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THE EFFECT OF IOT AND AI IN AGRICULTURE

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Abstract: To battle the growing population, farmers and innovators alike will need to come together to devise strategies to help farmers meet growing production demands. The world population is expected to grow More than a third, or 2.3 billion people, are between 2009 and 2050. This is a much slower rate from the growth seen in the past four Contracts grew during 3.3 billion People, or more than 90%. Almost all of them This growth is expected to occur in a year Developing countries[1], The Internet of Things allows agriculture, specifically arable farming, to become data-driven, which leads to timely production and management of farms at a lower cost, while reducing their impact on the environment , Automation in agriculture is a major concern and emerging issue worldwide , Various applications of AI in agriculture such as irrigation, weeding, sensor-assisted spraying and other methods included in robots and drones, Artificial intelligence technologies provide excessive use of water, pesticides, and herbicides, maintain soil fertility, and also help in the efficient use of human strength, raise productivity and improve quality. This paper survey the work of many researchers to get a brief overview of the effect of using internet of things and the artificial intelligence in the agricultural field.

Index Terms **IOT, AI, Smart Farming.**

I. INTRODUCTION

The Internet of Things in agriculture is a rapidly developing field, and it can make reviews quickly outdated. This challenge can be overcome by focusing on a critical view on the general principles and key areas of application and identifying constraints and challenges , So the Internet of Things is a key technology in smart agriculture because it ensures the flow of data between sensors and other devices, which makes it possible to add value to the data obtained by processing, analysis and automatic access, and this leads to more cost-effective production and time effort On-farm management. At the same time, IoT reduces the inherent environmental impact by interacting in real time to alert events such as weeds, pest or disease detection, or weather or soil monitoring warnings, which allow to limit the appropriate use of inputs such as agricultural chemicals or water. The Internet of Things facilitates documentation and supervision of various activities as well as the ability to track products, improve environmental survey and environmental control on farms by the competent authorities.[2]. Smart farming usually includes smart services for the application and management of information and communications technology in agriculture, and allows incidental integration throughout the entire agricultural food chain with respect to food safety and traceability, Smart agriculture, also called Agriculture 4.0 or Digital Agriculture is evolving beyond the modern concept of precision agriculture, whose management practices are based on spatial measurements thanks to GPS signals. Smart agriculture in its administrative tasks also depends on spatial data but it is enhanced by context awareness and activated by real-time events, which improves the performance of precision agriculture solutions so far, agro-industrial and environmental fields are ideal candidates for the deployment of IoT solutions because they occur in wide areas that need to be continuously monitored and controlled[3]. Artificial intelligence is an emerging technology in agriculture. Artificial intelligence-based equipment and machines have taken today's farming system to a different level. This technology has enhanced crop production and improved real-time monitoring, harvesting, processing and marketing.[4]. The latest automated systems technology that uses agricultural robots and drones has made a huge contribution to the agriculture-based sector. Many high-tech computer-based systems are designed to define many important parameters such as weed detection, crop detection, crop quality, and many other technologies.[5].

II. THE EFFECT OF ARTIFICIAL INTELLIGENCE ON AGRICULTURE

Artificial intelligence-based technologies help improve efficiency in all areas, and the challenges faced by various industries, including various fields in the agricultural sector, such as crop production, irrigation, soil content sensing, crop control, weeding, material and crops are established.[6]. Artificial intelligence contributed to the agricultural sector as follows:

AUTONOMOUS TRACTORS

An autonomous agricultural machinery is considered to be one of the most effective ways of improving agricultural productivity. Especially, the agricultural tractor is the major product of agricultural machinery because of their versatility[7]. There is a need for more efficient farm machinery as agricultural areas become more limited and energy and labor costs increase[8]

AGRICULTURAL ROBOTICS

The growing interest in developing precision and smart agriculture has sparked a scientific debate on the application of artificial intelligence and robotics to agricultural production systems. Intelligent and automated systems for agricultural operations are necessary to meet the challenge of labor shortages, repeat tasks, reduce human safety and health risks in performing agricultural activities, and reduce production costs by saving time, money, and energy[9]. Automation technology applications have made notable improvements in agricultural production. Human-like machine capabilities, including perception, reasoning and learning, communication, task planning and implementation, system integration, and will remain the primary enablers of agri-intelligent automation systems. Cognition provides information through sensing to obtain and manage data. It is used to enhance understanding of the surrounding environments. The richness and value of intelligence is often believed to increase through the forms of data, information, knowledge and wisdom (or in short DIKW) resulting from thought and learning processes. Moreover, decision support based on the results of statistical analysis and targeted data mining has become available. Communication aims to communicate information and obtain responses appropriately between components for appropriate monitoring and control of the system. It is often presented in models that include Information and Communications Technology (ICT), Internet of Things (IoT), and mobile device technology[10]

CONTROLLING PEST INFESTATIONS

In response to the deteriorating global food situation, scientists have been searching for innovative ways to control the impact of agricultural pests by developing integrated production systems that include biotechnology, including genetically modified organisms and pesticides from the new generation. We tested the reliability of a new method for immediate and effective pest identification and monitoring by analyzing morphometric features and species diversity.[11]

SOIL AND CROPS HEALTH MONITORING

Grain production plays an important role in the global economy. In this sense, the demand for efficient and safe methods of food production is increasing. Information Technology is one of the tools to that end. Among the available tools, we highlight computer vision solutions combined with artificial intelligence algorithms that achieved important results in the detection of patterns in images[12].

III. IOT IMPLEMENTATION IN AGRICULTURE

The collected data experience diverse stages during their transition from sensors to cloud, interfaces, and occasionally actuators, and these stages have considerable influence on the technologies applied in an IoT context. Six main stages regarding data flow have been identified in the literature reviewed: sensing/perception, communication/transport/transfer, storage, processing, analytics, and actuation and display.Fig.1.[13]

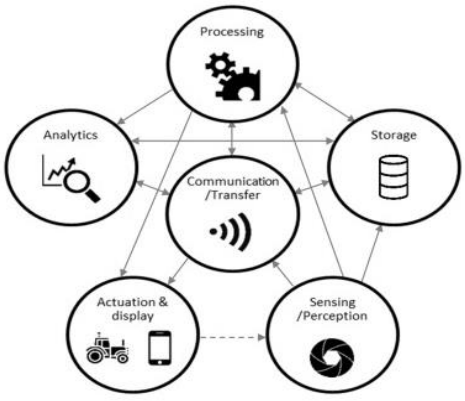

Fig.1. agricultural data flows

[3]The architecture has four main layers: physical, communication, service, and application. The physical layer includes perception and control. In perception, the main objective is to produce valuable data sensing field variables using a WSN .Data produced are sent to the communication layer through field gateways. Devices in the perception layer can be powered by batteries for short-term deployments or by solar panels because of their low-power consumption. In contrast, the control layer acts as a data sink, receiving information from a communication layer or a perception layer in the simplest case. Information received in the control layer alters the state of field actuators frequently requiring power from the electrical grid. In the middle of the perception and control layers there is a mobile robot that can be used when fixed devices are not the best option. In the communication layer, the objective is to move the information from the physical layer to the Internet, collecting data from IoT gateways based either on Ethernet or mobile networks (e.g: GPRS/3G/4G/NB-IoT and eventually 5G). This layer includes field gateways acting as interfaces between IoT gateways and transceivers using ZigBee, Bluetooth, NFC, WiFi, LoRA, or Sigfox. The service layer handles data ingestion from the communication layer, as well as their storage, analytics, visualization, and security. Finally, the application layer consumes services from the previous layer in the architecture and allows the user to handle monitoring, control, prediction, and logistics.Fig.2.

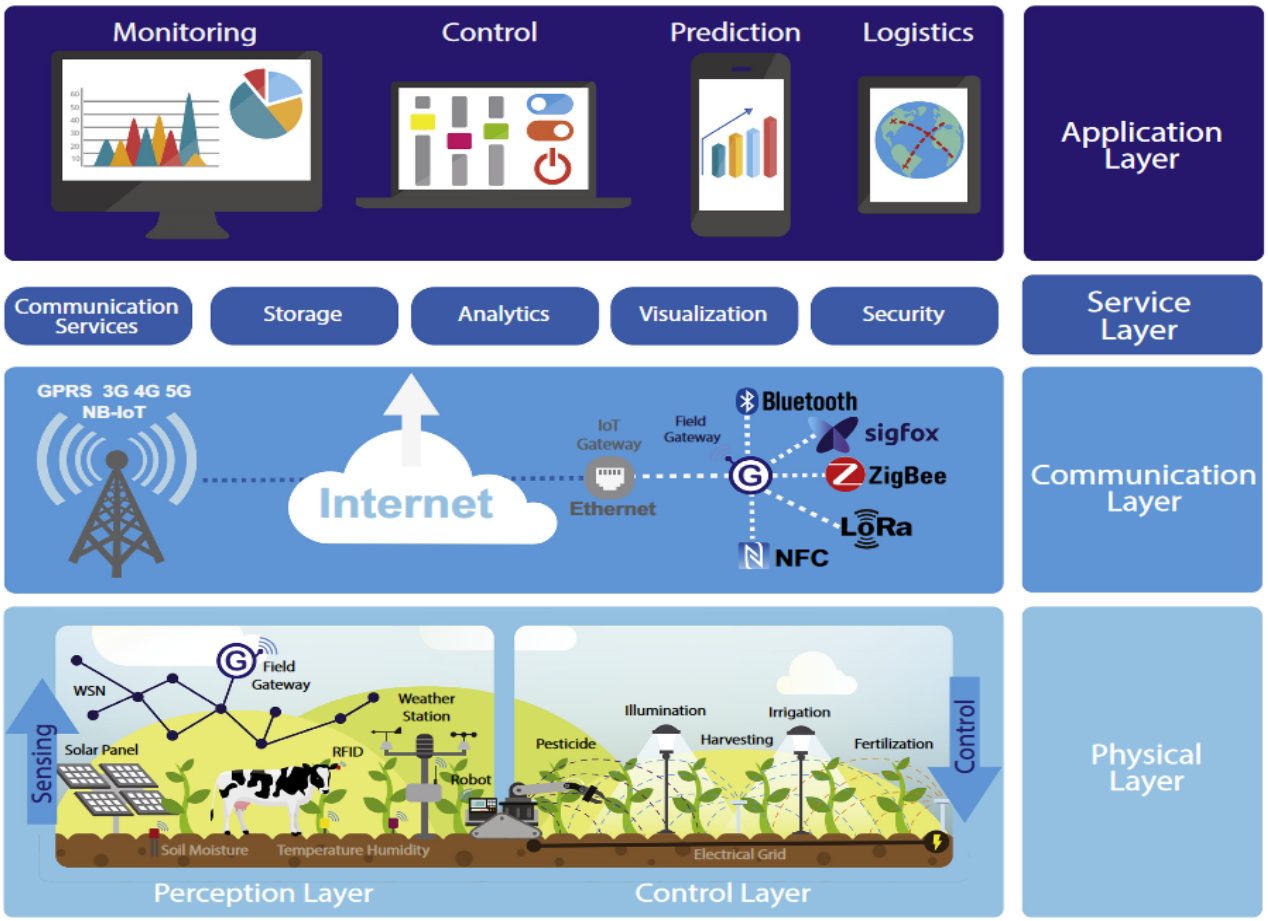

Fig.2. IoT architecture for agro-industrial and environmental applications

IV. Conclusions

This paper presented and updated review of IOT applications in agriculture, this has included overview of the IOT architecture and how 5G network the near future will enhance the capabilities of smart mobile devices due to their enhance performance, The agricultural industry faces various challenges such as lack of effective irrigation systems, weeds and plant control problems due to high crops and severe weather conditions. But performance can be increased with the help of technology and thus these problems can be solved. It can be improved by using various Artificial intelligence -driven technologies such as remote sensors to detect soil moisture content and GPS-assisted automatic irrigation. Finally By applying AI to IOT data, farm management systems ,it provide rich recommendations and insights for farmer decision support and action.

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