Popular Article

Precision Livestock Farming (PLF) –Challenges and Prospects

Praveen Kumar.I[1], Gauresh Naik[2] and Deepika. A[3]

[1,2] M.V.Sc Scholar, Department of Livestock Production Management, College of Veterinary and Animal Sciences, Mannuthy, Thrissur.

[3] Under Graduate, Rajiv Gandhi Institute of Veterinary Education and Research, Puducherry.

Introduction:

Given the burgeoning human population, the livestock industry faces mounting pressure, driven by both heightened demand for animal products and challenges such as dwindling fodder/feed resources and climate change impacts, necessitating a focus on enhancing production efficiency while mitigating environmental harm. The agricultural digital revolution is swiftly transforming various forms of farming. Within animal husbandry, the concept of "Precision Livestock Farming" (PLF) has already gained significant traction. PLF defines as "Utilizing process engineering principles and techniques, livestock farming is automated to monitor, model, and manage animal production seamlessly." Precision Livestock Farming employs cutting-edge technology and data-driven strategies to enhance the efficiency of livestock production and management. By incorporating sensors, automation, and monitoring systems, it enables the collection of real-time data on animal health, behavior, and environmental conditions. The PLF goal is to boost productivity, reduce resource usage, enhance animal welfare, and foster sustainable and effective livestock farming methods.

Application domains:

Monitoring of Animals – Over the past decade, significant advancements have occurred in animal monitoring technology. These range from basic RFID tags for animal identification to sophisticated health monitors capable of detecting subtle behavioural changes in individual animals. RFID tags and microchips eliminate the need for constant handling or restraining of animals, enabling continuous monitoring and tracking even in extensive production setups. GPS

tags are employed for tracking animals, particularly useful for large herds on pasture, aiding in monitoring walking behavior. Collars equipped with behavior-monitoring sensors help identify estrus occurrences by measuring rumination rate, feeding, and resting behavior. Additionally, sensors like pedometers, accelerometers, and posture monitors find increasing application across various aspects of animal management.

Animal Well-being - The health of animals significantly affects the profitability and efficiency of livestock operations, given the close relationship between animal and human health. Early detection and effective management of livestock diseases are crucial, driving the need for technologies that can provide early warnings of health issues. The primary motivation behind the development and advancement of Precision Livestock Farming (PLF) technologies. By enabling early detection, PLF technologies help reduce losses associated with diseases, as most ailments are more easily treatable when detected early.

Recent developments utilize sensors, AI, ML, and big data analysis to empower farmers in addressing health concerns signalled by alterations in animal behavior, movement, and consumption patterns. Through ongoing data collection and sophisticated analysis, farmers can anticipate, detect, and mitigate potential health crises. Thermal imaging, for example, identifies anomalies such as inflammation or lameness by continuously monitoring temperature fluctuations in animals, effectively identifying conditions like mastitis or hoof issues. Rumen sensors, employing telemetry-based pH monitoring systems, track changes in the rumen environment to predict and prevent feed digestion-related health problems like ruminal acidosis or bloat. Temperature sensors detect alterations in rumen environment or heat stress, while pressure or motility sensors help detect bloat or irregularities in rumen motility, aiding in disease forecasting.

Growth and Nutritional Needs of Animals – Most promising aspects of Precision Livestock Farming (PLF) technologies in animal production is the implementation of precise feeding methods tailored to individual animals' nutritional needs, facilitated by real-time sensors. Traditional feeding practices rely on group feeding standards, as monitoring individual feed intake and growth is challenging. PLF offers a solution with its individual feeding approach, enabled by automatic monitoring of factors such as feeding behavior, feed intake, water intake, and rumination time for each animal.

A variety of sensors have been developed to measure different aspects of nutrition, including energy balance, feed digestion, feed degradation, and energy expenditure. These data can be integrated in various ways to optimize animal feeding in terms of nutrient intake and feed efficiency. Another approach involves the use of photogrammetry, which accurately monitors

839

feed intake, feeding behavior, and individual feed efficiency. Despite the potential, the implementation of feeding interventions using information and communication technology (ICT) is still in its early stages, primarily confined to research studies. There is a pressing need to develop and integrate animal models with emerging technologies customized to deliver the right amount of feed and nutrients to each animal at the right time. PLF holds the promise of need-based nutrient delivery, thereby reducing waste of feed and fodder resources resulting from excessive supply to animals.

Challenges:

Challenges in Extensive Systems Adoption: The implementation of Precision Livestock Farming (PLF), particularly in developing countries, faces hurdles due to the predominantly extensive nature of production systems. Real-time monitoring using wireless technology is hindered by the limited range of most sensors in these expansive setups. While microchips and wearable collars offer viable solutions for extensive production, affordability emerges as a significant barrier. Furthermore, the dominance of a few major enterprises in the market for software and technology innovation results in limited options and inflated costs for PLF solutions.

Standardization Deficiency: Animals are complex, individually unique, and dynamic systems, requiring extensive standardization for accurate results. Currently, PLF technologies lack standardization across the systems they target, the species they serve, and the physiological states of the animals involved.

Skilled Manpower-Shortage: The traditional workforce in the livestock sector often lacks the necessary skills to effectively handle emerging technologies and interpret collected data.

Risk of Equipment Failure: There is a high probability of equipment failure associated with PLF technologies, which can disrupt monitoring and management processes.

Intrusive Nature of Technologies: Many monitoring devices used in PLF can be intrusive, potentially compromising animal welfare by interfering with normal behavior and states.

Prospects

Precision Livestock Farming (PLF) technologies are in their early stages of development in developing countries. These technologies represent a critical avenue for transforming livestock management practices in a rapidly changing world, where the pressure on the livestock sector to sustainably feed a growing global population while mitigating environmental impacts is substantial. PLF has the potential to create new employment opportunities across various levels of the workforce, from innovators to those directly involved in livestock care.

However, realizing the full potential of this technological revolution requires significant

840

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com

Published 28.02.2024

upgrades in terms of workforce skilling and reskilling, as well as the development of quality infrastructure capable of supporting the adoption of these technologies. With the sector evolving rapidly, PLF offers a pathway to enhance food security while also addressing concerns related to animal welfare.

Conclusion:

Livestock farming presents a multifaceted challenge characterized by considerable uncertainty. However, advancements in technology offer promising avenues for improving decision-making processes in daily farming operations. Precision Livestock Farming (PLF) emerges as a pivotal solution, leveraging innovative tools like IoT and AI to revolutionize traditional farming practices. With a focus on enhancing animal welfare, promoting health, and mitigating greenhouse gas emissions, PLF holds immense potential for reducing the environmental footprint of livestock production. This integration of diverse field's opens doors to more sophisticated approaches, marking a significant shift toward a more efficient and sustainable farming paradigm.

References:

FAO, 2020. Key facts and findings. FAO http://www.fao.org/news/story/en/item/ 197623/icode/

Lehr, H., 2011. Trying to define practical and acceptable precision lifestock farming: Results from brightanimal, In: Hegarty, R., Banhazi, T., Saunders, C. (Eds.), 2011 Society for Engineering in Agriculture Conference: Diverse Challenges, Innovative Solutions. Engineers Australia, Barton, pp. 337-337.

Matthews, S.G., Miller, A.L., PlOtz, ¨ T., Kyriazakis, I.J.S.r., 2017. Automated tracking to measure behavioural changes in pigs for health and welfare monitoring. 7, 1-12.

Muhammad Sayem, A.S., Hon Teay, S., Shahariar, H., Fink, P.L., Albarbar, A., 2020. Review on Smart Electro-Clothing Systems (SeCSs). Sensors 20, 587.

Tullo, E., Finzi, A., Guarino, M.J.S.o.t.t.e., 2019. Environmental impact of livestock farming and Precision Livestock Farming as a mitigation strategy. 650, 2751-2760.