APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN AGRICULTURE

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Abstract

Agriculture is greatest systematic term use to describe various forms with which crops plant as well as domestics animal provide food as well as other goods to the world's human population. Artificial Intelligence (AI) has recently made an appearance in the agriculture sector. Unsuitable soil management, diseases as well as pest infestations, large data requirement, poor productivity, as well as a information gap between farmer as well as technologies are only a few of the challenges the sector faces in order to increase its production. This paper gives all details about artificial intelligence as well as agriculture. This paper also contain applications of artificial intelligence, robots in artificial intelligence, architecture of artificial neural network in artificial intelligence as well as irrigation using artificial intelligence. Artificial intelligence (AI) can be used to forecast demas well as by studying factors such as demographic rise, historical demas well as trends for food resources, as well as regional main food patterns, among others. This knowledge may be use to effectively change harvesting habits, as well as reduce crop yield waste as well as improve farmer incomes.

Key words: Agriculture, Artificial intelligence (AI), Crop, Farmers, Robots

Introduction

Agriculture was a central advancement in the growth of sedentary human civilization, as it allowed people to live in cities by creating food surpluses from domesticated species farming[1]. Agriculture is the most expressive term use to describe the various way in which crops plants as well as domestic animal provide food as well as other goods to the world's human population. English term agriculture comes from the Latin words ager (farm) as well as colo (cultivate), which together forms Latin word agricultura, which means "field or ground tillage." However, term come for include a broad range of agricultural practices that have their own descriptive meanings, such as forestry, horticulture, domestication, arboriculture, as well as vegeculture, and livestock management methods such as diverse crop livestock pastoralism, breeding, as well as transhumance. Agriculture is also often qualify by terms like proto, incipient, vast,shifting, as well as intensive, exact meaning of which aren't obvious.

Different characteristics, like soil condition, regularity of harvest, as well as primary crop or livestock, are often used to describe specific types of agriculture. The word agriculture is often limited to crop production only, without the raising of domestic animals, but it generally refers to both. Agriculture is described as " science as well as art of cultivating the las well as, including the allied pursuits of gathering in the crops as well as rearing live stock (sic); tillage, husbandry well asry, farming (in the broadest sense)" .Agriculture is the foundation of every economy's long-term viability. Although it is important for long-term economic growth as well as systemic change, it varies by country. Agricultural operations used to be restricted to food as well as crop processing. However, in the last two decades, it has expanded well used to include crop as well as livestock harvesting, manufacturing, marketing, as well as distribution.

Agricultural operations currently help as a basic foundation of livelihood, the Gross domestic product, serving as source of national trade, lowering joblessness, supplying raw material for additional sectors, as well as helping to grow economy as a whole. With the world's geometric population growing, it's more important than ever to revisit agricultural practices in order to come up with new ways to maintain as well as improve agricultural activities. Other technical advancements, such as big data analytics, the internet of things, robotics, internet of things, the availability of inexpensive sensors as well as cameras, drone technology, as well as even wide-scale internet coverage on geographically scattered las well ass, would allow the application of Artificial intelligence to agriculture. Artificial intelligence system will be able to determine which crops to plants in given

years as well as when the best dates to sow as well as harvest are in a particular region by evaluating soil management data sources such as temperature, atmosphere, moisture ,soil analysis, , as well as historic crop efficiency. This will improve crop yields as well as reduce the uses of water, fertilizer, as well as pesticides. Effect on natural environments can be minimized, as well as worker protection can improve, thanks to the use of AI technologies.

Medical science, education, finance, agriculture, defense, as well as a variety of other fields have all been affected by AI. AI implementation necessitates a machine learning method. This leads us to a subdomain of Artificial intelligence known as "ML(Machine Leaning)." Machine learning's primary aim is to fed the machine data from previous interactions as well as mathematical data so that it complete its assigned task of solving a specific problem. Today's technologies include data analysis based on previous data as well as experience, voice as well as facial recognition, weather prediction, as well as medical diagnostics. The domains of big data as well as data science have grown to such a great degree as a result of machine learning. Machine learning is a method for creating intelligent machines that is based on mathematics. As Artificial intelligence stimulated, many novel logic as well as methods were created as well as found which make the process of problem. Such methods are listed below:

- Artificial neural networks (ANN)
- Fuzzy logic
- Expert systems
- Neuro-fuzzy logic

Artificial neural networks is the most commonly used as well as often used tool for testing purposes among all of these. The brain is the greatest compound organ of human body. Electric signals travel via neurons through axons, which are based on interconnected neural networks. The signal is passed ahead by synapses at the end of each node. The Artificial neural networks system was created with the same idea in mind as the human brain's other functions. For train this specific model, algorithm such as Silva as well as Almeida's algorithm, Delta bar delta, R prop, Dynamic Adaption algorithm, as well as Fast prop are used. In the operation, 9 neuron used. Artificial neural networks is a task-oriented approach that instructs the machine to work based on a pre-programmed tasks rather than a computationally programmed task as shown in Figure 1. Architecture of ANN contains three layers are given below:

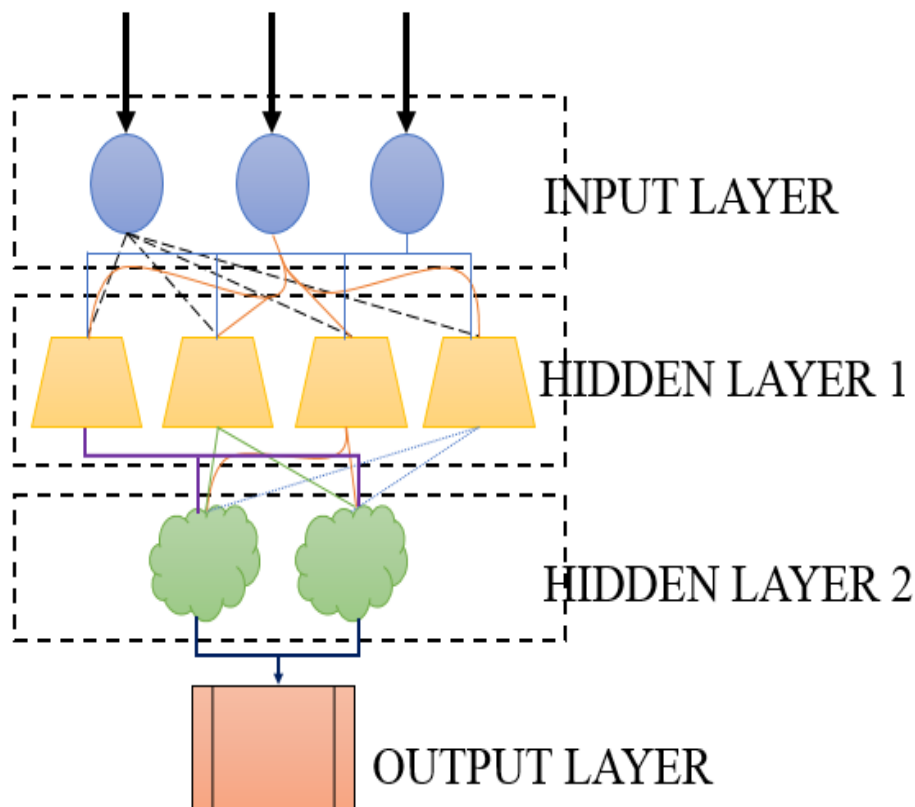- Input layers
- Hidden (middle) layers
- Output layers

Figure1: Artificial Neural Network Layer having Three Layers Input Layer, Hidden Layer, as well as Output Layers.

The following parameters of the feed forward back propagation mechanism: The input layer is 7, the output layer is 1, the hidden layer is 50, as well as the number of iterations is 1200. In the unseen as well as output layers of the activation layer, sigmoidal functions are used, while the input layer uses a linear function. Furthermore, artificial intelligence as well as machine learning are largely based on assumptions as well as hypotheses. This is where scripting as well as algorithms come in. There should be a hardware-software framework for implementing these algorithms as well as logic-based principles. Embedded devices are the means by which this can be accomplished. Embedded system are hardware-based systems made up of memory chips that contain proprietary applications (Figure 2). The application of artificial intelligence as well as expert system in agriculture is loosely defined topic. Agriculture is a vital component of every country's economy. Currently, China, South Korea, as well as North America are spending trillion of dollars in agricultural production as well as the implementation of advanced technology. The population is rapidly growing, which is directly proportional to the rise in food demands . India has a diverse range of food crop as well as, in particular, species. Agriculture is unique of the most vulnerable areas of Indian economy, as it supports all others areas as well as has far-reaching implications.
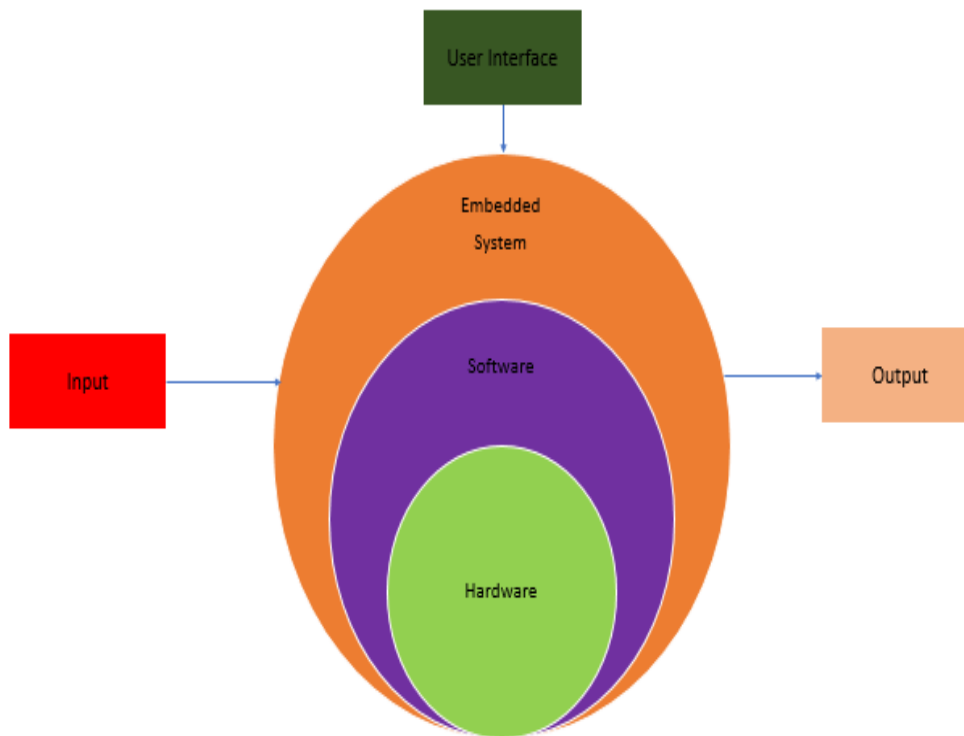
Figure 2: Embedded System having Software, Hardware which Provide Output by Giving User Interface as well as Input.

With the advancement of technology in other sectors, automation in agriculture is becoming increasingly important. By the continued growths of human populations, the demands well as on agriculture will increases, as well as agri-technology as well as precision farming have become increasingly important in today's world. Digital agriculture refers to use of high-tech computer system to measure various parameter such as weed identification, crop predictions, yield detections, crop efficiency, as well as a variety of other machine learning techniques

1.1.Robots in Agriculture:

In major areas of economy with little efficiency, like agri food, robotics as well as autonomous system (RAS) are being implemented. According to UK RAS White Paper, the UK Agri Food Chains produces over £108 billion a year as well as employs 3.8 million people in a genuinely multinational market that generated £21 billion in export in 2016. In agricultural processing as well as administration, robotics has played a significant role. Since the unorthodox farming machineries were inefficient, researchers have begun focusing on technology to design autonomous agricultural equipment.

The key goal of developed this technology is to substitute human labour as well as provide productive results in both small as well as significant productions. In industry, use of robotic technologies has greatly increased efficiency. Weedinatering, protecting the farm for successful report, ensuring that disapproving environmental condition don't impact performance, increasing accuracy, as well as managing individual plants in different unfamiliar ways are all tasks that the robots conduct autonomously. The inspiration for such a technology was inspired by the creation of Eli Whitney cottons gin. Elis Whitney (1765–1825), a U.S.-born inventor, patented a method for extracting seed from cotton fiber in 1794 that revolutionized cotton production. In one day, it produced 50 pounds of cotton. As a result, autonomous agricultural robots were born. To assess the actual location of seeds, a simple automatic model was implemented. Seed positioning with extreme precision also developed. Mechanism that guarantee that seed planted have no field velocities. This is important because it means that the seed does not rebound after contact with the soil. Automated computers kept track of the plant's condition as well as progress. Various biosensors have been developed to monitor plant growth as well as detect plant diseases. The manuals weeding method was replace by lasers weeding technologies, in which a has well as held directed infrared light disturbs the cell of the weed as well as is operated by computers. Automated irrigation systems were also built to make efficient use of water.

1.2.Irrigation :

Agriculture uses 85 percent of the world's total freshwater energy. As well as this proportion is steadily rising in tandem with demographic growth as well as rising food demands well as. As a result, we'll need to develop more efficient solutions to ensure that water supplies are well used in irrigation. Auto irrigation scheduling methods have replaced manual irrigation dependent on soil water estimation. When introducing autonomous irrigation machines, the plant evapo -transpiration-rate, which reliant on on numerous atmospheric parameter like humidity, solar radiation, wind speed, as well as even crop factor like soil properties, , stage of development, plant density, as well as insect, was taken into account. Fertility meters as well are set up the field to detect the percentage of the primary ingredients of the soil, such as phosphorous, potassium, as well as nitrogen, to regulate fertility of soil. Wireless equipment is used to plant automatic plants irrigators on field for drop irrigation.

That approach preserves soil's stability as well as the efficient utilization of water resources. Smart irrigation technology is being developed to maximize productivity without the use of a large number of people by sensing water levels, soil temperature, nutrient quality, as well as weather forecasting. The irrigator pump is turned ON/OFF according to the microcontroller's instructions. The M2M has been create to make connectivity as well as data share between nodes in the agricultural field easier, as well as to the cloud, through main networks. An Arduino as well as Raspberry Pi3 moisture content as well as temperature are detected using an automatic robotic model. Data is collected at regular interval as well as sent to Arduino microcontrollers (which is attached to edges level hardware), which transforms the analog input to digital. Signal sent to Raspberry Pi 3 (which is embedded with the KNN algorithm) which then sends it to Arduino to start the irrigation water supply as shown in Figure 3. The resource will supply the water based on the demands well as, as well as it also updated as well as stores sensors value. An automatic irrigation system using Arduino technologies to reduce manpower as well as time usage in the irrigation process.
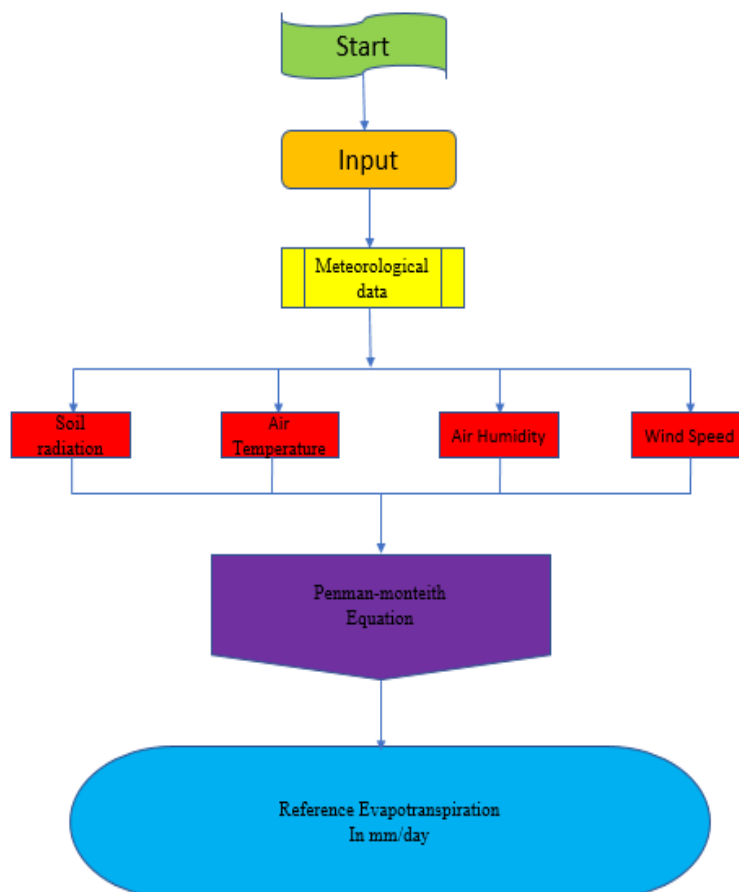

Figure 3: Flowchart for Evapotranspiration in which Show Evapotranspiration by giving the Input.

Also, by developing remote sensors using Arduino technology, the concept of an efficient as well as automated irrigation system was born, which can increase output by up to 40%. Another irrigation facility that is automatic. Soil moisture sensors for detect soil moisture, a temperature sensor to detect temperature, a pressure regulators sensor to manage pressure, and a molecular sensors to boost crop growth were all developed for other purposes

in this process. Cameras with digital equipment are being installed. The outputs of each of these instruments are converted to digital signals and sent to a multiplexer done a wireless network like ZigBee or a hotspot. Subsurface drip irrigation was the first process, which minimized water loss due to evaporation and deforestation because it was immersed directly underneath the crop.

Different sensor, like a soil moistures sensor as well as a rain drop sensors, were used to sense the essential for water source to the fields as well as were controlled by a wire less broadbands as well as network as well as power by solar panel. Rain drops sensor as well as soil moistures sensor send SMS to the farmer' mobile phone using the GSM module, informing them of the moistures content in soil. As a result, the farmer will use SMS for turn on as well as off the water supplies. As a result, assume that device can sense areas of the fields that need more water as well as will prevent the farmers from water when they rains. Soil moistures sensors are unique of devices that can be used to determine the moisture content of soil. It is buried near the crop's root areas. The sensors assist in correctly measuring the moistures level as well as transmitting this information to irrigation controller. Soil moistures sensor will help you save a lot of water. Water on demands well as irrigation is a moisture sensor technique in which the setting threshold based on the soil field ability as well as these sensors allow the controller to water only when required. When schedule times comes, sensor read the moisture content or level for that zone, as well as watering is only permitted if the moisture content is below the threshold. The additional was suspended loops irrigation, which, different water on demands well as irrigation, necessitates irrigation time.

Literature Review

They have various researcher who do the researches as well as studies about the AI in agriculture. The few analyzer & researcher as well as their researches as well as their studies are: Tanha Talaviya et al. studies Agriculture contributes significantly to the economy. Agriculture automation is a major source of concern as well as a hot topic around the world. The world's population is rapidly growing, as well as with it comes increased demands well as for food as well as jobs. The farmers' conventional approaches were insufficient to meet these criteria. As a result, novel automated method was developed. These novel approaches fulfilled nutritional demandss well ass while also providing job prospects for billions of people. This paper's key goal is to examine the different uses of AI in agriculture, such as spraying, irrigation, spraying, as well as weeding, using sensors as well as other devices installed in robots as well as drones. These innovations reduce the usage water, pesticides herbicides, as well as pesticides, preserve soil fertility, as well as aid in the efficient use of manpower, thus increasing efficiency as well as improving quality. They survey the work of several researchers in their paper to get a quick summary of the latest application of automations in agriculture, specifically weeding systems using robots as well as drones. Two automatic weeding strategies are explored, as well as various soil water sensing approaches[7].

In Ebonyi, Nigeria, researchers are looking at how AI can be used in the agriculture field. Improper land maintenance, disease and pest infestation, big data requirements, low productivity, and a skills gap between farmers and technology are only a few of the obstacles the sector faces in order to boost production. The core principles in AI in agriculture are stability, high performance, accuracy, and cost-effectiveness. An review of AI applications in soil control, field management, disease management and weed management,. management is presented in their article. A particular importance is placed on the application strengths as well as faintness, as well as how use expert programs to increase productivity [8].

Kirtan Jha studies Agriculture automation is a major source of concern as well as a hot topic in every region. The world's population is rapidly growing, as well as as a result, the need for food is rapidly increasing. Farmers' traditional approaches are insufficient to meet rising demands well as, so they must wreak havoc on the soil by using toxic pesticides in greater quantities. This has a significant impact on farming practices, as well as as a result, the soil remains sterile as well as devoid of fertility. Their paper discusses various automation techniques such as the Internet of Things, machine learning, wireless communications, as well as artificial intelligence, as well as deep learning. Crop diseases, lack of storage management, pesticide control, weed management, lack of irrigation as well as water management are some of the issues that plague the agriculture sector, as well as all of these issues can be addressed using the strategies listed above. Today, it is critical to decipher topics such as the usage of toxic pesticides, regulated drainage, emissions regulation, as well as environmental impacts of agricultural practice. Farming operations that are automated have been shown to maximize soil benefit while also increasing soil productivity. This paper reviews the work of a number of researchers in order to provide a brief summary of the current state of agricultural automation. Their paper also includes a proposed system for herb, leaf, and watering recognition that can be used in a botanical farm using IOT.[9].

Lal Mohan Bhar et al. study AI is quietly but steadily infiltrating Indian agriculture, changing our society as a whole. Though machine learning (a subset of AI) has been used for classification as well as prediction in a number of applications, such as food grading as well as crop yield forecasting, the new set of deep learning algorithms has heralded the potential of taking AI research as well as applications to much higher levels as well as with even greater precision. Additional AI techniques are also making inroads in a variety of areas, including agriculture. While there are strong hopes about how AI can favor the average person as well as change his mindset, feelings, as well as attitude about the advantages that it could offer, there are also some questions regarding the negative consequences of such advanced technologies. Finally, if AI programs are to boost farmers' economic as well as social well-being, we must be open to the production of novel new technologies with AI at its heart [10].

This paper gives all details about artificial intelligence like explanation of artificial intelligence, explanation of agriculture. This paper also contain applications of AI, architecture of ANN in artificial in AI as well as irrigation using artificial intelligence.

Discussion

The researcher studies as well as analyzed about the applications of artificial intelligence in agriculture but they did not explain well like the about the artificial intelligence, definition of agriculture, benefit of artificial intelligence, robots in agriculture etc. This paper gives all details about artificial intelligence like definition of artificial intelligence which states that the simulation of human intelligence in machines that are programmed to think like humans as well as mimic their actions, definition of agriculture which agriculture is the science, art, or practice of cultivating the soil, producing crops, as well as raising livestock as well as in varying degrees the preparation as well as marketing of the resulting products. This paper also contain applications architecture of artificial neural network in artificial intelligence(such as input layers, output layers as well as hidden layers) as well as irrigation using artificial intelligence.

Conclusion

This paper explains artificial intelligence, which is described as a simulation of humans intelligence in machine that are planned to think as well as act identical humans. Description of agriculture which states that agriculture is science, art, as well as practice that includes cultivating las well as for the purpose of growing crops as well as breeding as well as raising livestock. This paper also contain architecture of artificial neural network in artificial intelligence(such as input layer, output layer hidden layers) as well as irrigation using artificial intelligence. Human Beings, or simply humans, are a race that stas well ass apart from all other living beings, as well as AI can be used to foresee a future of unprecedented diversity. It is not only our sophisticated physiology as humans that gives us a unique social character, but also our culture. Human cultures have been evolving since the dawn of time, as well as the majority of their progress has been centered on food collection as well as consumption, making farming activities an important part of their base. We've come a long way from a civilization of nomadic food gatherers as well as hunters to the current model of systematic agriculture.

Before we go any further, let's have a look at what agriculture is all about. Agriculture is a science, an art, as well as a practice that includes cultivating las well as for the purpose of growing crops as well as breeding as well as raising livestock. It is the re-channeling of energy for human as well as animal consumption, as well as the simplification of nature's diverse food chains. When it comes to India, agriculture has been more of a way of life than a business. Agriculture has always played an important role in the Indian economy, as well as it continues to do so today. It is not an exaggeration to say that agriculture is the Indian economy's backbone. Demas well as is calculated by looking at factors such as population growth, historical demas well as patterns for food resources, as well as regional staple food patterns, among others. This knowledge can be used to effectively change cropping habits, as well as reduce crop yield waste as well as improve farmer incomes..

References

1.   "agriculture," Merriamwebster. https://www.merriam-webster.com/dictionary/agriculture.

2.   "Artificial Intelligence (AI)," Investopedia. https://www.investopedia.com/terms/a/artificial-intelligence-ai.asp#:~:text=Artificial intelligence (AI) refers to,as learning as well as problem-solving.

3.   "Application of AI," java T point. https://www.javatpoint.com/application-of-ai.

4. "15 Real World Applications of Artificial Intelligence," ANALYTIXLAB. https://www.analytixlabs.co.in/blog/applications-of-artificial-intelligence/#application9.

5. "Applications of artificial intelligence," wikipedia. https://en.wikipedia.org/wiki/Applications_of_artificial_intelligence.

6. "AI Applications: Top 10 Real World Artificial Intelligence Applications," Edureka. https://www.edureka.co/blog/artificial-intelligence-applications/#AI In Autonomous Vehicles.

7. T. Talaviya, D. Shah, N. Patel, H. Yagnik, as well as M. Shah, "Implementation of artificial intelligence in agriculture for optimisation of irrigation as well as application of pesticides as well as herbicides," Artif. Intell. Agric., vol. 4, pp. 58–73, 2020, doi: 10.1016/j.aiia.2020.04.002.

8. N. C. Eli-Chukwu, "Applications of Artificial Intelligence in Agriculture: A Review," Eng. Technol. Appl. Sci. Res., vol. 9, no. 4, pp. 4377–4383, 2019, doi: 10.48084/etasr.2756.

9. K. Jha, A. Doshi, P. Patel, as well as M. Shah, "A comprehensive review on automation in agriculture using artificial intelligence," Artif. Intell. Agric., vol. 2, no. September, pp. 1–12, 2019, doi: 10.1016/j.aiia.2019.05.004.

10. L. M. Bhar, V. Ramasubramanian, A. Arora, S. Marwaha, as well as R. Parsad, "Era of Artificial Intelligence: Prospects for Indian Agriculture," Indian Farming, vol. 3, no. 69, pp. 10–13, 2019.