LITERATURE SURVEY ON

SMARTFARMER-IoT Enabled Smart Farming Application

Paper 1: Agricultural Production System Using IoT as Inclusive Technology

Publication year: December - January 2016

Author name: **CHANDHINI. K.** Bangalore, Karnataka.

Summary: The IoT (Internet of Things) based agricultural convergence technology is a technology to create a high value such as improvement of production efficiency, quality increase of agricultural products in the whole process of agricultural production. In addition, implementing precision agriculture, which is an alternative to the future agriculture, through the convergence technology allows prediction of supply and demand, real-time management and quality maintenance during the entire life cycle of agricultural products. We make a literature study on the cited title and present it in the form of this note.

Methodology used: Sensor/Information Collection Layer, Transport/Network Layer, Application Layer, Sensors, Cloud-Computing, Mobile-Computing &Big-Data Analysis.

Conclusion: The IoT-based agricultural production system has built on the long-standing desire of farmers to ensure their land remains productive into the future. It also addresses the community's expectations and concerns for safe food and for environmental protection. An agricultural production system for the agricultural production using IoT technology and implemented it as GUI visualization software was designed. The IoT based agricultural production system through correlation analysis between the crop statistical information and agricultural environment information has enhanced the ability of farmers, researchers, and government officials to analyze current conditions and predict future harvest. Additionally, agricultural products quality can be improved because farmers observe whole cycle from seeding to selling using this IoT based agricultural production system. The production system can be improved to support more types of products and provide more services. By taking advantage of IoT technology, the efficiency of agricultural production can get a significant improvement. With constantly improving, agriculture IoT must be able to lead agriculture production to a new era.

Paper 2: An Approach Based on Fog Computing for Providing Reliability in IoT Data Collection: A Case Study in a Colombian Coffee Smart Farm

Publication year: 14 December 2020

Author name: Ana Isabel Montoya-Munoz

Summary: The reliability in data collection is essential in Smart Farming supported by the Internet of Things (IoT). Several IoT and Fog-based works consider the reliability concept, but they fall short in providing a network's edge mechanisms for detecting and replacing outliers. Making decisions based on inaccurate data can diminish the quality of crops and, consequently, lose money. This paper proposes an approach for providing reliable data collection, which focuses on outlier detection and treatment in IoT-based Smart Farming. Our proposal includes an architecture based on the continuum IoT-Fog-Cloud, which incorporates a mechanism based on Machine Learning to detect outliers and another based on interpolation for inferring data intended to replace outliers. We located the data cleaning at the Fog to Smart Farming applications functioning in the farm operate with reliable data.

Methodology used: Motivation, Reliable Fog Computing-Based Architecture, Failure Detection and Recovery Mechanism, Coffee Smart Farming Datasets, Test Environment, Failure Detection Evaluation—Results and Analysis.

Conclusions: This paper introduced an FC-based architecture approach that incorporates a mechanism for detecting outliers and another for inferring data intended to replace them. The evaluation demonstrated our approach's effectiveness in a real network deployed in a Colombian Smart Coffee Farm. For the failure detection mechanism, we selected the DBSCAN algorithm due to it presenting an excellent performance for marking outliers over all the tests with a FAR lower than 6%, a perfect Recall as well as an Accuracy, Precision, and F-Score greater than 99% for the most extensive dataset. We selected the linear interpolation for the failure recovery mechanism because it infers data with low RMSE allowing for replacing the detected outliers properly. Considering the obtained results, we concluded that the proposed approach is suitable for providing reliability in the IoT-based Smart Farming data collection process and supports the correct decision-making. Apart from that, our proposal falls behind in terms of power consumption analysis, architectures validation, or comparison, and optimal location of nodes per layer in the Fog Tier.

Paper 3: A Low-Cost Platform for Environmental Smart Farming Monitoring System Based on IoT

Published year: 24 May 2021

Author name: Ben Othman Soufiene, Faris A. Almalki

Summary: When integrating the Internet of Things (IoT) with Unmanned Aerial Vehicles (UAVs) occurred, tens of applications including smart agriculture have emerged to offer innovative solutions to modernize the farming sector. This paper aims to present a low-cost platform for comprehensive environmental parameter monitoring using flying IoT. This platform is deployed and tested in a real scenario on a farm in Medenine, Tunisia, in the period of March 2020 to March 2021. The experimental work fulfills the requirements of automated and real-time monitoring of the environmental parameters using both under- and aboveground sensors. These IoT sensors are on a farm collecting vast amounts of environmental data, where it is sent to ground gateways every 1 h, after which the obtained data is collected and transmitted by a drone to the cloud for storage

and analysis every 12 h. This low-cost platform can help farmers, governmental, or manufacturers to predict environmental data over the geographically large farm field, which leads to enhancement in crop productivity and farm management in a cost-effective, and timely manner.

Conclusion: Smart farming involves the integration of advanced technologies into existing farming practices to increase production efficiency and quality of agricultural products. The evolution of IoT and UAVs has enabled the vision of sustainable smart farming, where these smart technologies have proven to increase the quality of crop yield and reduce the environmental footprint from the agricultural sector. This paper shows a low-cost platform for comprehensive environmental parameter monitoring using flying IoT. The proposal is based on experimental work to fulfill the requirements of automated and real-time monitoring of the environmental parameters using both under- and aboveground sensors. These IoT sensors devices on a farm collect vast amounts of environmental data.

Paper 4: Smart farmer system

Publication year: 04, April 2020

Author name: Athrva Dalvi, Shefali Kulkarni, Utsavi Kulkarni, Shweta Todkar

Summary: Agriculture is considered as the backbone of India, is the major contributor to the country's economy. However, technology involvements and their usage have still not been incorporated in this sector. Some initiatives have been incorporated by the governments by providing mobile messaging and calling services to farmer's queries relating sowing, harvesting and selling of crops, it provides static data related to quantity of soil in each region. The paper takes care of all major factors of agriculture i.e., monitoring, irrigation and security.

Methodology used: In this system can monitor the humidity, moisture level and can even detect motions. In, the authors have identified current and future trends of IoT in agriculture and highlight potential research challenges. In, the authors have introduced the latest technologies such as sensors, IoT to radically revise approaches to agriculture by collecting the data about various parameters of soil, analyzing the data and performed the computations.

Conclusion: The described system uses supervised machine learning algorithm to classify the crops into the various months in which they should be yielded based on their ideal requirements. The system uses information from soil moisture sensors to irrigate the soil to avoid the damage of crops due to over irrigation or under irrigation. The project provided us with an opportunity to study the existing systems, along with their features and drawbacks.

Paper 5: Smart Agriculture using IoT

Publication year:23, March 2018

Author name: Dr V.Nagaveni

Summary: In the literature there are numerous examples of versatile IoT application-oriented studies. In, an example of control networks and information networks integration with IoT technology has been studied based on an actual situation of agricultural production. A remote monitoring system with combining internet and wireless communications is proposed. Furthermore, taking into account the system, an additional information management sub-system is designed.

Conclusion: The main advantage of this paper is that, all the functions to be performed by the Fan and Sprinkler to control the climatic conditions like temperature, relative humidity and soil moisture levels in the Greenhouse environment are all automated and it does not require any human intervention. This is particularly an important factor because the presence and availability of the human cannot always be trusted on. For important structures like the greenhouses, we need a more dependable and reliable way for its management which is easily achieved by this project. Greenhouses are very important as they are responsible for the efficient growth of crops that are either necessary to feed the population or necessary for the economic growth of any country.

Paper 6: IoT and agriculture data analysis for smart farm

Publication year: 2018

Author name: Jirapond Muangprathub, Nathaphon Boonnam, Siriwan Kajornkasirat, Narongsak Lekbangpong, Apirat Wanichsombat, Pichetwut Nillaor.

Journal name: Elsevier B.V

Summary: In this paper, we propose developing a system optimally watering agricultural crops based on a wireless sensor network. This work aimed to design and develop a control system using node sensors in the crop field with data management via smartphone and a web application. The three components are hardware, web application, and mobile application. The first component was designed and implemented in control box hardware connected to collect data on the crops. Soil moisture sensors are used to monitor the field, connecting to the control box. The second component is a web-based application that was designed and implemented to manipulate the details of crop data and field information. This component applied data mining to analyze the data for predicting suitable temperature, humidity, and soil moisture for optimal future management of crops growth. The final component is mainly used to control crop watering through a mobile application in a smartphone. This allows either automatic or manual control by the user. The automatic control uses data from soil moisture sensors for watering. However, the user can opt for manual control of watering the crops in the functional control mode. The system can send notifications through LINE API for the LINE application. The system was implemented and tested in Makhamtia District, Suratthani Province, Thailand. The results showed the implementation to be useful in agriculture. The moisture content of the soil was maintained appropriately for vegetable growth, reducing costs and increasing agricultural productivity. Moreover, this work represents driving agriculture through digital innovation.

Paper 7: Scientific development of smart farming technologies

Publication year: 2018

Author name: Dieisson Pivoto, Paulo Dabdab Waquil, Edson Talamini, Caroline Pauletto Spanhol Finocchio, Vitor Francisco Dalla Corte, Giana de Vargas Mores.

Journal name: Elsevier B.V

Summary: Smart farming (SF) involves the incorporation of information and communication technologies into machinery, equipment, and sensors for use in agricultural production systems. New technologies such as the internet of things and cloud computing are expected to advance this development, introducing more robots and artificial intelligence into farming. Therefore, the aims of this paper are twofold: (i) to characterize the scientific knowledge about SF that is available in the worldwide scientific literature based on the main factors of development by country and over time and (ii) to describe current SF prospects in Brazil from the perspective of experts in this field. The research involved conducting semi-structured interviews with market and researcher experts in Brazil and using a bibliometric survey by means of data mining software. Integration between the different available systems on the market was identified as one of the main limiting factors to SF evolution. Another limiting factor is the education, ability, and skills of farmers to understand and handle SF tools. These limitations revealed a market opportunity for enterprises to explore and help solve these problems, and science can contribute to this process. China, the United States, South Korea, Germany, and Japan contribute the largest number of scientific studies to the field. Countries that invest more in R&D generate the most publications; this could indicate which countries will be leaders in smart farming. The use both research methods in a complementary manner allowed to understand how science frame the SF and the mains barriers to adopt it in Brazil.

Paper 8: Smart Farming using IoT, a solution for optimally monitoring farming conditions

Publication year: 2019

Author name: Jash Doshi, Tirthkumar Patel, Santosh kumar Bharti.

Journal name: Elsevier B.V

Summary: network of different devices which make a self-configuring network. The new developments of Smart Farming with use of IoT, by day turning the face of conventional agriculture methods by not only making it optimal but also making it cost efficient for farmers and reducing crop wastage. The aim is to propose a technology which can generate messages on different platforms to notify farmers. The product will assist farmers by getting live data (Temperature, humidity, soil moisture, UV index, IR) from the farmland to take necessary steps to enable them to do smart farming by also increasing their crop yields and saving resources (water, fertilizers). The product proposed in this paper uses ESP32s Node MCU, breadboard, DHT11

Temperature and Humidity Sensor, Soil Moisture Sensor, SI1145 Digital UV Index / IR / Visible Light Sensor, Jumper wires, LEDs and live data feed can be monitored on serial monitor and Blynk mobile. This will allow farmer to manage their crop with new age in farming.

Paper 9: Literature study on Agricultural production system using IoT

Publication year: Dec-Jan 2016
Author name: Chandhini.K

Summary: The complexity of smart farming is also reflected into the ecosystem of players. They can be classified in the following way: Technology providers-these include providers of wireless connectivity, sensors, M2M solutions, decision support systems at geomapping applications. Providers of agricultural equipment and machinery. Precision agriculture makes use of a range of technologies that include GPS services, sensors and big data to optimize crop yields. Rather than replace farmer expertise and gut feeling, ICT-based decision support systems, backed up by real time data, can additionally provide information concerning all aspects of farming at a level of granularity not previously possible.

Conclusion: The IoT-based agricultural production system has built on the long-standing desire of farmers to ensure their land remains productive into the future. It also addresses the community's expectations and concerns for safe food and for environmental protection. The IoT based agricultural production system through correlation analysis between the crop statistical information and agricultural environment information has enhanced the ability of farmers, researches, and government officials to analyze current conditions and predict future harvest.

Paper 10: IoT Based Smart Agriculture Monitoring System

Publication year: July 2021

Author name: Harika Pendyala, Ganesh Kumar Rodda,Anooja Mamidi,Madhavi Vangala,Sathyam Bonala,Keerti Kumar Korlapati

Journal name: International Journal of Scientific Engineering and Research (IJSER)

Summary: In every country agriculture is done from ages which are considered to be science and also art of cultivating plants. In day today life, technology is updating and it is also necessary to trend up agriculture too. IoT plays a key role in smart agriculture. Internets of Things (IoT) sensors are used to provide necessary information about agriculture fields. The main advantage of IoT is to monitor the agriculture by using the wireless sensor networks and collect the data and send by wireless protocol.

Methodology used: A system is developed by using sensors and according to the decision from a server based on sensed data. Through wireless transmission the sensed data is forwarded to web server database. If the irrigation is automated then the moisture and temperature fields are

decreased below the potential range. The user can monitor and control the system remotely with the help of application which provides a web interface to user.

Paper 11: IoT based SMART FARMING SYSTEM

Publication year: December 2018

Author name: YASIR FAHIM

Journal name: CENTRAL INSTITUTE OF TECHNOLOGY, KOKRAJHAR

Summary: The aim / objective of this report is to propose IoT based Smart Farming System assisting farmers in getting Live Data (Temperature, Soil Moisture) for efficient environment monitoring which will enable them to increase their overall yield and quality of products. The IoT based Smart Farming System being proposed via this report is integrated with Arduino Technology mixed with different Sensors and a WIFI module producing live data feed that can be obtained online from Thingsspeak.com. The product being proposed is tested on Live Agriculture Fields giving high accuracy over 98% in data feeds**.**

Methodology used: Internet of Things has a strong backbone of various enabling technologies- Wireless Sensor Networks, Cloud Computing, Big Data, Embedded Systems, Security Protocols and Architectures, Protocols enabling communication, web services, Internet and Search Engines.

Conclusion: IoT based SMART FARMING SYSTEM for Live Monitoring of Temperature and Soil Moisture has been proposed using Arduino and Cloud Computing. The System has high efficiency and accuracy in fetching the live data of temperature and soil moisture. The IoT based smart farming System being proposed via this report will assist farmers in increasing the agriculture yield and take efficient care of food production as the System will always provide helping hand to farmers for getting accurate live feed of environmental temperature and soil moisture with more than 99% accurate results.

Paper 12: IoT-Enabled Smart Agriculture: Architecture, Applications, and Challenges

Publication year:27 March 2022

Author name: Licensee MDPI

Journal name: applied sciences

Summary: The growth of the global population coupled with a decline in natural resources, farmland, and the increase in unpredictable environmental conditions leads to food security is becoming a major concern for all nations worldwide. These problems are motivators that are driving the agricultural industry to transition to smart agriculture with the application of the Internet of Things (IoT) and big data solutions to improve operational efficiency and productivity. The IoT integrates a series of existing state-of-the-art solutions and technologies, such as wireless sensor networks, cognitive radio ad hoc networks, cloud computing, big data, and end-user applications.

Methodology used: IoT ecosystem for smart agriculture based on three main components, including IoT devices, communication technologies, and data process and storage solutions. An illustration of the IoT ecosystem for smart agriculture is presented

Conclusion: In this study, we presented an overview of IoT and big data for the smart agriculture sector. In addition, security, technologies need to be continuously improved, but in our opinion, the application of IoT solutions for smart agriculture is inevitable and will enhance productivity, provide clean and green foods, support food traceability, reduce human labor, and improve production efficiency