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Artificial Intelligence in Agriculture.

Implementation of Artificial Intelligence in Agriculture for Optimisation of Irrigation.

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ABSTRACT

Agriculture plays a significant role in the economic sector. Automation in agriculture is the main concern and the arising subject across the world. The demand for food and employment is also increasing. and work is likewise increasing. The traditional techniques which were utilized by the farmers were not sufficiently adequate to satisfy these prerequisites. In this manner, new automated techniques were presented. These new methods fulfilled the food prerequisites and furthermore gave work open doors to billions of individuals. Artificial Intelligence in farming has brought an agricultural upset. This innovation has safeguarded the harvest yield from different factors like environmental changes, and population growth. Employment issues and the food security Problems.

The main concern of this paper is to review the different utilizations of Artificial intelligence in agriculture, for example, for irrigation, weeding, and spraying with the help of sensors and different means embedded in robots and drones. These technologies save the overabundance utilization of water, pesticides, herbicides, keep up with the fruitfulness of the soil, In additionally help in the proficient utilization of labor supply and raise efficiency and improve the quality. This paper studies crafted by many scientists to get a brief overview of the current execution of automation in farming, and the weeding frameworks through robots and drones. The different soil water sensing methods are examined alongside two automated weeding techniques. The execution of drones is examined, and the various techniques utilized by drones for showering and crop observing are likewise emplaned in this paper.

INDRODUCTION

The world's population is thought to be almost 10 billion by 2050, supporting farming request in a circumstance of humble financial improvement by somewhere in the range of half contrasted

As of now, around 37.7% of the complete land surface is utilized for crop production. Employment generation to contribute to National Income, agriculture is important. It is contributing a huge piece to the financial success of the created countries and is having a functioning impact in the economy of the developing nations too.

The augmentation of farming has resulted about a critical expansion in the per-capital income of the country rural area. Subsequently, placing a greater emphasis on the agriculture sector on the farming area will be rational and opposite. In countries, similar to India, the agrarian area represents 18% of Gross domestic product GDP and provides employment to half of the nation's workforce. Development in the agricultural sector will boost the rural development, further leading toward rural transformation and
Eventually resulting in the structural transformation with the coming of innovation, there has been noticed a sensational changes in numerous industries across the globe.

Shockingly, agriculture, though being the least digitalized, has seen momentum for the development and commercialization of agricultural technologies. artificial intelligence has started to assume a significant role in day-to-day lives, extending our perceptions and ability to change the climate around us gave a method for harvest planning based on the coupling of crop assignment with vehicle routing is presented. With these emerging technologies, the workforce which was restricted to only minimal industrial sectors is now

contributing to various sectors. AI is based on huge spaces like Science, Semantics, Software engineering, Arithmetic, Brain research, and engineering.

A brief overview of the ongoing execution of horticultural automation. The paper likewise addresses a proposed framework for flower and leaf identification and watering utilizing using IoT to be carried out on the natural farm. The basic concept of AI is to develop a technology that functions like a human brain. This technology is executed by concentrating on the human brain's thought process, how people learn, decide, and work while solving an issue, and on this ground intelligent software and systems are developed. These products are taken care of with preparing information and further these intelligent gadgets give us

With desired output for every valid input, very much like the human brain. Tremendous domains include Machine Learning and Deep learning core parts of AI (Artificial intelligence). While AI is the study of making intelligent machines and programs, ML is the capability to learn something without being explicitly programmed and DL is the learning of deep neural networks.

The main subjective of AI is to form problem solving facile which can include the utilization of ANN, ANN could be a processing algorithm or a hardware who's functioning is Inspired by the look and functioning of a Human's brain. Neural networks have an interesting ability of self-organization, and adaptive learning. it's replaced many traditional methods in numerous fields like computing, Mathematics, Physics, Engineering image/signal processing, Economic/ Finance, Philosophy, Linguistics, Neurology. ANN undergoes the method of learning. Learning is that the process of adapting the change in itself as and when there**'s** a change in environment. There are two learning techniques, supervised learning and unsupervised learning. AI is an emerging technology within the field of agriculture. AI-based equipment and machines, has taken today's agriculture system to **a** special level. This technology has enhanced crop production and improved real-time monitoring, harvesting, processing and marketing.

The latest technologies of automated systems using agricultural robots and drones have made **an** incredible contribution within the agro-based sector. Various hi-tech computer based systems are designed to see various important parameters like weed detection. This paper encompasses the technologies used for the automated irrigation, weeding and spraying to reinforce the productivity and reduce the work load on the farmers

The data from the robots was fetched through Zigbee wireless protocol. The readings were displayed on the 16 × 2 LCD display which was integrated to the LPC2148 microcontroller**.** The newest automated weeding techniques are discussed and also the implementation of drones for the aim of spraying within the fields is discussed followed by the kinds of sprayers utilized on UAVs. Further speaking about drones, yield mapping and monitoring is discussed beginning with the an overview of the yield mapping process followed by the programming of the software and briefing about the calculation yet as calibration process. Finally the processing of those yield maps is illuminated.

Impact of AI on agriculture:

The technologies which are AI-based help to boost efficiency altogether the fields and also manage the challenges faced by various industries including the assorted fields within the agricultural sector just like the crop yield, irrigation, soil content sensing, crop-monitoring, weeding, crop establishment. Agricultural robots are inbuilt order to deliver high valued application of AI within the mentioned sector. With the world population soaring, the agricultural sector is facing a crisis, but AI has the potential to deliver much-needed solutions. AI-based technological solutions have enabled the farmers to provide more output with less input and even improved the standard of output, also ensuring faster go-to-market for the yielded crops. By 2020, farmers **are** using 75 million connected devices. By 2050, the typical farm is predicted to get a mean of 4.1 million data points daily. the varied ways during which AI has contributed to the agricultural sector are as follows:

1. Image recognition & perception:

Expanding interest has been seen in independent UAVs(unmanned aerial vehicle) and their applications including credit and reconnaissance, organic structure identification and geo-localization, search and salvage, and fire recognition.

cause of their versatility moreover as amazing imaging technology which covers from delivery to photography, the flexibility to be piloted with a foreign controller and also the gadgets being skilful within the air which empowers us to try to a large amount with these gadgets, drones or UAVs are bobbing up to be progressively famous to make extraordinary levels and distances and completing some applications.

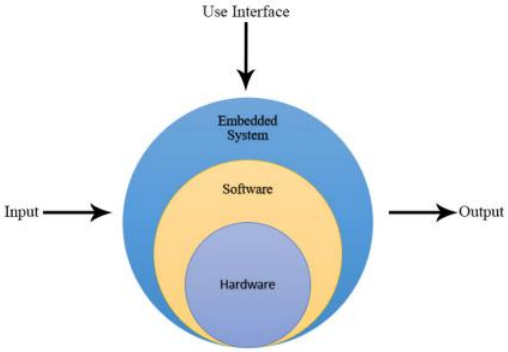
2. Maximize the output:

Variety selection and seed quality set the most performance level for all plants. The emerging technologies have helped the most effective selection of the crops and even have improved the choice of hybrid

seed choices which are best suited to farmer's needs it's been administrated by understanding how the seeds reply to different weather patterns and different soil types. By gathering this data, the chances of plant illnesses are decreased.

3. Chatbot's for farmers:

Chatbot's are nothing but the conversational virtual assistants who automate interactions with end users. AI powered chatbot's, together with machine learning techniques has enabled us to know linguistic communication and interact with users in away more personalized way. they're mainly equipped for retail, travel, media, and agriculture has used this facility by assisting the farmers to receive answers to their unanswered
questions, for giving advice to them and providing various recommendations also.



Robots in agriculture

Robotics and Autonomous Systems (RAS) are introduced in large sectors of the economy with relatively low productivity like Agri-food the united kingdom Agri-Food chain, from primary farming through to retail, generates over £108bn p.a., and with 3.7 m employees in a very truly international industry yielding £20bn of exports in 2016. Robotics has played a considerable role within the agricultural production and management. The researchers have now started emphasizing on technologies to style autonomous agricultural tools because the conventional farming machineries lacked in efficiency. . During this sector, the space for robotic technologies has amplified productivity immensely. The robots are performing various agricultural operations autonomously like weeding, irrigation, guarding the farms for delivering effective reports, ensuring that the adverse environmental conditions don't affect the assembly, increase precision, and manage individual plants in various unfamiliar ways.

The idea of bobbing up with such a technology came with the introduction of a machine called Eli Whitney's machine. it had been invented in 1794 by U.S. - born inventor discover (1765–1825), a tool which revolutionized cotton production by significantly accelerating the method of extracting seed from cotton fibre. It created 50 pounds of cotton in someday. Thus this gave birth to the autonomous agricultural robots. A basic automated model was introduced to see the particular position of seeds. Ultra high precision placement of seed was also established. Mechanisms that make sure that the seeds planted has zero ground velocity. this can be important because it ensures that the seed doesn't bounce from its actual position after the soil impact. The status or the event of plant was recorded by automated machines. Various biosensors were established to observe the plant growth and also to detect plant diseases. the method of manual weeding was replaced by the laser weeding technology, where a mobile focused infra-red light disrupts the cells of the weeds, this beam was controlled by computers. For the effective use of water, automated irrigation systems were also established.

3.1. Irrigation

The agriculture sector consumes 85% of the available freshwater resources across the planet. And this percentage is increasing rapidly with the increase and with the rise in food demand. This leaves us with the requirement to come back up with more efficient technologies the manual irrigation which was supported soil water measurement was replaced by automatic irrigation scheduling techniques. The plant evapotranspiration which was obsessed with various atmospheric parameters like humidity, the wind speed, solar radiations and even the crop factors like the stage of growth, plant density, the soil properties, and pest was taken into consideration while implementing autonomous irrigation machines.

The technology of smart irrigation is developed to extend the assembly without the involvement of enormous number of man power by detecting the extent of water, temperature of the soil, nutrient content and forecasting. The actuation is performed in step with the microcontroller by turning ON/OF the irrigator pump. The M2M that's, Machine to Machine technology is been developed to ease the communication and data sharing among one another and to the server or the cloud through the most network between all the nodes of the agricultural field.

3.1.1. Dielectric method

The moisture within the soil is decided by the sensors which essentially assess the moisture content within the soil supported the dielectric constant (soil mass permittivity) of the soil. the number of irrigation needed also can be determined on the supported the dielectric steady proposes a computerized framework that utilizes dielectric soil dampness sensors for

continuous, The estimation technique in light of the dielectric properties is viewed because the most potential one gave the data regarding how soil types affect the accuracy to dielectric moisture sensors. The dielectric steady is just the capacity of soil to transfer power or electricity. The soil is comprised of assorted parts like minerals, air and water, subsequently the estimation of its dielectric consistent **is** set by the final commitment of each one among these segments. Since the estimation of the dielectric value of water (Kaw = 81) may be a lot bigger than the estimation of this consistent for the opposite soil parts, the estimated value of permittivity is primarily represented by the nearness of moisture within the soil. One method to calculate the link between the dielectric constant (Kab) and volumetric soil moisture (VWC) is that the equation of Topp et al:

VWC= −5.3×10-2+2.29×10-2Kab−5.5×10-4 Kab2 +4.3×10−6Kab3 (1)

The other method used for determining the dielectric constant is that the by the Time Domain Reflectometry (TDR). it's determined on the premise of the time taken by an radiation to propagate along a line that's surrounded by the soil. As we probably are aware, the propagation velocity (V) is a part of the dielectric constant (Kab), therefore it's legitimately adore the square of the transmission time (t during a flash) down and back along the transmission line:

Kab=(c/v)2=((ct)/(2L))2 (2)

where c is that the speed of electromagnetic waves in an exceedingly vacuum (3•108 m/s or 186,282 mile/s) and L is that the length of the TL within the soil (in m or ft).

3.1.2. Neutron moderation

This is another technique for deciding the moisture content within the soil. during this strategy fast neutrons are launched out from a decomposing radio dynamic source like 241Am/9Be (Long and French, 1967) and when these neutrons slam into particles having an analogous mass as theirs(protons, H+), they drastically cut down, making a “cloud” of “thermalized” neutrons. As we already know that water is that the primary wellspring of hydrogen in soil, the thickness of thermalized neutrons round the test is about equivalent to the division of water present within the soil. The arrangement of the test is as a protracted and limited chamber, comprising of a source and a finder.

The estimations are taken during this test by bringing the test into an entrance tube, which is as of now presented within the soil. One can decide soil amount of moisture within the soil at various profundities by balancing the test within the cylinder at various profundities.

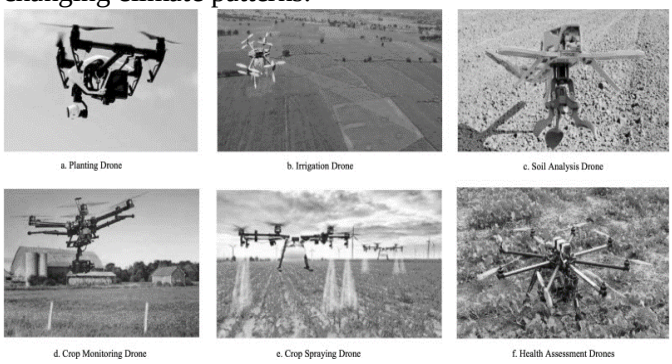
The moisture substance is gotten with the help of this gadget captivated with an on the spot alignment between the check pace of thermalized neutrons read from the test, and therefore the soil moisture substance got from adjacent try out e installation of sensors plays a very important role within the efficient implementation of irrigation robotics. One can use one sensor to manage the irrigation of multiple zones within the fields. And one may also set multiple sensors to irrigate individual zones.

4. Drones in agriculture

Unmanned aeronautical vehicles (UAVs) or unmanned ethereal frameworks (UAS), otherwise called automatons, during a mechanical setting are unmanned aircrafts which will be remotely controlled (Mogli and Deepak, 2018). They add confluence with the GPS et al. sensors mounted on them. Drones are being implemented in agriculture for crop health monitoring, irrigation equipment monitoring, weed identification, herd and wildlife monitoring, and disaster management. The complete addressable estimation of automation fuelled arrangements in every only relevant industry is critical – quite USD 127 billion, as indicated by an ongoing PwC analysis. they'll be contrasted with a standard modest to use camera for unmistakable pictures, yet while a regular camera can give some data about plant development, inclusion and various things, a multispectral sensor extends the utility of the procedure and enables farmers to determine things that cannot be found within the noticeable range, as an example, moisture content within the soil, plant health checking. These could help defeat the various restrictions that obstruct agrarian production. the event of the UAS(Unmanned Air/Aircraft System) is incorporated with Wireless Sensor Networks (WSN). the information recovered by the WSN allows the UAS to advance their utilization for example to limit its spraying of synthetic compounds to carefully assigned regions. Since there are abrupt and continuous changes in ecological conditions the control circle must almost certainly respond as fast as could reasonably be expected. The reconciliation with WSN can help toward that path.

In precision agriculture, UAVs are mainly applicable for agriculture operations like soil and field analysis. crop monitoring, crop height estimation, pesticide Spraying, However, their hard ware implementations. are purely adherent on critical aspects like weight, range of flight, payload, configuration and their costs. a search involving technologies, methods, systems and limitations of UAVs are examined .About over 250 models are analysed still as summarized so as to settle on an appropriate UAV in agriculture. The agricultural

drone market is predicted to grow over 38% in coming years. it's believed that the requirement for efficient agriculture is simply visiting become more important because of increasing population levels and changing climate patterns.



4.1. Crop spraying

The UAVs, otherwise called drones, are chiefly established on the innovations of sensors and microcontrollers which are grown especially with an expectation to form up for the nonattendance of the pilot and accordingly empower the trip of unmanned vehicles and their independent conduct. These drones are utilized as substance sprayers by farmers for varied years now and that they are considered effective and of great importance within the situations of cloudy climate and have also solved the matter of inaccessibility to a field of tall crops, solid superiority contrasted with satellite airborne sensors of high picture resolution. A foliage volume estimation framework, visible of ultrasonic range transducers, was interfaced to a PC which controlled the 3-nozzle manifolds on all sides of the sprayer by the use of control calculations obsessed with the quantity of spray deposited utilized drones for spraying synthetic substances on the yield where the drones are joined to actualize a bearing circle for horticulture applications. These drones were implemented with sensors conveyed on the crops within the field called remote sensor networks (WSN) which controlled the way toward applying the synthetic compounds. the information recovered by these remote sensors limited drones to spray the synthetic substances only into the assigned regions.

This technique and therefore the systematic outcomes from this system provides a precursor that would be utilized in creating UAV flying application frameworks for higher yields which have the next target rate and greater VMD droplet size. built up an unmanned airborne vehicle-based programmed flying praying framework. The framework utilized a profoundly coordinated and ultra-low-power MSP430 single-chip miniaturized scale PC with a free practical module. This permitted course was programmed to coordinate the UAV for spraying at the specified or the required areas on the fields. The spray consistency for these UAV tests was better than the quality Requirement for ultra-low volume spraying variety coefficient.

Based on the vitality required to atomize and fling the shower liquid, sprayers are arranged into four categories namely: The hydraulic energy sprayer, the gaseous energy sprayer, the centrifugal energy sprayer and also the Kinetic energy sprayer.

4.1.2. Gaseous energy sprayer

In Gaseous Energy Sprayer, a blower produces a high speed air stream. This air stream is coordinated through the pipe toward the finish of which spray liquid are going to be available which can be permitted to be streamed by the activity of gravity through a diffuser plate. A fluid or residue is sustained into air stream to be conveyed to the target.

4.1.3. Centrifugal energy sprayer

The Centrifugal Energy Sprayer consists of a quick turning devise**,** for instance, level, a concave or a convex plate, a wire mesh cage or a bucket, a puncture strainer or chamber or a brush. At the point of interest of this gadget, the shower liquid is nourished under low weight which is additionally atomized by diffusive power because **it** leaves the outskirts of the atomizer. The droplets are conveyed by the air stream created by the blower of the sprayer or by the common breeze, if the sprayer isn't equipped an addict.

4.1.4. Kinetic energy sprayer

In Kinetic Energy Sprayer the spray liquid streams by gravity to a vibrating or swaying spout which delivers a rough fan like spray design. this can be explicitly utilized for the spraying of herbicides. The spray effectiveness of any of the above utilized showers may be determined by utilizing the equation given underneath:

Spray proficiency (%) = Minimum spray volume required x 100%

The plant foliage which is tainted by a pest or weed or the other reason has got to be sprayed. The region which is required to be sprayed differs with separation between the lines of plants, separation between the plants in a very similar line even as the event of the harvest. Additionally, it's important to finish sprayer alignment practice earlier embraced real spraying work **to ensure** uniform use of pesticides on the yields. We can process the spraying volume by utilizing the formula:

Application Rate in Litre per Acre or Hecter = (Constant 600 British Matric* Nozzle Discharge Rate in Litre every Minute)/(Effective Swath Width in Feet or Meters* Spraying speed in Mile or Kilometre every

hour).

4.2. Crop monitoring

The advanced sensors and imaging capabilities have provided the farmers with many new ways to extend yields and reduce crop damage. Unmanned airplanes which are used for practical purposes in recent years have taken a bizarre flight. New sensors mounted on UAV, with high-tech cameras being the eyes of the client on the bottom and optimal procedures for survey, data acquisition and analysis are continuously developed and tested. As a matter of fact, the employment of aerial surveys isn't unaccustomed the agricultural world.

Satellites are used for a decade to examine large croplands and forestry but a brand new level of precision and suppleness has been obtained with the employment of UAVs. to hold out UAV flights, one doesn't must rely on the position of the satellite or having the proper climate and as UAV pictures are taken 400–500 ft. from the bottom level, they end in better quality and supply precision.

5. LITERATURE REVIEW

Over the past 50 years, there has been a sustainable development in AI because of its robustness within the application and is pervasive in every field. One such field is agriculture. Agriculture faces many challenges on a each day and isn't smooth running business. a number of the pith problems faced by farmers from seed sowing to harvesting of crops are as follows:

1. Crop diseases infestations
2. Lack of storage management.
3. Pesticide control
4. Weed management
5. Lack of irrigation and drainage facilities.

Artificial Intelligence and Machine learning has penetrated each and each category mentioned above. Segregated advancements in AI category wise and gave a quick overview on various AI techniques. Computers and technology started penetrating during this sector from 1983 onwards. Since then, there are many suggestions and proposed systems for betterment in agriculture from the database to higher cognitive process.

Filtering out every process, only AI based systems have proved to be the foremost feasible and reliable one. The AI based method doesn't generalize the matter and offers a selected solution to a specific defined complex problem. The literature survey covers major breakthroughs within the domain of agriculture from early **1980's to 2018**. The paper discusses quite fifty advancement in technologies within the sub domain of agriculture.

First it discusses penetration of artificial neural networks and expert systems to resolve above mentioned problems, then machine learning and mathematical logic system. Lastly it covers automation and Drone within the agriculture.

6. METHODOLOGY, FINDINGS AND RESULTS

Though AI offers vast opportunities for application in agriculture, there still exists an absence of familiarity with high tech machine learning solutions in farms across most parts of the planet. Exposure of farming to external factors like atmospheric condition, soil conditions and presence of pests is sort of lots. So what might seem like a decent solution while planning during the beginning of harvesting might not be an optimal one thanks to changes in external parameters?

AI systems also need lots of knowledge to coach machines and to create precise predictions. just in case of vast agricultural land, though spatial data will be gathered easily, temporal data is tough to induce. as an example, most of the crop-specific data are often obtained just one occasion in an exceedingly year when the crops are growing. Since the info infrastructure takes time to mature, it requires a major amount of your time to create a sturdy machine learning model. this is often one reason why AI sees lots of use in agronomic products like seeds, fertilizer, pesticides then on instead of in-field precision solutions.

7. CONCLUSION

AI technologies help farmers to analyse land/soil/health of crop etc and save time and permit farmers to grow right crop in each season that has best yield. Vertical cropping can reduce water usage, make efficient land usage, will be cultivated in urban areas in buildings. It can reduce the issues with labour unavailability. Allows prediction of next year crop seasons/weather/climate/rainfall etc.

AI based predictions enable suggesting appropriate pesticides/crops/place at right time before large scale incidence of disease. With an enormous space still untouched in agriculture for the intrusion of automatic response systems,

There is an unlimited opportunity for the agriculture industry to leverage emerging technology of catboats for assisting farmers with the answers to all or any their queries and giving relevant advice and proposals to their specific farm related problems. This successively propels the expansion of the AI market in agriculture.

8. REFERENCES

- Aitkenhead, M.J., Dalgetty, I.A., Mullins, C.E., McDonald, A.J.S., Strachan, N.J.C., 2003. Weed and crop discrimination using image analysis and artificial intelligence methods.
- Comput. Electron. Agric. 39 (3), 157–171. Al-Ghobari, H.M., Mohammad, F.S., 2011. Intelligent irrigation performance: evaluation and quantifying its ability for conserving water in arid region.
- Appl Water Sci 1, 73–83. Arif, C., Mizoguchi, M., Setiawan, B.I., Doi, R., 2012. Estimation of soil moisture in paddy field using Artificial Neural Networks. International Journal of Advanced Research in Artificial Intelligence.
- 1 (1), 17–21. Banerjee, G., Sarkar, U., Ghosh, I., 2017. A radial basis function network based classifier for detection of selected tea pests.
- International Journal of Advanced Research in Computer Science and Software Engineering. 7 (5), 665–669. Bannerjee, G., Sarkar, U., Das, S., Ghosh, I., 2018.
- Artificial Intelligence in Agriculture: A Literature Survey. International Journal of Scientific Research in Computer Science Applications and Management Studies. 7 (3),
- 1–6. Bargoti, S., Underwood, J., 2017. Deep Fruit Detection in Orchards. 2017 IEEE International Conference on Robotics and Automation (ICRA) 3626–3633. Batchelor, W.D., McClendon, R.W., Adams, D.B., Jones, J.W., 1989. Evaluation of SMARTSOY: an expert simulation system for insect pest management. Agric. Syst. 31 (1), 67–81. Dursun, M., Ozden, S., 2011.
- A wireless application of drip irrigation automation supported by soil moisture sensors. Sci. Res. Essays 6 (7), 1573–1582. Encinas, C., Ruiz, E., Cortez, J., Espinoza, A.,