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"Applications of Artificial Intelligence and Robotics for Indian Agriculture Development".

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ABSTRACT: This research paper is about the application of advanced technology in Computer application like Artificial Intelligence and robotics in Agriculture are of the Indian states which are having lot of variations in land that is soil , rainfall climate and other geographical conditions . The paper is focusing on the various application areas like climate forecasting , water management , soil testing and other yield increasing measures for the benefit of the farmers and public at large who are dependent on agriculture activities. Agriculture in India is main activity and widely done through various states and regions more then 70% population depend on agriculture activities and produce large food products and are involved in various agriculture activities . In agricultural production and administration, robotics plays an important role. Automated and time-saving agriculture technology has to be efficiently managed. The use of emerging technologies in many domains is an essential process. Agriculture is seeing rapid adoption of Artificial Intelligence (AI) and Machine Learning (ML) both in terms of agricultural products and in-field farming techniques. Cognitive computing in particular, is all set to become the most disruptive technology in agriculture services as it can understand, learn, and respond to different situations (based on learning) to increase efficiency. Agricultural robotics has been a popular subject in recent years from an academic as well as a commercial point of view. This is because agricultural robotics addresses critical issues such as seasonal shortages in manual labor, e.g., during harvest, as well as the increasing concern regarding environmentally friendly practices. On one hand, several individual agricultural robots have already been developed for specific tasks (e.g., for monitoring, spraying, harvesting, transport, etc.) with varying degrees of effectiveness.

KEYWORDS: Artificial Intelligence , Robotics, Machine Learning , Agriculture , Soil Testing , Economy, Climate change.

I. INTRODUCTION

India is an Economic country cantered in Argo with a 60.45% share, which according to the World Bank statistics is around 159.7 million hectares (394.6 million acres). In today's world, new methods of producing Argo goods have transformed the world's worldwide forms of agriculture, and the population explosion has satisfied the demand to feed everyone across the world. The technology is now days forcing the way the farming is done in India. These AI applications will surely benefit the crop yield and make the modernization more effective in the area of Agriculture . Present farmers are ready to perform agriculture to fulfil the demands of the coming generations. To make agriculture too intelligent and increase farmers' income. The growing rate of IoT-based technology is making our lives much easier than anybody can accomplish. Monitors the water content, soil fertility, rain detection, detection of growth, temperature/moisture value, light intensity, production forecasts, etc. The popular term Precision Agriculture, or PA for short, has been defined as "a management strategy that uses electronic information and other technologies to gather, process, and analyze spatial and temporal data for the purpose of guiding targeted actions that

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improve efficiency, productivity, and sustainability of agricultural operations" . Based on this definition, the introduction of robots in agricultural tasks can serve the purpose of PA by taking advantage of sophisticated equipment for accurate measurements, management, and operations.

Application Areas AI and Robots in Agriculture

The Financial Survey shows that agriculture automation has to be improved throughout the country. Increases in productivity control over pest infection play an important function. The farmers face major problems in the management of infestations using pesticides. Pesticides are unwanted insects or pathogens that affect human activities, which can attack, plant damage, or make farmers' lives tougher. Early identification and monitoring of pests are important elements in crop management. **Effective pest control** AI based technologies like **yield forecasting** can help better planning of other farming activities to improve productivity. This not only protects the farmer from life-threatening diseases and physical symptoms but also saves him income due to the reduced use of pesticides. It allows farmers to grow economically, in turn, the society. Use of this type of robot when spraying the pesticide liquid, lowered time consumption due to AI solutions helps farmers to reduce the burden and to complete jobs throughout any period.

Source:-https://www.google.com/search?q=Applications+of+Artifi

Due to insufficient involvement of technology, the throughput of agriculture is yet to reach its full glory. Every farmer is interested in knowing the yield he/she could expect at the harvest period and hence, yield prediction is an important aspect for them. Over the years, farmers have an idea about the pattern in yield as per innate human intuition. However, rainfall as a major driver for crop raising can extensively rattle intuitive yield prediction by controlling some of the soil and environmental parameters related to the crop growth.

Agriculture is seeing rapid adoption of Artificial Intelligence (AI) and Machine Learning (ML) both in terms of agricultural products and in-field farming techniques. Cognitive computing in particular, is all set to become the most disruptive technology in agriculture services as it can understand, learn, and respond to different situations (based on learning) to increase efficiency.

AI in Agriculture

- **Yield Management using AI**

The emergence of new age technologies like Artificial Intelligence (AI), Cloud Machine Learning, Satellite Imagery and advanced analytics are creating an ecosystem for smart farming. Fusion of all this technology is enabling farmers achieve higher average yield and better price control. Microsoft is currently working with farmers from Andhra Pradesh to provide advisory services using Cortana Intelligence Suite including Machine Learning and Power BI. The pilot project uses an AI sowing app to recommend sowing date, land preparation, soil test-based fertilization, farm yard manure application, seed treatment, optimum sowing depth and more to farmers which has resulted in 30% increase in average crop yield per hectare. Technology can also be used to identify optimal sowing period, historic climate data, real time Moisture Adequacy Data (MAI) from daily rainfall and soil moisture to build predictability and provide inputs to farmers on ideal sowing time. To identify potential pest attacks, Microsoft in collaboration with United Phosphorus Limited is building a Pest Risk Prediction API that leverages AI and machine learning to indicate in advance, the risk of pest attack. Based on the weather condition and crop growth stage, pest attacks are predicted as High, Medium or Low.

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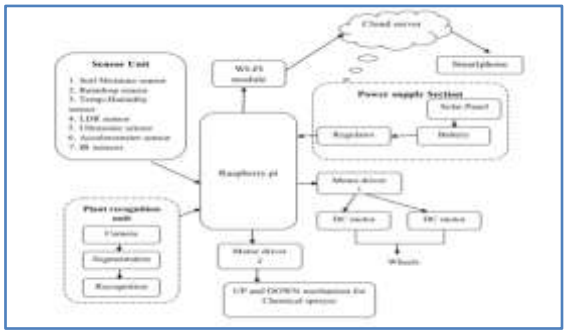
Source :-https://www.google.com/search?q=Applications+of+Artificial+Intell

AI based Smart Agriculture Equipments

Huge volumes of data get generated every day in both structured and unstructured format. These relate to data on historical weather pattern, soil reports, new research, rainfall, pest infestation, images from Drones and cameras and so on. Cognitive IOT solutions can sense all this data and provide strong insights to improve yield. Proximity Sensing and Remote Sensing are two technologies which are primarily used for intelligent data fusion. One use case of this high-resolution data is Soil Testing. While remote sensing requires sensors to be built into airborne or satellite systems, proximity sensing requires sensors in contact with soil or at a very close range. This helps in soil characterization based on the soil below the surface in a particular place. Hardware solutions like Robot



(Source: Pravin Kshirsagar, OPTIMIZATION OF HUMAN MANPOWER USING ROBOTICS-BASED IOT SYSTEM IN THE FIELD OF AGRICULTURE)

Image-based Insight Generation

Precision farming is one of the most discussed areas in farming today. Drone-based images can help in in-depth field analysis, crop monitoring, scanning of fields and so on. Computer vision technology, IOT and drone data can be combined to ensure rapid actions by farmers. Feeds from drone image data can generate alerts in real time to accelerate precision farming. Preprocessing of image ensure the leaf images are segmented into areas like background, non-diseased part and diseased part. The diseased part is then cropped and send to remote labs for further diagnosis. It also helps in pest identification, nutrient deficiency recognition and more.

Identification of optimal mix for agronomic products

Based on multiple parameters like soil condition, weather forecast, type of seeds, infestation in a certain area and so on, cognitive solutions make recommendations to farmers on the best choice of crops and hybrid seeds. The recommendation can be further personalized based on the farm's requirement, local conditions, and data about successful farming in the past. External factors like marketplace trends, prices or consumer needs may also be factored into enable farmers take a well-informed decision.

Health monitoring of crops

Remote sensing techniques along with hyper spectral imaging and 3d laser scanning are essential to build crop metrics across thousands of acres. It has the potential to bring in a revolutionary change in terms of how farmlands are monitored by farmers both from time and effort perspective. This technology will also be used to monitor crops along their entire lifecycle including report generation in case of anomalies.

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Applications of Robotics in Agriculture

The main area of application of robots in agriculture today is at the harvesting stage. Emerging applications of robots or drones in agriculture include **weed control, cloud seeding, planting seeds, harvesting, environmental monitoring and soil analysis**.

- Crop-Harvesting Robots.
- Harvest Automation.
- Harvest CROO.
- Weeding Robots.
- Naio Technologies.
- Nexus Robotics.
- Robotic Greenhouses & Robot Farming

Robots Working in Farming and Agriculture

Source :- https://cropforlife.com/top-10-appli

Application of Robotics in farming

- Before the crop cycle, drone can be used to produce a 3-D field map of detailed terrain, drainage, soil viability and irrigation. Nitrogen-level management can also be done by drone solutions
- Aerial spraying of pods with seeds and plant nutrients into the soil provides necessary supplements for plants. Apart from that, Drones can be programmed to spray liquids by modulating distance from the ground depending on the terrain
- Crop Monitoring and Health assessment remains one of the most significant areas in agriculture to provide drone-based solutions in collaboration with Artificial Intelligence and computer vision technology. High-resolution cameras in drones collect precision field images which can be passed through convolution neural network to identify areas with weeds, which crops need water, plant stress level in mid growth stage. In terms of infected plants, by scanning crops in both RGB and near-infra red light, it is possible to generate multispectral images using drone devices. With this, it is possible to specify which plants have been infected including their location in a vast field to apply remedies, instantly. The multi spectral images combine hyper spectral images with 3D scanning techniques to define the spatial information system that is used for acres of land. The temporal component provides the guidance for the entire lifecycle of the plant.

I. Action

While there is nowadays a general agreement on the basic structure of the autonomous agent/robot, the question of how this structure can be implemented has been subject to a long debate and is still under investigation. Agents and, specifically, robots, usually present various kinds of sensing and acting devices. The flow of data from the sensors to the actuators is processed by several different modules and the description of the interaction among these modules defines the problem is that building a high-level world model and generating a plan are time consuming activities and thus these systems have shown to be inadequate for agents embedded in dynamic worlds. Reactive architectures focus on the basic functionalities of the robot, such as navigation or sensor interpretation, and propose a direct connection between stimuli and response.

II. ACTION THEORIES

A number of theories of actions have been developed in order to represent the agent's knowledge. They are characterized by the expressive power, that is the ability of representing complex situations, by the deductive services allowed, and by the implementation of automatic reasoning procedures. Several formalisms have been investigated starting from Reiter's Situation Calculus, A-Languages , Dynamic Logics Fluent and Event Calculi . The proposed formalisms address several aspects of action representation including sensing, persistence, non determinism, concurrency. Moreover, they have been further extended with probabilistic representations,

representations of time A more popular approach to action representation on robots is based on decision making techniques, which maximize the utility of the actions selected by the robot, depending on the operational context. However, this approach does not provide an explicit representation of the properties that characterize the dynamic system, while focusing on the action selection mechanism.

III. ARCHITECTURES

There are many features that are considered important in the design of agents' architectures and each proposal describes a solution that provides for some of these features. Approaches to architectures that try to combine symbolic and reactive reasoning are presented for The robot is a real physical agent tightly interacting with the environment and the robot behaviour is generated not by the robot controller alone, but it emerges by means of the interactions between the robot with its body and the environment. Other contributions to the realization of robot architectures come from evolutionary computing, where evolutionary robotics is a research field aiming at developing robots through evolutionary processes inspired by biological systems. For example, neuro-fuzzy systems

IV. CONCLUSION

The Application of AI and Robotics for various agriculture activities is the main and important are in near future for the Indian States . The Farmers can already choose from several robotic options for improving agricultural technology based on their requirements. Rising costs for farm labour and expected falling costs for various electronic equipment also will provide further catalysts for the shift.

A perfect combination of AI and robotics will indeed end up helping to reduce cost and time management for overall agriculture industry in the country, regardless of the diverse environmental conditions in country from most favourable conditions for farming to the most unfavourable ones of the country. In agriculture, there is a great potential of AI machines to **provide information to farmers on the quality of soil**, when to sow, where to spray herbicide, and where to expect pest infestations. Thus if AI systems can advise farmers on best practices, India could see a farming revolution.

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