis of current advancement in Linked Data (LD) supported on JSON-LD known as NGSI-LD, as specified in RDF (Resource Description Framework), has been ongoing effort.Currently, FIWARE supports both NGSI and NGSI-LD although the NGSI-LD specifications are provisional.

Many FIWARE GEs are measured to be important enabler, like:

- Orion: A background broker publishers / subscribers, regarded FIWARE's heart. Orion just store the newest edition of body characteristics, and has to job by extra application to keep previous information.
- IoT Agent: Map sensor and actuator information for the FIWARE NGSI data framework to also be store in Orion and process by certain other GE or exterior application.
- Quantum Leap: Novel GEs which conserve previous information of the Orion NGSI as time, replace older and fewer measureable STH Comet.

- Cygnus: A information as well as delivery framework for application which allow information delivery regulation to be more complex than simple prior information.
- Cosmos: Sets of interface tool by admired Big Data Platform.

Agricultural Production Model

Precision farming systems are the enablers for more sophisticated modeling, being able to collect extremely entrenched information from the farming field. The representation of farming manufacture and the decomposition of the manufacture process are shown in Fig. 1 which is the subject of this study. A large set of information requirements to be noticed in each step of the manufacture procedure to explore the full potential of agricultural models. Market analysis preparation, study of varieties, and compilation of previous crop data.Production Preparation buy pesticides / fertilizers, buy seeds / plants, supervise worker and machineries, manage the manufacture procedure from planting to harvest as well as receiving the ultimate produce, manage the manufacture process events, integrate the supply chains with the product supplying chains. The model's first layer represents the procedures usually performed by farmers whenever they include a farming production. Typically, Regulation of farming systems is dependent on subsections or the whole collection described in the very first sheet. Agricultural data also moves through the step of each model, with farmer containing all pieces of data with them whenever required. Getting an appropriate approach will assist those able to identify patterns in growing season. For instance, if peasants consider a small area to become less profitable throughout the farm, they may be able to counteract the problem with different fertilizers or irrigation systems.

Procedures for production

Farmer aim to observe employees to get a additional comprehensive vision of performance with agricultural activities in the farms. Workforce monitoring is closely linked to the production process in farm which are extra reliant on labors, allowing a information capture apparatus which was accessible only by the farms that have heavy machines. One of these interventions has individual activities which need to be tracked, which is the primary objective of staff evaluation criteria. [1]. It will also add value to production management by tracking other tasks such as manual fertilization.In this case, irregular fertilizer applications that can be harmful to crops can be detected by analyzing the location of the worker throughout the action. Since the entire manufacturing cycle is tracked, farmer are able to track the growth of crops and notice anomaly. Monitoring all the activities allows farmer to predict crop problem and overcome the problems of agricultural variability. In addition to being linked with earth and weather, agricultural variability is also linked to human decision and behaviors. Monitoring worker activities thus allows for better monitoring of crops causing variations, a practice considered in the process of managing the production chain.

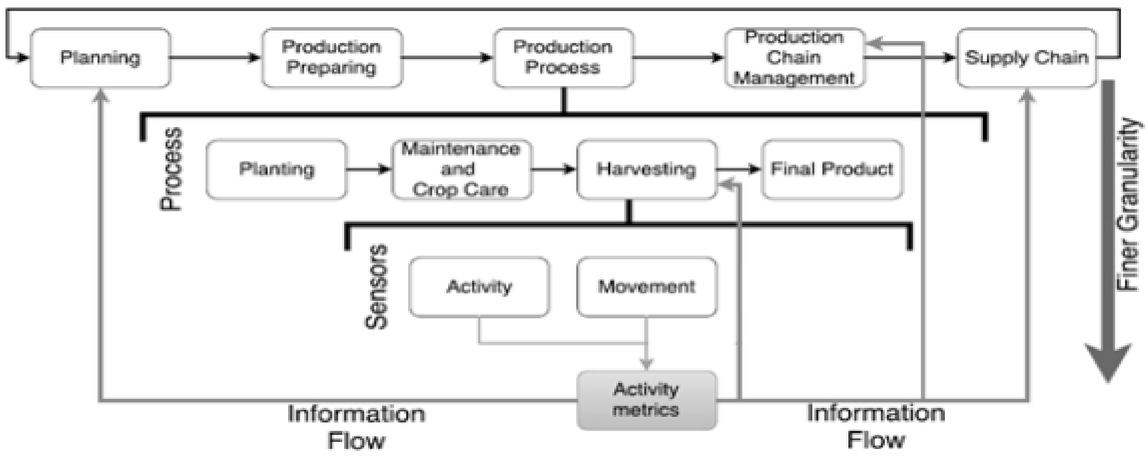

Fig. 1: Agricultural Production Model

Irrigation Monitor and Control

Typically, systems for controlling the irrigation are on the basis of Wireless Sensor Network (WSN) and provide the agricultural expert with a user interface for displaying information on field water resources.Several researchers built approaches for water management and researched the advantages they offer to precision farming. Dispersed WSNs, a portal, and isolated internet servers is an integrated irrigation networkas in Fig. 2. This system was intended to show how water consumption can be minimized by using an automated irrigation system.Growing network node consisted of sensors of soil and temperature, a Zig Bee radio modems, lot of rechargeable battery, and PV cells. To measure soil humidity and temperature's level, nodes were fitted near the roots of the plants [2]. When the humidity and temperature's level are reached, a gate way is utilized to activate the automatic irrigation. This gateway is also utilized to contact to ZigBee sensor's node as well as the isolated servers using the GPRS and GSM-based mobile cellular data network. The authors of this article point out that there may be a weak mobile network signal in some rural locations. The isolated servers are utilized to maintain certain data, and to also include a graphic framework that enables the tracking and watering systems of sensors to be programmed. The execution of the system illustrated was installed to a sagacious crops with permissible 60 percent and 90 percent savings in water use optimization contrasted to a conventional systems for water irrigation in the experiment conducted[3].It investigated the possibility of using a WSN for a fine-grained irrigation system to irrigating the fields more efficiently utilizing water merely wherever it is actually required, known as site-specific irrigations or uneven irrigating velocity. Data on soil and atmospheric parameters such as moisture, temperature and humidity are required when using this irrigation system. To do this, the authors mounted five field-wide sensing stations in-field, sending a base station computer regularly to local sensed information[4]. It was decided to use the Bluetooth communication to connect between the sensing stations and the base station machine as respect to size, data rate, performance and value, leaving ZigBee as well as other license-free transmission protocols behind [5-6].

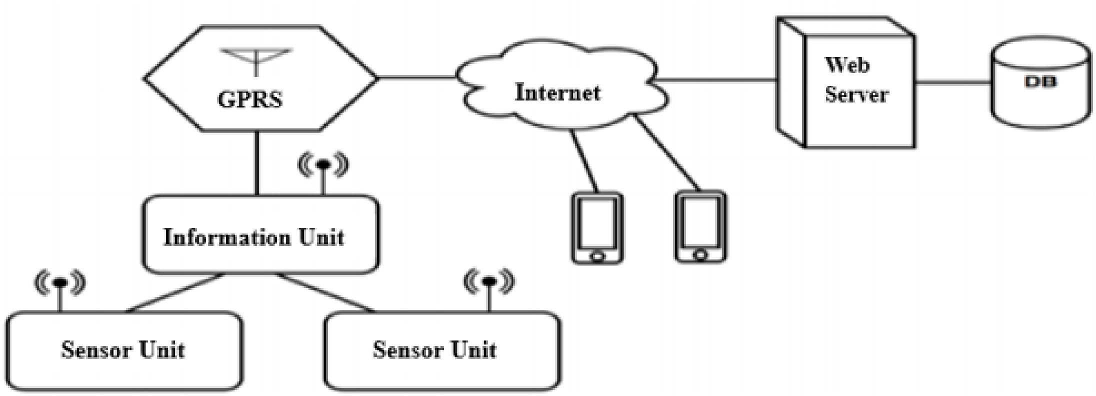

Fig. 2: System Overview of Automated Irrigation System

SMART AGRICULTURE SYSTEM

Pest Control:

Farmers are also concerned about pest monitoring and control in order to increase crop quality and productivity. It is vital to sense appropriate climatic event may be the reason for the increase of pests in order to prevent the occurrence of pests in crops [7-10]. The utilization of WSNs by temperatures, humidity's and lightning sensor is one way to monitor climate data. Farmers have a better chance of preventing this occurrence by using pesticides and other pest control techniques in the existence of information that predict encouraging condition for pest development. Nevertheless, avoiding the emergence of insects is not always feasible, so there are also mechanisms for detecting the presence of such species in the plant [11].

Harvesting:

Sensor are also useful to a number of agricultural's equipment, like tractor, harvester or sprayers, information collection on carry out task as well as substituting data by means of base station or additional devices in order to further improve productivity [12-14]. Interconnected GPS which can be connected to variable rate control devices is common and also offers measurement sensors that can attach the extracted commodity to the area where it was gathered. These strategies enhances governance in large areas by using multiple network nodes that connect with each other to gather more valuable data. Robots can be used to help improve the quality of grapes and wine.

Integrated Precision Agriculture System:

This framework includes a high-quality wine management program which focuses on helping wine farmers in both the warehouse and the winery deal with climate factors. Mostly during growth period, it is critical to measure those variables which are especially useful to the enologist. Assessing land moisture, temperature, plus relative humidity will contribute to enhanced winery judgments, result in improved quality grape varieties. [15]. A WSN was deployed to the vineyard to collect this information, with every node have sensors of lightning, temperatures as well as the moisture.

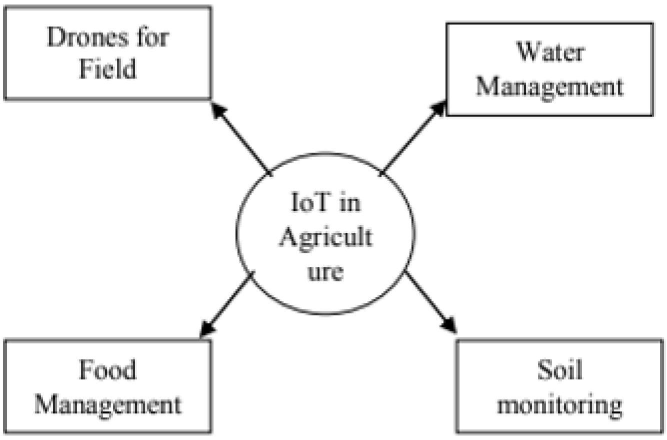

Fig. 3: Application of IoT in Agricultures

METHODOLOGY

Smart farming is the core purpose of the Internet of Things. The world's population is increasing, reaching 9.6 billion by 2050. A problem arises from that point. How much will feed the population? IOT technologies are used to predict the weather, climate change and environmental changes that may be useful for crop growth. This can be called smart agriculture, a hi-tech system that can be used to grow crops.A system containing sensors is built for monitoring the crop field in smart farming [15]. The sensors are used to determine the density of air, humidity, temperature, and soil. The sensors are used to optimize the irrigation system, which is very important. From anywhere, the farmers can track the crop area. Smart farming is used to manage the crop field's internal processes and reduce lower production risks. IoT monitors tracking of vehicles, cattle monitoring, food storage and other farm operations in agriculture as in Fig. 3. Precision farming using IOT helps make farming for livestock and crops more accurate and controlled.Drones from agriculture are used to monitor the health of the crop. Livestock monitoring using IOTis used to determine the animal’s health condition [16]. Whether any animals are sick and suffering from illness can be used to classify. So that the virus will avoid other pets. In agriculture, the key applications of IoT are soil moisture sensing, regulated water use for optimum plant growth, deciding fertilizer usage, finding the optimum time to plant/harvest and reporting the weather [17].

CONCLUSION

Agricultural industries are changing with an emphasis on sustainability and production, and growers like to monitor the efficiency of the supply chain more closely. This has contributed to the development of crop production frameworks utilizing agricultural information gathered to minimize costs and maximize profits while forecasting the potential of agricultural enterprises. New data must be noticed in every farming manufacture procedure step to feed the agricultural models, including the activities that need to be done by hand in smaller or less mechanized farms. The requirement for a worldwide understatement of consequences to the crops at all times has guided growers to fit novel technologies in their lands to examine climate, earth as well as pest through the life cycle of the crop. Several cultivators are monitoring the field actions by capturing location of machinery and data on productivity. For smaller farms or those with specialised crops where a substantial proportion of the job is performed by hand, the choices available are usually not suitable. In this paper, the proposed system produces good result in term of hindrance, reliability and the ratio of packet delivery.

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