SSN COLLEGE OF ENGINEERING
KALAVAKKAM-603110

INTERNALLY FUNDED STUDENT PROJECT (IFSP-2023)

Forewarning of goat diseases diagnosis using IoMT to improve the productivity and economy of small and big farming

Biancaa.R
Second year, ECE

Rachel Tania A
Second year, ECE

Rupadharshini R
Second year, ECE

Dr. A Jawahar
ECE

Dr.C.Vinothkumar
ECE

Budget (in thousands)
Twenty Thousand

Project Duration (in months)
Twelve months

Signature of the Project Students   Signature of the Project Guide(s)

Signature of the HOD

1. Project Title: Forewarning of Goat diseases diagnosis to improve the productivity and economy of small and big farming

2. Broad Subject: The broad topic under which this project falls into is internet of things as, various wearable sensors, pi camera is going to be controlled and connected through a micro-processor raspberry pi, the data collected is also passed on to the cloud for later use or retrieval.

3. Project Duration *(in months)*: Eighteen months

4. Budget *(in thousands)*: Twenty thousand only

5. Project Summary:

Goats were one of the first domesticated animals. Easier and cheaper to manage than cattle, goats are far more profitable than other animals. They prove vital for development because of their ability to convert forages, crops, and household residues into meat, milk, fibre, and skin. The foot and mouth disease are a serious and highly contagious disease that affects goats. Therefore, it needs to be continuously monitored through sensors to analyse the clinical behaviour of the goats. Multiple systems are available in an animal healthcare information system that are used for clinical usage and formulating resolutions. So far, complete data is not available for the following cases: individual goats affected by a particular disease, groups of goats affected by geolocation-based diseases, and all aspects of a goat healthcare information system.

6. Keywords:

Disease pattern, continuous monitoring, goat healthcare data analytics, forewarning system, geolocation

7. Objectives:

- To improve the productivity and economy of small and big farming by forewarning the goat diseases and reducing the mortality rate.
- Achieving a GHC by implementing various facades of IoMT.

8. Introduction:

In India, disease control and management system help to identify the symptoms in sheep and goat, such as fever, redness and swelling of nose, respiratory failure, nasal discharge accompanied by sneezing and cough, muscular stiffness and difficulty in walking, which are caused by epizootic, only through physical evaluation. The total goat population in India is around 150 million and out of which 75% is located in 6 states. In this 40% are non-descript animals and the rest comprise pure/graded, cross bred or exotic animals in Tamil

Nadu. High mortality rate in lambs (up to 40%) is a worldwide problem. The clinical disease and the spread of the outbreak in the locality identified through GIS and web-based monitoring. This provides opportunities for future disease control to enhance animal welfare and rural prosperity. To improve the productivity and economy of small and big farming by forewarning the goat diseases and reducing the mortality rate, a GHC-Goat Health Care facility incorporating IoMT is formulated. The proposed system plays the role of information agent to manage the diseases and helps provide care at any time.

9. Definition of the Problems

- The major diseases such as Blue Tongue, Peste-des-Perits Ruminants (PPR), ORF, and Anthrax cause mortality in goats.
- The diseases are the major cause of mortality in goats with young ones and adult goats being almost equally affected. Adult females suffered a higher mortality than males due to diseases.
- The mortality patterns were found similar in both the genders in the given time. Gender had significant association with different age groups and diseases in terms of mortality pattern. Diagnosis of above diseases is made through appropriate laboratory investigations.

10. Review of status of Research and Development in the subject:

10.1 National Status

[REF] / YEAR	PROBLEM	METHODOLOGY / COUNTRY
[1] / 2012	Web-based software to predict livestock diseases	Project Directorate on Animal Disease Monitoring and Surveillance (PDADMAS) under ICAR has developed a Web-based interactive software to predict livestock diseases two months in advance in the country / India
[2] / 2019	Spread and impact of goat pox	A detailed description of the clinical disease and the spread of the outbreak in the locality are provided. Awareness of the disease with reference to farming practices will provide opportunities for future disease control to enhance animal welfare and rural prosperity / India
[3] / 2016	Different endemic infectious diseases	Prevalence, diagnosis, management and control of important diseases of ruminants with special

	causes significant economic loss	reference to Indian Scenario / India

10.2 International status

[REF] / YEAR	PROBLEM	METHODOLOGY / COUNTRY
[1] / 2020	The welfare of animals be continuously monitored in a real-time way	Collecting on-farm videos / School of Information and Computer Sciences, Anhui Agricultural University, Hefei, China
[2] / 2016	Recent advances in wearable sensors	Nano biosensors and advanced molecular biology diagnostic techniques for the detection of various infectious diseases of cattle / Bio-Nano Laboratory, School of Engineering, University of Guelph, Guelph, Canada
[3] / 2011	Analytic function of disease rate and guide goat immunization	Goat medical records subsystem / Coll. of Animal Husbandry & Veterinary Med. Shenyang Agric. Univ. Shenyang, China
[4] / 2009	Human-animal interaction	Health status of animals in terms of body condition scoring, skin and hair conditions, lameness and injuries, and management practices in relation to cleanliness, animal handling and moving, milking procedures and abnormal behaviours, are proposed as potential animal-based indicators / Italy

11. Novelty Importance of the proposed project in the context of current status:

- The novelty of the study is the collection of real time data continuously and updating it in the cloud periodically.
- Generally, for cattle monitoring the usage of computer vision is widespread but here the other sensors are also used for data collection, which would boost the accuracy and can predict illness in an earlier time.

12. Patent details *(domestic and international),* if applicable
None
13. Work plan and Detailed technical information:

13.1 Methodology

The proposed methodology to forewarning goat disease is shown in Figure 1.

- Goat Health Care (GHC) consists of Embedded System, Wireless Technology and Machine Learning to form the IoMT-GHC.
- IoMT-GHC integrates data from sensors such as MEMS acoustic, MEMS vibration and Temperature, fixed in the nose, neck, foot and ear of goat and analyses the collected data to provide forewarning.
- In-stream analysis of data from the IoMT-GHC builds for interoperability and accelerates time for forewarning.
- The proposed IoMT-GHC system plays the role of information agent to manage the diseases and helps provide care at any time.
- A machine learning model can be made from the general response of the goats in the various sensors used, in case any variation is seen from the model, the model predicts the existence of some form of ailment in the goat.
- The variation in parameters, change in the goat's health is informed to the farm owner, nearby veterinary doctor.

The Data analytic process in identifying the disease based on geolocation is shown in Figure 2.
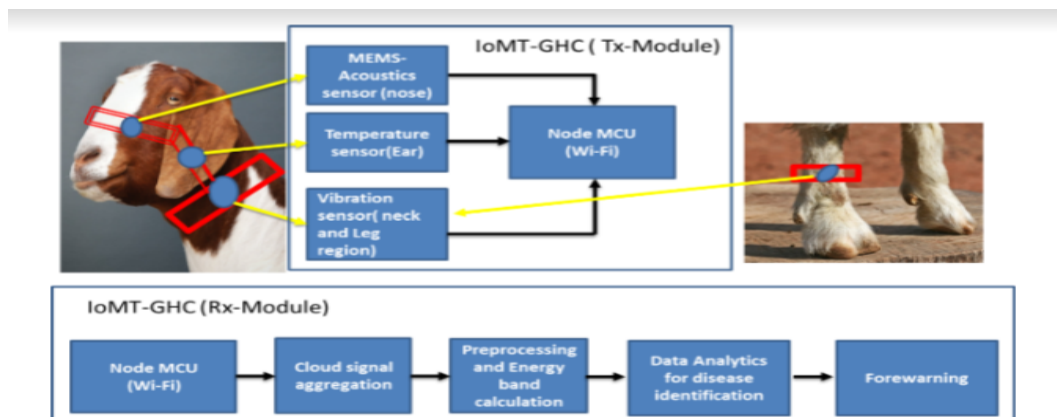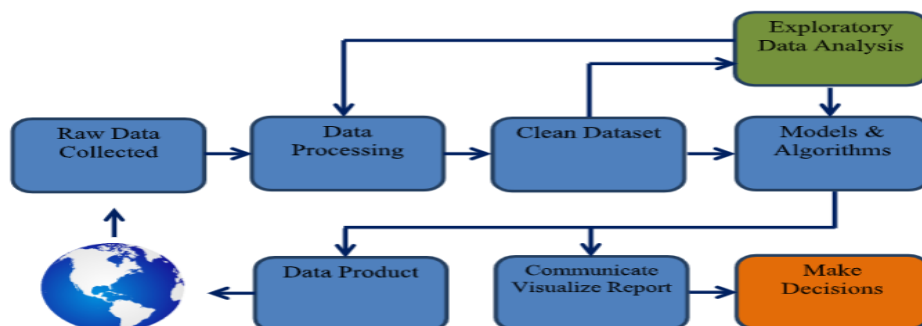

Fig 1. Proposed IoMT-GHC block diagram

Fig 2. IoMT-GHC Data analytic process for disease identification based on geolocation.

14. Time schedule of activities giving milestones:

14.1 Time Schedule of Activities through BAR Diagram:

Time schedule of activities giving milestones:

Sl. No.	Activity / Milestone	1st part (in months)		2nd Part (in months)		3rd part (in months)	
		1-2	3-4	5-6	7-8	9-12	12-18
1	Data Collection	▩	▩	▩			
2	Process development	▩	▩	▩	▩	▩	
3	Evaluation and Validation			▩	▩	▩	▩
4	Product development			▩	▩	▩	▩
5	Documentation		▩	▩	▩	▩	▩

15. Deliverables:

- Design review
- Product quality enhancement
- Strategic report
- Progress report
- Improved process efficiency
- Faster response time
- Useability report
- Product prototype
- New knowledge or experience by attending conferences.
- Improved response procedure by looking into new journals.
- Based on end-user feedback, the final product will be developed. Preparing publication, final report and applying for patent

16. Target beneficiaries of the proposed work

The target beneficiaries of the proposed word are farmers, people engaged in animal husbandry rearing goats which could be possibly infected by diseases. It decreases the losses and setbacks in the farm, the humans who are directly in contact with the goat who have a chance of contacting the disease. Other goats in the farm which are in the risk of contracting the disease from the infected goat

17. Suggested plan of action for utilization of research outcome expected from the project

       17.1 As journal publication- Can be utilised for paper presentation in symposiums and conferences and publishing papers on the same.

       17.2 Patent filing

       17.3 Project preparation for submission to external funding - The project can be proposed on external conferences that provide funding.

18. References

[1]   Rao Y, Jiang M, Wang W, Zhang W, Wang R. On-farm welfare monitoring system for goats based on Internet of Things and machine learning. *International Journal of Distributed Sensor Networks*. July 2020.

[2]   Suresh Neethirajan, Recent advances in wearable sensors for animal health management Citation Data Sensing and Bio-Sensing Research, ISSN: 2214-1804, Vol. 12, pp. 15-29, 2017.

[3]   L. Li, J. Dong, X. Song, L. Nie, S. Zhang and M. Liu, "Research on Goat Health Management System," 2011 3rd International Workshop on Intelligent Systems and Applications, Wuhan, 2011, pp. 1-4, doi: 10.1109/ISA.2011.5873323 Add to Citavi project by DOI.

[4]   Mariangela Caroprese, Donato Casamassima, Salvatore Pier Giacomo Rassu, Fabio Napolitano & Agostino Sevi (2009) Monitoring the on-farm welfare of sheep and goats, Italian Journal of Animal Science, 8:sup1, 343-354, DOI: 10.4081/ijas.2009.s1.343

[5]   https://www.thehindubusinessline.com/economy/agri-business/   Now-Web-based-software-to-predict-livestock-diseases/ article20380729.ece

[6]   Hopker, A., Pandey, N., Saikia, D. et al. Spread and impact of goat pox ("sagolay bohonta") in a village smallholder community around Kaziranga National Park, Assam, India. Trop Anim Health Prod 51, 819–829 (2019). https://doi.org/10.1007/s11250-018-1759-4

[7]   Gopal, S., Allwin, B., Senthil, N.R., Vedamanickam, S., Kumar V.N., 2015. A Retrospective Study of Ailments in Goats at Thiruvallur District, Tamil Nadu State. International J. Livestock Res. 5, 26-34.

[8]   Gupta, R.P., Yadav, C.L., Choudhri, S.S., 1987. Epidemiology of gastrointestinal nematodes of sheep and goats in Haryana, India. Vet. Parasitol. 24, 117–27.

[9]   Iqbal, A., Khan, B.B., Tariq, M. and Mirza, M.A. 2008. Goat- A potential dairy animal: Present and Future Prospects. Pakistan J. Agri. Sci. 45, 227-230.

[10] Krishna, L., Paliwal, O.P., Kulshreshtha, S.B., 1979. Incidence of perinatal mortality in lambs and kids. Indian Vet. Med. J. 3, 19.

[11] Kumar, S., Vihan, V.S., Deoghare, P.R., 2003.Economic implication of diseases in goats in India with reference to implementation of a health plan calendar. S. Rumin. Res. 47, 159-164.

[12] Kusiluka, L., Kambarage, D., 1996. Diseases of Small Ruminants in sub-Saharan Africa. VETAID. Centre for Tropical Veterinary Medicine, Easter Bush Roslin, Midlothian EH25, Scotland, 1996.

20. Budget Estimates:

PARAMETERS	QUANTITY	COST (in rupees)
Rasperrypi(4b)	1	8799
NodeMCU(32 bit)1	1	794
Sensors (humidity sensor, vibration sensor, temperature sensor, acoustics sensor, heart rate sensor)	1(each)	499+38+153+176+219
Pi Camera	1	361
Miscellaneous		8961
TOTAL		20,000

21. Budget Justification:

PARAMETERS	NECESSITY
Rasperrypi	To control Pi camera and take relevant input image signals.
NodeMCU	IOT component to connect the different sensors to the cloud and use data for future use.
Sensors 1. Humidity sensors 2. Vibration sensors 3. Temperature sensors 4. Acoustics sensor 5. Heart rate sensor.	Humidity sensors: The sensor can monitor the respiration pattern and used for physiological and physical monitoring. Vibration sensors: Used for vibration-related health monitoring and voice sensing by evaluating the vibration acceleration of the skin surface. Temperature sensors: Used for monitoring the course of certain diseases by measuring body temperature. Acoustics sensor: Used for monitoring physiological and pathological conditions e.g. heart and respiratory sounds. Heart rate sensor: Used for detecting the pulse rate and monitoring stress and activity levels during the day accurately.
Pi Camera	The Pi Camera module can be used to take pictures and high definition video. Raspberry Pi Board has CSI (Camera Serial

	Interface) interface to which we can attach the PiCamera module directly.