SMART LIVESTOCK MANAGEMENT WITH IoT SOLUTIONS

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INTRODUCTION

Dairy farmers are some of the most hardworking people. They are the backbone of the nutrition provider for the entire world. Milk and dairy products supply about 70% of the calcium needs of the Indian population. But lately, dairy farmers are having a hard time managing their cattle and keeping their farm's profitable venture. So, we are here talking about the ways to leverage smart dairy farming using IoT. Let's explore how livestock management becomes easier and more profitable with IoT technologies.

For the people who run such farms, their livelihood is more than just a business venture. 97% of dairy farms are family-owned farm businesses. That means it's a massive majority of family businesses passed on from generation to generation working together. Applying artificial intelligence to modern animal husbandry to identify the animals of different weights and stages, feed differently and improve the output rate of high quality feeding animals.

INTERNET OF THINGS (IOT)- The Internet of Things (IoT) has the potential to revolutionize various industries, including animal husbandry. IoT technology enables the connectivity of devices and the exchange of data over the internet, allowing for advanced monitoring, automation, and optimization of processes. In the context of animal husbandry, IoT can bring several benefits, such as: 1. Livestock Monitoring, 2. Environmental Monitoring, 3. Feeding and Nutrition Management.

HOW CAN IoT HELP DAIRY FARMERS?

So, how do these IoT smart livestock monitoring products help dairy farmers? These smart livestock management products have various sensors that record and transmit various vitals of the cattle to livestock management software.

- **Machine learning:-** Milking machine, Automated feed pushe, Manure removal robot
- **Electronic sensor:-** Animal tracking system, Rumination sensor, Activity sensor, Electronic ear tag, Neck collar sensor, Camera monitoring
- **Electronic Data Processing :-** Disease detection, Oestrus detection, Data transfer into herd management system, Concentrate feed allocation depending on milk yield

1. Automatic milking system:-

Automatic milk machines have cups with sensors that can be attached individually to cows' teats. The machines can also clean and sanitize teats. Machines can also identify colours, impurities and quality of milk. If the milk is not good for human consumption it is diverted to separate container.

2. Automatic feeder-

Automatic robot feeder is used to feed concentrate mixture and roughages as per need of farm animal.

3. ROBOTIC SCRAPPER-

A scrapper robot used to clean slatted floors. It pushes and scraps tirelessly, easily traversing long passage and ensure clean, slurry-free surfaces

4. Drones :-

Farmers kept manual vigilance, whenever the livestock moves out of the farm for grazing. Drones can keep track of the cattle and herd them back from fields to barns. Drones can also capture the pictures of pasture areas. Some companies such as TRITHI ROBOTICS, DRONITECH, have made initiative in building commercial drones in India. Lidar (light detection and ranging sesor)

5. Walking activity:-

Pedometer allows monitoring of both walking and milking activity in dairy farm. Used to observe daily movements, including milking, eating, standing and lying can detect changes in this measurement of activity. Pedometer predicts lameness earlier than the appearance of the clinical signs. By correlating pedometric activity with clinical cases of lameness.

6. Automated weighing system-

weighing is crucial in terms of quality control. Automation helps the whole weighing process as smooth and short as possible. Sensitive sensors can precisely detect weight in a split second and automatically register the results in the database.

7. Geographic information system:-

Surveillance and monitoring studies, identification and location of environmental risk factors for disease prediction, prevention and control. GIS integrates hardware, software and data for capturing , managing, analysing and displaying all forms of geographically referred information. GIS predict the possibility of transmission of infectious diseases between herds.

8. Feeding behaviour and Intake:-

Observation of feed intake and production by monitoring activity at the feeder. Found that healthy animals spent more time at the feeder than morbid animals, and a greater percentage of healthy animals visited to feeder immediately after feed delivery. Found that changes in short term feeding behaviour of dairy cows occurred with the onset of the health disorders like ketosis, acute locomotory problems, and chronic lameness.

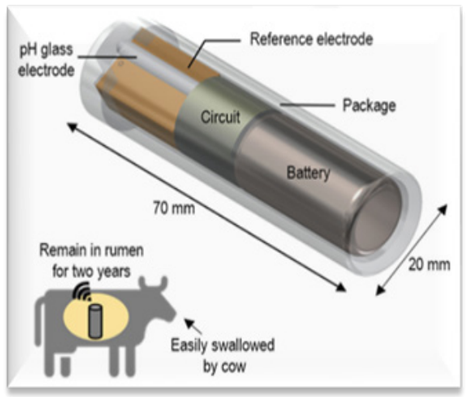
9. Motion activity instrumentation:-

Instrumentation like electronic collar, ear tag, pedometer that consists of sensors that shows variables related to the status of animal. Animal status is estimated by the history of recent time of position, activity, temperature, live weight and other physiological parameters of all individuals in the herd.

10. Animal behaviour sensor-
Sensors are necessary for a detailed record of behaviour of animals

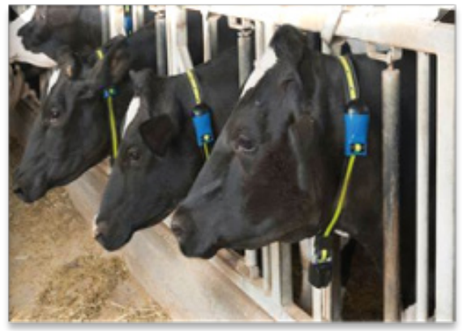
11. Sensor measuring-
Head angle and head acceleration. Leg acceleration and steps. Swallowing and jaw movements. Biting and chewing. Sounds, weight, heart rate, core temperature etc. E.g: PIR sensor (passive infrared sensor)

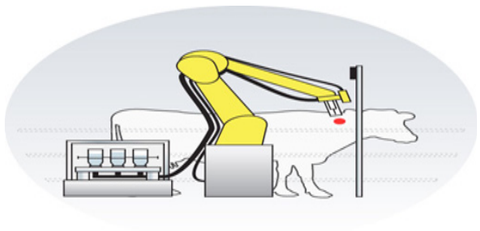
12. Rumen pH and Rumen temperature:-
Rumen sensors to measure temperature, pressure/motility and pH in rumen. Measurement of ruminal pH is a reliable and accurate diagnostic test for ruminal acidosis. Continuous monitoring of ruminal pH is possible through wireless telemetry which has the capacity to accurately detect subacute ruminal acidosis.



13. Body Temperature:-
Body temperature is the first and foremost sign to be detected during any disorders. The largest potential benefit of employing an automatic body temperature monitoring system in a dairy farm would be in early detection of disease, illnesses, or disorders.

14. Oestrus Detection system:-
The detection of cows in heat has become more and more difficult due to changes in animal behaviour and management. 3D accelerometers are used to detect estrus and calving.





15. Robotic system to deliver the vaccines-
For a sustainable economic future of dairy farms and to achieve 100% compliance rate, modern dairy farms use a robotic injection system to deliver the vaccines and reproductive medicines to domestic animals on the dairy farm. The robotic injection system reads the RFID tag.

16. Improving animal health using facial recognition systems-
Several useful applications, such as helping us learn more about the animals emotional and attentional state. e.g. By studying the ear and eye movements of an animal.

CURRENT STATUS OF USE OF ARTIFICIAL INTELLIGENCE IN DAIRY FARMING IN INDIA:

National Livestock Identification Scheme Developed by NDDB, Anand. Android tablet based field IT application. Capturing of real time reliable data on breeding, nutrition and health services delivered at farmer's doorstep. Send messages to farmers , providing appropriate advice regarding their animals. Workout report are available to the managerial team and other decision markers for analysis.

LIMITATIONS OF ARTIFICIAL INTELLIGENCE IN AH:

- Adoption rate depend on various factors like farmers age, level of formal education, farm size, types of production and overall expenses on information and use of technology. Small herd size and heavy investment in technology increase the cost of input
- Poor availability of AI tools and computer illiteracy of farmers contribute to non-adoption of technologies. Unavailability of local technical expertise for interpretation and decision making.
- Different skills will be required the farmers adapt AI technologies. Farmers have uncertainty regarding investment in technologies due to a lack of information.
- Lack of success stories, demonstrated effects, leading to reduction in the interest of the farmers to adopt the technology.