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Internet of things (IOT) for animal husbandry- an outlook in livestock and poultry

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Abstract
Internet of Things (IoT) is growing in all activity. Here we discuss the most basic, important and fundamental aspects of Internet of Things and its amenities. The IoT has promptly grown according to our lifestyle. Lot of energies have been put in to incorporate IoT in all endeavours of Life. All organizations and departments concerned and correlated with Animal Husbandry need to realize the potential of IoT for the speedy, accurate and reliable dissemination of information. The cognizance among livestock rearers about the information and accessibility of IoT is the very basic and is to be taken to increase livestock rearers' participation in IoT advantages. Awareness about the "Internet of Things" is needed for livestock rearers development.

Keywords: Internet of Things (IoT), Information needs, IoT Tools. Livestock rearers

Introduction

The importance of internet is being felt in all sphere of life. It has grown rapidly according to our life style. It has been the product of people, all the big data, recordings, books, e-commerce, research and scientific activities are carried out by the people for the people, around the people and about the people. The internet is the most important and transformative technologies ever invented. The internet is like a digital material that is merged into the lives of all of us into one way or another way. The concept of "Internet of Things" is not about people, it's about the inter communication of sensors within devices with each other and a concept of connecting any device with an on/off switch to the Internet and with each other. This includes everything from receivers, all types of machines and equipment, pet collar, coffee makers, sweeping machines, headphones, lamps, wearable devices and almost everything else that we can think of. This also applies to components of machines, for example a jet engine of an airplane or the drill of an oil rig. As mentioned, if it bears on/off switch then it can be put as a part of the IoT. The Research and analyst firm Gartner (world's leading research and advisory company) says that by the end of 2020 there will be more than 26 billion connected devices. The IoT is a massive network of connected "things" (which also includes people). The relationship between is as:- people-people, people-things, and things-things.

Mostly the number of changes that we see occurring in every sphere of life is the result of application of IoT and therefore Animal Husbandry and Livestock sector is not an exception. IoT in Livestock sector, development and extension are becoming an indispensible part of our society. The advances in IoT from last few years have created new opportunities and challenges for Livestock professionals like Veterinary doctors, Veterinary students, Veterinary technicians, Livestock farm managers, Livestock assistants and above all Livestock rearers(farmers).

Livestock occupies an important place in the economy of India. Livestock contributes 16% to the income of small farm house holds as against an average of 14% for rural. It provides livelihood to two-third of rural community besides an employment to about 8.8% of population of India (Anonymous 2018) [1].

IoT in Animal Husbandry

Livestock census actually covers the census of livestock, poultry and machinery used for livestock rearing. India has largest livestock numbers in the world. Sound and on time availability of Big Data are the basic requirement for any planning and policymaking purposes. With the help of IoT implementation; it has become very reliable and powerful resource of

processed information. The conduct of livestock census is thus essential for making plans and policies for growth of livestock sector and also for overall growth of the economy. Livestock Census in our country started in the year1919 and since then the process has been continuing on five year basis. Big data that gets generated as a result of census needs to be tabulated analysed and interpreted. Use of IoT not only eases the massive exercise but helps in its better tabulation, presentation, analysis and interpretation.

The IoT provides new pedagogical models for Livestock professionals. Simultaneously Potential of Animal Husbandry is gaining importance day by day and is greatly benefited through use of bioinformatics tools and statistical programs.

Animal Husbandry and Livestock extension system is playing an important role in disseminating technology to stakeholders. IoT strengthens our extension system manifold by use of various information technology (IT) tools in technology dissemination and empowering Professionals with the desired information. Their use with right perspective will provide information services to the users timely, efficiently and effectively. Shaik *et al.* (2004) [10], Griffin *et al.* (2008) [4], Raja and Ahmad (2013) [7] and Songtao Guo *et al.* (2015) [5], Ghavifekr and Rosdy WAW (2015) [3] Raja and Khan (2017) [8], Rajeev and Housure (2020) [9] have their works on applications of information and communication Technology in agriculture and Veterinary and Internet of Things respectively.

The present paper discusses various techniques of information simulation and dissemination needed for livestock rearers for the upliftment of livestock sector.

Information Needed
The focus of IoT in Animal husbandry and Livestock sector is to meet the modern advances in research and extension technologies. A Livestock centre or a Veterinary clinic or an Animal hospital is in most cases a small business offering a range of services to clients and livestock owners. Many people are involved in delivering the service and ensuring that you as the client get the best care for their Livestock, in the most efficient manner. The delivering of services and efficiency is taken care by use of IoT. Information on cost, quality of treatment, availability of medicines and inputs like case history, species, breed, are required by professionals at various levels of practice. Similarly for more remunerative production of farms (dairy, sheep, goat, poultry etc.) accurate, reliable, timely and precise information should reach to the investors at proper time as and when required. The information needed by the investors in Livestock field can be broadly categorized into following.

- Input Procurement
- Package of practices
- Disease forecasting and forewarning
- Preservation and Value addition
- Past trends
- Marketing Information and Policy Decisions

Input Procurement
Information relating to availability of various inputs and their cost is the first priority. Livestock rearers frequently require the information regarding various inputs such as quality germplasm, feed, medicine etc in terms of cost, quality, availability and possible sources. Entrepreneurs desirous of taking up livestock rearing require expert advice in drafting viable project proposals. Livestock business proposals

designed to specific conditions, specific areas and specific regions are required.

Package of Practices
The area specific package of practices for various livestock species is pre-requisite. Preparation of package of practices its continuous updating with changing times and its timely dissemination among livestock rearers is essential. The package of practices includes breeding, feeding, housing and management practices of livestock.

Disease forecasting and fore-warning
Diseases take a heavy toll of livestock enterprise on account of morbidity and mortality. Availability of timely disease forecast can help farmer to take measures well in advance and prevent losses which is very important for farmers.

Preservation and Value addition
Livestock products being of perishable nature their preservation is very essential. Reliable and modern methods that enhance shelf life of various livestock products are required by the livestock owners, besides methods of value addition and product development are also required.

Past trends
Information on past trends regarding production, consumption, utilization, environmental factors and climatic conditions are of immense use in decision making regarding rearing and management of livestock.

Marketing Information and Policy Decision
After the harvest, the most important demand is about its marketing, so that the farmer may not fall prey to middle man and hoarders. Information related to processing and grading, any government interventions like support price, identified central markets and agencies involved may help livestock rearers in making right decisions in selling their produce.

News about various events and decisions related to livestock and its products, labour laws, rural development programmes, government schemes etc are also important in decision making, such information must be available to the farmer to take right decision and get maximum returns.

Information Technology (IT) tools
A variety of IT tools are available for development and implementation of information technology and decision support systems. Recent development in Electronics and communication technology has made it possible to gather data, process, transmit and disseminate information in meaningful order with tick of a button. This helps to analyse and interpret the data using sophisticated computational tools and techniques such as artificial intelligence, machine learning, image processing, pattern recognition, probabilistic modelling, large scale simulation, data mining, text mining and graphic algorithms and decision support system.

The support of "Internet of Things" required for Livestock rearers is as under:-

- Database management system
- Information Retrieval system
- Decision Support System
- Expert Support System
- Trend Analysis and Forecasting
- Electronic Network and Messaging System
- Helpline.

Database System (DBS)
Database Management System or DBMS refers to the technology of storing and retrieving data with utmost efficiency along with security measures. Aim of building database is to convert traditional knowledge into electronic knowledge base. Huge and metadata is generated in livestock related to breeding, feeding, genetic disorders and disease, their characters, and control. Database technologies play an important role in storing data in electronic form and retrieve information in desirable way.
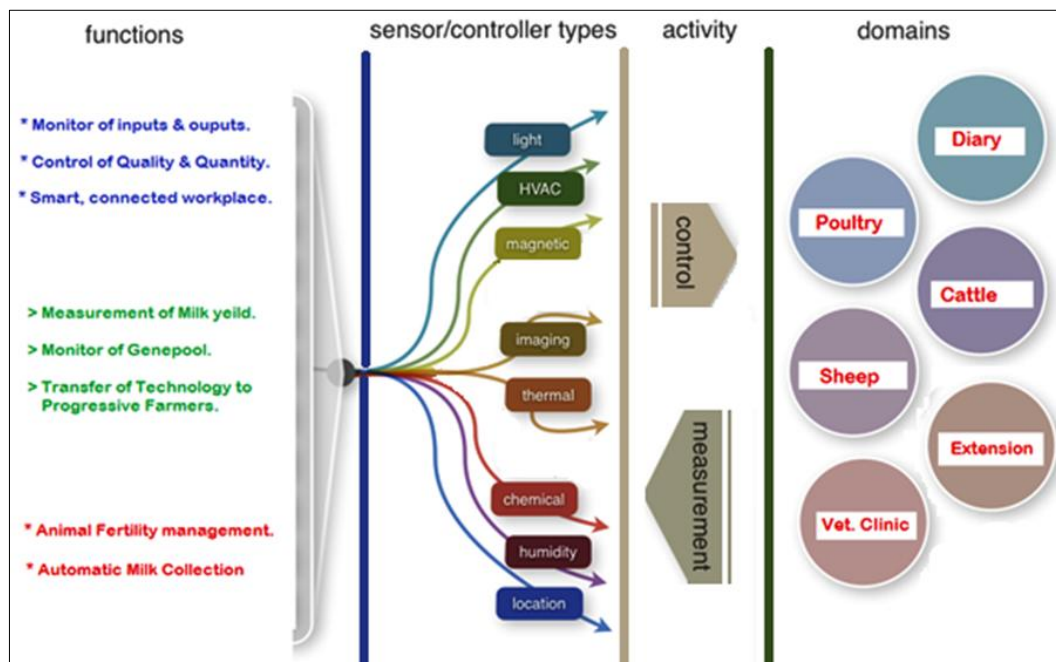

Fig 1: Internet of things in animal husbandry

Information Retrieval System
Store and retrieval of information in user friendly manner is ultimate objective of an information system. Such systems uses search engines, user friendly interface and other controls to mine the data from database and present the same in the form of reports, graphs, images, tables, etc. On the same line information retrieval system is developed to retrieve information as and when required.

Decision Support System
The Internet-based system is being used for decision support regarding establishment of surveillance and eradication zones. VetMet a decision support system developed by Danish Meteorological and Veterinary Research Institutes and authorities was the first to be implemented. It can describe both local spread of infectious airborne diseases between neighbouring farms and long-range dispersion, including disease spread to or from other countries.

Expert Support System
An Expert system is a computer programme with artificial intelligence, knowledge base and inference engine to solve problems that are difficult enough to require significant human expertise for their solution. A knowledge base is the repository of facts and rules about the specific problem. Such IT system can provide instant solution to problems faced by livestock rearers. Expert system can be developed to help and guide the veterinarian under various situations such as feed and fodder, health check-ups, disease control and vaccine scheduling. It can also suggest control measures on the basis of symptoms.

Trend Analysis and Forecasting
Forecasting and trend analysis are purely statistical techniques. Study of statistical trends regarding livestock, weather data, utilization, consumption patterns, disease attacks, fertility, etc. may be executed with IT tools. Trend analysis assists livestock rearers in decision making during entire process of livestock production and marketing. Graphical or pictorial trends may be generated using the database of specific parameters.

Analysis of trends enables the forecasting and prediction in livestock production system. For example, forecasting weather is a useful endeavour in deciding the various Livestock operations. IT has developed tools for such forecasting system.

Electronic Network and Messaging System
Internet has made the world a global village and empowers information transfer and exchange quickly. Readily online modules are available to livestock rearers for quick disposal of their problems. Websites can be developed to provide information to livestock rearers in their own regional languages. E-mails, Chatting and conferencing will help livestock rearers in seeking advice from experts and exchanging ideas with other livestock rearers to find solutions to problems. Nowadays mobile phones are widely being used and have facilitated in addressing the day to day issues of the livestock rearers.

Help Line
The Purpose of help line is to respond to issues raised by livestock rearers instantly in local language. Queries related to live stock and allied sectors are being addressed through these centres. Experts and Subject Matter Specialists (SMSs) using telephone and computer, interact with livestock rearers to understand the problem effectively and provide the solution directly. This is the vital existing extension mechanism and

enables close and quick linkages and communication mechanism among the subject matter specialists, extension activists, communication centres, consultancy agencies with rearers.

IOT Based Model for Poultry
A model for IOT based tools have been developed for advancement in poultry production both in terms of
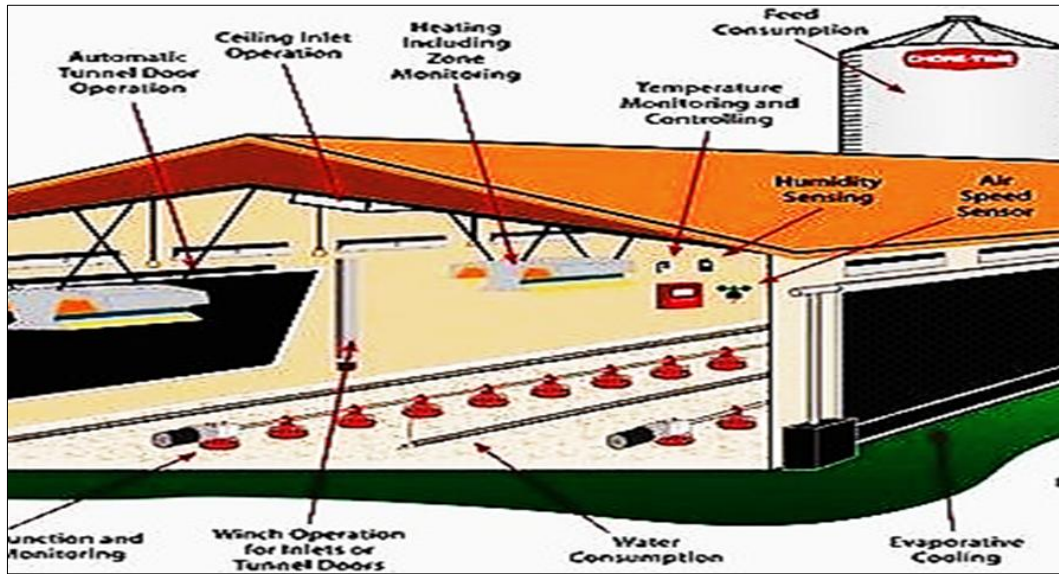• Egg production
• Poultry meat production

Fig 2: IOT Based Model for Poultry

Environment controlled fully automated poultry house are coming up where all the required environmental conditions like temperature, humidity, ammonia built up, litter conditions are monitored by the sensors and various operations like feeding, watering, medication, egg collection etc are all automated and controlled by an operator who may be physically away from the farm location.

To begin with sensor based monitoring of temperature, humidity, litter conditions and video based location of sick birds in a farm could be introduced to increase the efficiency of management. Some degree of automation in feeding and watering can also be introduced. Complete automation and sensor based environment controlled housing can come later.
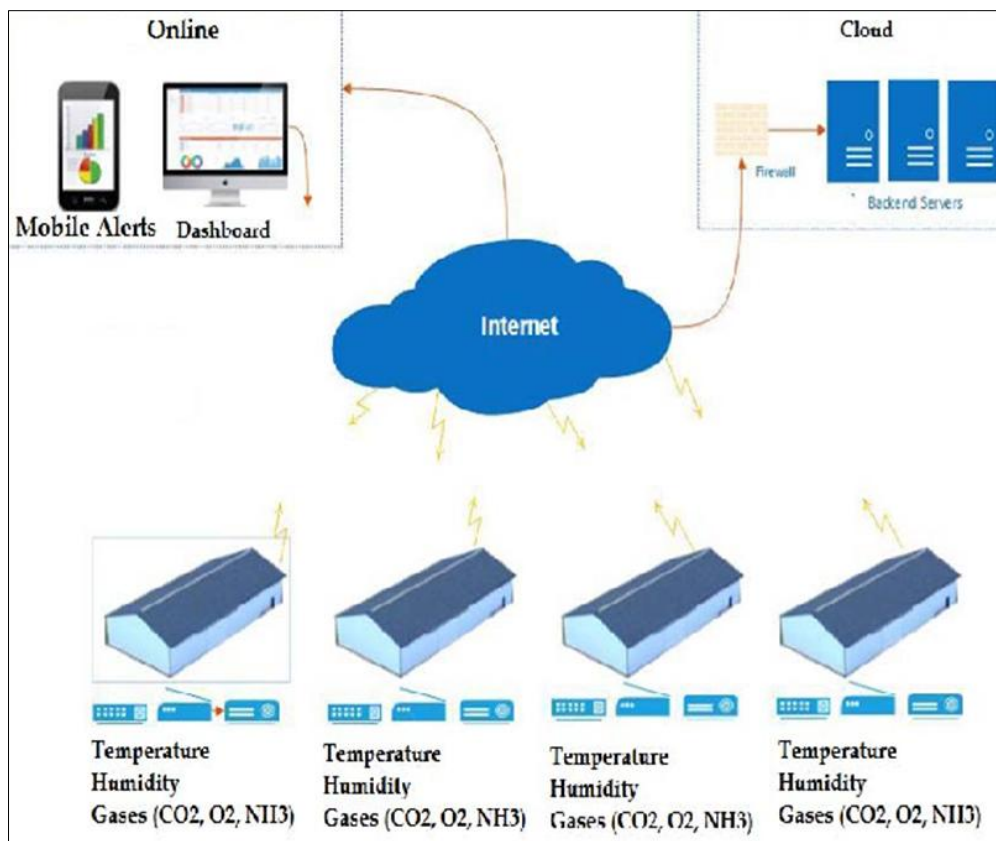

Fig 3: Controlling Many Poultry Farms

Conclusion
The Internet of Things (IoT) in livestock can offer solutions to improve the livestock production. Latest IT tools for information dissemination offer enormous potential in transfer technology. Systematic and synchronized approach is required to identify, organize make available information on time to the livestock rearers and in a user friendly manner. Use of IT techniques using regional languages in dissemination of livestock rearing technologies will certainly enhance the decision-making capabilities of livestock rearers. It will improve economic status of the livestock. For sustainable livestock production, it is must to understand the information needs of livestock rearers and develop such information systems that supports the functioning aspects of livestock rearers. An illustration of the IOT in Livestock and Poultry has been depicted. All organizations concerned with livestock and poultry need to realize the potential of IoT for over all development.

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