RECENT TRENDS IN AGRICULTURAL ENGINEERING

Abstract

Engineering, technology, and the biological and physical sciences are all crucial to modern agriculture. Agricultural engineers' expertise is needed in the domains of irrigation, drainage, conservation, and channeling, all of which are crucial to ensuring agricultural success. The progress of science has an impact on closely related processes including packaging, processing, and marketing. The markets for agricultural products have expanded thanks to quick freezing and dehydration techniques. The dominant aspect of agriculture in the late nineteenth and early twentieth century's was mechanisation, which significantly reduced the workload for farmers. More significantly, mechanisation has raised farm output and efficiency. In agriculture, planes and helicopters are used for planting, moving perishable commodities, putting out forest fires, and spraying fumigant on crops to ward off insects, diseases, and pests. Radio and television provide important weather information as well as other content of relevance to farmers.

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I. INTRODUCTION

Innovations in agricultural engineering have a huge potential to improve sustainable development by meeting the needs of the expanding global population. The environmental effect per unit of food, feed, fibre, and fuel generated is reduced by better efficiency and accuracy in the use of inputs like fertilisers and agricultural chemicals.

We should put our efforts into protecting and developing the nation's natural resources of land and water in order to realise the aforementioned vision of agricultural engineering. On a mission mode, programmes that encourage agricultural mechanisation are given the weight they deserve in order to solve the challenges caused by a lack of farm workers in rural areas. Work is done on farms to improve water use efficiency in command areas and to save soil and water to stop the degradation of the land. For replenishing the ground water, cutting-edge technologies are being used.

II. AGRICULTURAL ENGINEERING DEALS WITH

Tractor and drawbar mounted farm implement design and production, localization and planning of farm structures, soil and water management, irrigation and drainage management, processing of agricultural products, design and production of solar, wind, and water powered equipment, energy production through greenhouse gas mitigation, and waste management techniques.

Recent Trends in Agricultural Engineering

1. **Data management and electrification:** e-agriculture for data management and electrification with a primary focus on agriculture, information and communication technology in agriculture, often known as e agriculture, is creating and implementing cutting-edge ways to employ ICTs in the rural sector.

   ICT in agriculture provides a variety of answers to some agricultural problems. It is regarded as a developing field that focuses on advancing agricultural and rural development through better information and communication systems. ICT is used in this context as a catch-all phrase for all information and communication technologies, including hardware, software, networks, mobile devices, and services.

   As new ICT applications continue to be tapped into in the agriculture industry, e agriculture's reach continues to expand. E-agricultural, in further detail, entails the conception, design, development, testing, and implementation of novel ICT applications in the rural domain, with a primary focus on agriculture.

2. **Automation and agbots:** By decreasing overlapping inputs, computing in advance the form of the field where the inputs are to be used, and comprehending the relative productivity of various sections of the field, existing geolocation technology could reduce the production of seed, minerals, fertiliser, and herbicides.

   Inputs can be procedurally applied at different rates across the field by tractors or Agbots. These are employed to automate tasks related to agriculture, including planting,

harvesting, weeding, and irrigation. With the help of tens of thousands of microscopic sensors, agricultural robots could monitor, forecast, cultivate, and harvest crops from the ground with essentially no human involvement.

Automatic milking systems are standalone computer-controlled devices that milk dairy cattle without the need for human labour. A sophisticated herd management programme, specialised computers, and an agricultural robot work together to fully automate the milking process. The farmer may spend more time managing the farm and the herd because automatic milking removes them from the actual milking procedure.

Using the information acquired by the computer, farmers may also enhance herd management. Farmers can make the necessary adjustments to achieve the best milk yields by assessing the impact of different animal feeds on milk yield. Each cow can be watched and evaluated because the data is available at the individual level, and the farmer may be informed if there are any unexpected changes that could indicate illness or injuries.

3. **Precision agriculture:** Farming management focused on tracking differences within individual fields. Farmers may maximise input yields while protecting resources at greater sizes by using satellite images and sophisticated sensors. The experts concur that User-Centered Design (UCD) in the design expert software has the potential to hasten the process of sustainable innovations by comprehending crop variability, geolocated meteorological data, and accurate sensors. The better-fitting items are simpler to use if users are more actively involved in the design process.

4. **Sensors:** Real-time understanding of the state of farms, forests, and water bodies is made possible by air and soil sensors. The right amount of fertiliser is required, and it is determined using high resolution crop sensors mounted in fertiliser application equipment. Utilizing infrared light, optical sensors or drones assist in determining crop health throughout the field. The vibrations in factories, farms, bridges, buildings, and other infrastructure can be monitored by sensors for the health of the infrastructure.

5. **Equipment telematics:** Tractors and other mechanical devices can alert users of impending failures thanks to equipment telematics. They enable a reduction in the cost of work control and organisation, as well as a rise in the effectiveness of its utilisation. They perform round-the-clock monitoring of the equipment's operating modes and condition with the possibility of obtaining information about both general parameters (consumption, fuel level, engine temperature, etc.), as well as on specific parameters of the operation of mechanisms and assemblies, such as monitoring the operation of hydraulics, threshing drum, filling the tank with grain, or the condition of the threshing drum. They can reduce the cost of maintenance and operation of equipment by up to 30%.

6. **Livestock biometrics:** Cattle biometrics employ collars equipped with GPS, RFID, and biometrics to instantly identify and transmit critical data about the livestock. Each cattle is RFID-tagged for simpler identification, allowing access to pertinent information including the bearer's location, breeder's name, the cattle's place of origin, the livestock's sex, and the dates of movement. Additionally, the programme will improve the management of animal disease outbreaks.

7. **Vertical farming:** Urban vertical farms would raise plants or animals inside specific or mixed-use buildings. Energy-efficient lighting akin to that seen in glass homes could be used in vertical farms to supplement natural light. Numerous benefits include year-round agricultural production, weather protection, support for urban food independence, and lower transportation costs.

8. **Rain water harvesting:** The act of collecting and storing rainwater for later use on the property as opposed to letting it run off is known as rainwater harvesting. Rainwater can be captured from roofs or rivers, and in many locations the captured water is directed to a deep pit by a well, shaft, or borehole, a reservoir with percolation, and captured from dew or fog with nets or other tools. Water for gardens, cattle, irrigation, and properly treated residential consumption are just a few of its uses. The water that is collected can also be used for groundwater recharging, longer-term storage, and consumption.

