Smart Health Monitoring System for Animals

Anushka Patil, Chetana Pawar
Department of Computer Engineering
Sandip Institute of Technology and Research Center
anushkapatil220@gmail.com
pawarchetana94@gmail.com

Neha Patil, Rohini Tambe
Department of Computer Engineering
Sandip Institute of Technology and Research Centre
nehaspatil1994@gmail.com
rohinitambe66@gmail.com

Abstract: **Clinical techniques for monitoring livestock health are insufficient, as they provide only sporadic information and required too much resource investment in terms of time and veterinary expertise. The animal health monitoring system that is allocating hardware which will mount on the animal body, at present there are no such systems which will provide on current status of the animal. At present to detect the health status of animal we required to wait for veterinary expertise which take long time for its arrival. The system will not only improve individual animal health, but it also identifies and prevents widespread diseases, whether it originated from natural causes or from biological attacks. Such a system would help in early diagnosis of diseases. The system consists of four different sensors i.e. Temperature sensor, Heart rate sensor, Rumination sensor and Rumination sensor .For the implementation of sensor module we used Zigbee device and Ardiuno Microcontroller. The Graphical user interface (GUI) is used to display the values on the PC. The device is very important as well as helpful for the health care of animals.**

Keywords: Zigbee, sensors, wireless transmission, physiological parameters, temperature humidity index.

I.INTRODUCTION

Any country in particular faces certain challenges regarding the health care of its citizens. Public perception animal welfare and milk quality cause for continued use of grasslands for grazing in daily farming. From our research paper proposed a Zigbee[1] based animal health monitoring system and they are focused on health issues of animals. Every one knows that animals don't speak and they don't share their problems, so this paper presented a prototype of an animal health monitoring system. The prototype system consists of the various sensor modules such as temperature sensor module, rumination sensor module, heart rate sensor module and humidity sensor module. These various parameters measured have been used for different types of animal health judgement. So this prototype system is tested for the real time monitoring of parameters. To meet the people concern some milk Producers offer incentives to dairy farmers if they let their daily cows grazing, but for many farmers this is impossible due to livestock management and control problems.

Management and control relies on monitoring of the berd, which is significantly complicated by inherent distribution of animals as well as outdoor location. Polar sport tester (PST)[2] for cattle heart rate measurements. In India every village farmer faced the cattle health problem around the world because of the rise in air temperature. Such as the heart rate is the major problem of cattle health monitoring system. Successful grazing in developed agriculture caused for automated and efficient monitoring and control of the animal.

Zigbee based wireless sensor network [3] localization for cattle monitoring in grazing fields. No hardware was required for the estimation as Zigbee consists of link quality indication. They focused on localization performance at low cost and low power consumption for cattle monitoring. The LQI-based algorithm had been used for cattle health monitoring application. The design was taken into aspect considering various features such as cost, weight and energy consumption. The ratio metric vector iteration algorithm is also implemented. The monitoring should allow establishing a better understanding of animal behavior, detection individuals with potential health problems and general optimized the grazing process, all things that potentially would have significant impact on practical farming.

A body must be kept at a constant temperature, within a small range, in order for all of the system to work properly. This is the normal body temperature. The description of TEDS[6], a key feature of the standard and a complier for its preparation were presented. The use of this basic protocol in national scale sensor networks on the internet was described. A change in the temperature of the body is the sign of ill health. The body can only work properly at a certain temperature. The normal body temperature is differentiation different types of animals. Environmental factors such as humidity must be carefully monitored because they affect metabolism and behavior. Improper temperature and humidity levels may adversely affect research results. Relative humidity should be maintained at 30% to 70% humidity has a large impact on animal health. It affects the ability of both plants and animal to cool themselves through evaporation. It is also important to precipitation formation.

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The purpose of the "The art equipment for measuring the horses heart rate"[10], is that heart rate is reliable indicator of the impact that stress and agitation have upon an animal. Non invasive method must be used to monitor heart rate. They have advantage over the methods that have a negative influence on the condition of an animal. For the research adjusted devices also used by the top sportsman during training were used to measure heart rate at rest and during feeding.

The study of "Validation of rumination measurement equipment and role of rumination in dairy cow time budgets"[12] aimed to validate the technical functionality of the product RuminAct. They specially focused on this RuminAct. The validation was performed with direct observations that were compared to the automatically recorded ruminations durations.

II.REVIEW OF LITERATURE

According to research [1], the animal health monitoring system (AHMS) has been developed. The animal health monitoring system gives the idea or platform to detect various parameters regarding animal health. It becomes easy to detect various diseases such as temperature, rumination, heart rate and humidity as well as surrounding temperature. To meet the people concern some milk producers offers incentives to dairy farmers if they let their daily cows grazing, but for many farmers this is impossible due to livestock management and control problems.

M. Janzekovic, P. Vindis [2] have focused on the polar sport tester for cattle health rate measurement. According to (Hopster, Janzekovic, Aerts) the change of heart rate can be relevant parameter, when studying the response of animals to stress. This is in correlation with findings in human beings. Successful grazing in developed agriculture caused for automated and efficient monitoring and control of the animal. In India every village farmer faced the cattle health problem around the world because of the rise in air temperature. such as the heart rate is the major problem of cattle health monitoring system.

ZigBee is a wireless language that everyday devices use to connect to one another. It is upgraded version of Bluetooth.

ZigBee covers a large area of network for low power wireless LANs. ZigBee is based on Institute of Electrical and Electronics Engineers standards associations 802.15 standard. It operates on the IEEE 802.15.4 specification. According to research [3], they proposed a Zigbee based wireless sensor network localization for cattle monitoring in grazing fields. No hardware was required for the estimation as Zigbee consists of link quality indication. They focused on localization performance at low cost and low power consumption for cattle monitoring. The LQI-based algorithm had been used for cattle health monitoring application. The design was taken into aspect considering various features such as cost, weight and energy consumption. The ratio metric vector iteration algorithm is also implemented. The monitoring should allow to established a better understanding of animal behavior, detect individuals with potential health problems and general optimized the grazing process, all things that potentially would have significant impact on practical farming.

The basic problems faced by animals are heart rate, humidity rumination and temperature. Heart rate is reliable indicator of the impact that stress and agitation have upon an animal. R.N. Handcock [4] proposed a monitoring animal behavior and environmental interactions using wireless sensor networks, GPS Collars and satellite remote sensing. The animal landscape interactions are realized by the combination of ground based sensors and sense satellite images. Non-intensive methods must be used to monitor heart rate. They have advantage over the methods that have a negation influence on the condition of an animal.

According to research [5], they proposed an environmental air pollution monitoring system based on the IEEE 1451 standard for low cost. The environmental air pollution monitoring system has been successfully implemented in compliance with the main functional blocks: STIM, TII & NCAP to provide an industry standard interface efficiently connect the microcontroller to networks was achieve .When breeding the sport horses, which undergo stressful training every day, it is required, from an ethical aspect, to monitor their capabilities by using most advanced electronic devices.

In research [6] smart sensors and actuators with digital outputs are improving in performance and decreasing in cost as the component of smart sensors including signal conditioners, microcontrollers and communication electronics have improved. The data must be available over a wide area, but the complication is that many sensor manufacturers are able at best to deploy just one network protocol and there is no general agreement on which protocol to use. So D. Wobschall proposed the unspread adoption of the universal IEEE 1451 standard.

According to research [7], the utilization of framework for computer based pressure measurement systems developing environment is a real world project while stressing smart pressure sensor and internet connectivity. Smart transducers can be connected directly to an internet by Ethernet LANs. This paper presented a world wide application that brings a reusable design pattern for sensor based networked applications. The kernel of the paper focuses on utilization of discussed integrated framework for computer based measurement analyzer .So, it is very much important to tack care of animals and improve the animal health in order to have good farming. If there occurs an animal health problem in particular remote area, it is impossible for veterinary doctors to be on time.

Anuj Kumar and G. P. Hancke [8] proposed energy efficient environment monitoring system based on the IEEE 802.15.4 standard for low cost requirement. It can tack a lot of time for the doctor to arrive at the particular place. So, in order to avoid such a problem we will implement a smart animal health

monitoring system. The usage of these sensors adds several advantages to a system such as low power consumption, low cost, fast response, ability to produce online measurement etc.

B. C. Baker [9] proposed AN685 thermistor in single supply temperature sensing circuit. Before veterinary doctor arrives it will be easy to track or detect particular diseases. Variation in climate leads to various diseases. Animals may suffer from various diseases due to change in climate .As thermometer is used to detect the temperature of human beings it is not possible to detect temperature of animals. This system will provide facilities to detect the temperature of animal too.

According to research [10], they proposed the art equipment for measuring he horse heart rate. Heart rate measurement involves measurement of physiological stress parameter .Poplar sport tester facilitate the receipt of heart rate signal that obtained with ECG measurement. It will be easy for the doctor to prevent the diseases from spreading to other animals. This smart health monitoring system will help animals to get cured faster.

Lindetrom and I.I.Redbo [11] proposed effect of feeding duration and rumen feel behavior on dairy cow. We will used temperature sensor for the detection of temperature. Limit fed heifers provided their daily allotment of food 1 X spent more time feeding throughout the day more unrewarded time at the feed bunk and spent less time standing without eating.

According to research [12], they proposed validation of a heart rate monitor for measuring a stress response in dairy cows. They focused on the RuminAct system for the estimation of their project. RuminAct became a valuable tool for both farmers and researchers in future since it surveys rumination duration with good accuracy and is comparatively easy to manage.

In the research [13], they have presented some usage models for health monitoring and discussed the technical requirements for health monitoring and also discussed the technical requirements for health monitoring system based on wearable and ambient sensors. It gives the idea of system level issues to be considered for real applications.

III.PROPOSED SYSTEM

To overcome the drawbacks of animal health we are proposed in a smart animal health monitoring system for the sake of good animal health. We are implementing this system with the help of four sensor module i.e. temperature, humidity, heart rate and rumination. The proposed system will avoid animals suffering from many diseases. We proposed this smart system to track the good health of animals. The main aim is to develop a system which is capable to measure the body temperature, rumination and heart rate parameters with environmental conditions.

Animals faces various problems, diseases such as bovine spongiform encephalopathy, mouth diseases, temperature etc. In order to avoid such a problem good animal health to have we are proposing a smart animal health monitoring system. His animal system is based on four types of sensors 1.Temperature sensor 2.Humidity sensor 3.Heart rate sensor 4. Rumination sensor.

Figure 1 shows the block diagram or AHM system. The AHM system which is developed would make it easy for detecting the animal physiological parameters such as humidity, temperature, rumination & heart rate. The AHM system consists of four sensor modules i.e temperature, humidity, heart rate & rumination, Zigbee module, microcontroller and PC (GUI).

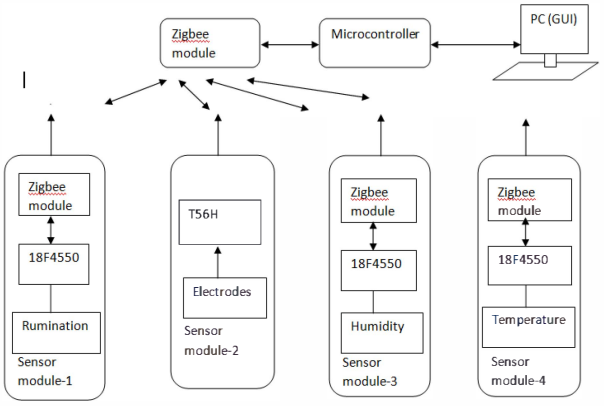

Figure 1: Architecture of animal health monitoring system.

Figure shows the block diagram or AHM system. The AHM system which is developed would make it easy for detecting the animal physiological parameters such as humidity, temperature, rumination& heart rate. The AHM system consists of four sensor modules i.e temperature, humidity, heart rate &rumination, zigbee module, microcontroller and PC (GUI).

Working of AHMS

The sensors are connected as shown in fig. The output signals of the modules which are developed are sent to the host computer through ZigBee module. The GUI (PC) is used to display the actual values of body temperature, surrounding humidity, surrounding temperature, rumination, heart rate etc. As the AHM is an autonomous system, it will be easy to add new extra sensor modules if needed.

1) Temperature Sensor Module:

We have used the thermistor for detecting the temperature. Thermistor is a high sensitive register. A body must be kept at a constant temperature, within a small range, in order for all of the systems to work properly. This is the normal body

temperature. a change in the temperature of the body is the sign of ill health. The body can only work properly at a certain temperature. The normal body temperature is different in different types of animals.

2) Humidity sensor module:

Environmental factor such as humidity must be carefully monitor because they affect metabolism and behavior. The parameters are affected the performance and animal of health both directly and indirectly. The environmental factor consist of temperature, air movement, humidity, radiation heat. Improper temperature and humidity levels they adversely affect research results. Relative humidity should be maintained at 30% to 70% . Humidity has a large impact on animal health. It affect the animal health both animals and plants to cool themselves through evaporation perception formation.

3) Heart rate sensor module:

Heart rate is a reliable indicator of impact that stress and agitation have upon an animal. Basically the heart rate measurement is an indirect method. Indirect contact also known as invasive. Non invasive methods must be used to monitor heart rate. They have advantage over the methods that have a negative influence on the condition of an animal's when breeding sport horses which undergoes tracefull training every day, it is required, from an ethical aspects, to monitor their capabilities by using most advanced electronic devices.

4) Rumination sensor module:

Rumination is the digestive process of ruminals. Rumination syndrome a chronic condition characterized by effortless regurgitation of most meals following consumption. Rumination contemplation or reflection, which may become persistent and recurrent worrying or brooding, Rumination is a compulsively focused attention on the symptoms of one's distress, on its possible cause and consequences as oppose to its solution. Rumination is an important constituent of digestive function in ruminant animals and one of the main functions in physical breakdown of coarse material to facilitate its passage from rumen.

IV. MATHEMATICAL MODEL

Let S be the set of three tuples.

S= {I,O,F}

Let I be the set of input function

I= {S1,S2,S3,S4}

Where,

S1=temperature sensor

S2= heart rate sensor

S3= humidity sensor

S4=rumination sensor

Now F is the set of functions.

F={Compare, Display}

Where,

Compare= Initial readings with new taken readings.

Display= Display the new readings.

Now O is the set of output functions.

O={O1,O2,O3,…..}

Where

O1=display temperature reading.

O2=display heart rate readings.

O3=display humidity readings.

O4=display rumination readings.

V. IMPLICATIONS

It will help the animals for their well health. This project will be used in rural areas. It will also be helped in veterinary hospitals. It will be used in factories and industries.

CONCLUSION

In order to overcome various health issues and problem related to animal, we have proposed a smart animal health monitoring system. This system consists of various sensor modules which will help to improve the animal health and their various problems. The system will be useful for testing real time monitoring of body temperature, rumination and heart rate as well as surrounding temperature. This system also uses Zigbee for the implementation of animals health.

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REFERENCES

1. Anuj Kumar and Gerhard P. Hancke, Senior Member, IEEE,"A zigbee-based Animal Health Monitoring system"IEEE Sensors Journal,vol. 15,NO.1,JANUARY 2015.

2. M. Janzekovic, P. Vindis, D. Stajnko, and M. Brus, "Polar sport tester for cattle heart rate measurements," in *Advanced Knowledge Application in Practice*, I. Fuerstner, Ed. Croatia: Sciyo, Nov. 2010, ch. 9, pp. 157-172.
3. J. I. Huircá*net al.*, "ZigBee-based wireless sensor Network localization for cattle monitoring in grazing fields," *Compute. Electron. Agricult.*,vol. 74, no. 2, pp. 258–264, 2010.
4. R. N. Handcock *et al.*, "Monitoring animal behaviour and Environmental interactions using wireless sensor Networks, GPS collars and satellite remote sensing," *Sensors*, vol. 9,no. 5, pp. 3586–3603, 2009.
5. N. Kularatna and B. H. Sudantha, "An environmental air Pollution monitoring system based on the IEEE 1451 standard for low cost requirements," *IEEE Sensors J.*, vol. 8, no. 4, pp. 415–422, Apr. 2008.
6. D. Wobschall, "Networked sensor monitoring using the universal IEEE1451 standard," *IEEE Instrum. Meas. Mag.*,vol. 11, no. 2, pp. 18–22,Apr. 2000
7. M. Sveda and R. Vrba, "Integrated smart sensor Networking framework for sensor-based appliances," *IEEE Sensors J.*, vol. 3, no. 5,pp. 579–586, Oct. 2003.
8. A. Kumar and G. P. Hancke, "Energy efficient environment monitoring system based on the IEEE 802.15.4 standard for low cost requirements," *IEEE Sensors J.*, vol. 14, no. 8, pp. 2557–2566,Aug. 2014.
9. B. C. Baker, "AN685-thermistor in single supply Temperature sensing circuits," Microchip Technol. Inc., Chandler, AZ, USA Tech. Rep. DS00685B, 1999.
10. M. Janzekovic, J. Prisenk, B. Mursec, P. Vindis, D. Stajnko, andF. Cus, "The art equipment for measuring the horse's heart rate,"*J. Achievements Mater. Manuf. Eng.*, vol. 41, nos. 1–2, pp. 180–186,Jul./Aug. 2010.
11. T. Lindström and I. I. Redbo, "Effect of feeding duration an drumen fill on behaviour in dairy cows," *Appl.Animal Behaviour Sci.*, vol. 70,no. 2, pp. 83–97, 2000.
12. E. Lindgren, "Validation of rumination measurement Equipment and the role of rumination in dairy cow Time budgets," Ph.D. dissertation,Dept. Animal Nutrition Manage., Swedish Univ. Agricult. Sci., Uppsala Sweden, 2009.
13. I. Korhonen, J. Pärkkä, and M. van Gils, "Health monitoring in the home of the future," *IEEE Eng. Med.Biol. Mag.*, vol. 22, no. 3, pp. 66–73,May/Jun. 2003.
14. S.J.Jung and W.Y.Chung,"Non-intrusive health Car system in global machine to machine networks", IEEE sensors, J.Vol.13, no 12.pp.4824-4830,Dec 2013.
15. B. Cao, Y. Ge, C. W. Kim, G. Feng, H. P. Tan, and Y. Li, "An experimental study for inter-user interference mitigation in wireless body sensor networks," *IEEE Sensors J.*, vol. 13, no. 10, pp. 3585–3595,Oct. 2013.