A Wi-Fi Based Animal Health Monitoring System

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Abstract— **An animal health monitoring system for monitoring the physiological parameters, such as rumination, body temperature, and heart rate with surrounding temperature has been developed. The developed system can also analyze the stress level corresponding to thermal Temperature sensor. The IEEE802.15.4 and IEEE1451.2 standards-based sensor module has been developed successfully. The Wi-Fi device and RL78 RENESAS microcontroller are used in the implementation of sensor module. The real-time monitoring of physiological and behavioral parameters can be present on the android free app. The device is very helpful for inexpensive health care of livestock. A prototype model is developed and tested with high accuracy results.**

Keywords— Wi-Fi, sensors, wireless transmission, physiological parameters, temperature humidity index.

I. INTRODUCTION

Now a days, livestock farmers face cattle health problems around the world because of continuous rise in air temperature in the troposphere. The variations in temperature on animals health has harmful effect leading to diseases such as foot and mouth disease, swine fever, bovine spongiform encephalopathy (mad cow disease), bovine rhinotracheitis, squalors cell carcinoma, warts, web tear, necrotic pod dermatitis, polioence, phalomalacia, hypomagnesaemia, clostridia disease and hypoglycemia. WHO report stated that severe acute respiratory syndrome corona virus (SARS-CoV) is said to be an animal virus that spread easily to other animals and have also affected human being directly. The evidence of humans getting infected through SARS has also being reported by various countries across the globe. This in turn has resulted in the economic loss of countries being affected.

For these reasons a system is needed to be in place for continuously monitoring the animal health and to control and prevent the eruption of diseases at large scale.

In this paper they have interpreted the emotional state underlying canine behavior is essential in human-canine interactions, to achieve effective training, and to improvetemperature, rumination, heart rate, stress level, and TH index (THI) can be displayed on the GUI PC. But, the transmission for the heart rate rate data is only upto 5 meter.

Transmission for heart rate data is only up to 5 meter. The heart rate sensor module's transmission range requires modification [3]. Dairy cows require careful monitoring for milking, weighing, and other activities, so the ability to reliably track these animals in large numbers is particularly important. Dairy cows are typically identified by visible ear tags. Although tags with embedded RFID devices have been available allowing them to be scanned electronically because of cost, most tags use low-frequency (LF) RFID, so the scanner must be within a few inches of the tag. The researcher designed and built a prototype wireless network that combines long-range ultra-high frequency (UHF) RFID tags with low-cost wireless and computing components. The long-range RFID allows unmanned scans of multiple tags, and the wireless network provides scalable data collection without costly infrastructure However, the load sensor, RFID reader, and the Zig Bee communication has not been consolidated into a single processor causing overhead of being separate devices [2].

In this paper, a novel RFID-based approach enabling an effective localization and tracking of small sized laboratory animals is proposed. It is mainly based on a near-field (NF) RFID multi antenna system working in the UHF bandwidth, to be placed below the animal's cage, and able to rigorously identify the NF RFID tags implanted in laboratory animals. The basic idea is to firstly design and realize a particular NF antenna system suitable for UHF RFID readers to be placed below the animal cage and, then, to validate the integration with software modules developed for management, controlling, storing, and reporting. Each reader antenna should be able to generate a rather uniform magnetic field in a well-defined and confined region representing the generic elementary cell of the system. In such a way, after appropriate NF tags have been implanted into the laboratory animals, when only one of the antennas reads a RFID tag, the position of the associated animal is promptly individuated. In particular, the system is thought for small-sized laboratory animals, usually mice, free to move within a cage. Consequently, a resolution of the order of the animal size is satisfactory. But the antennas in the center are more influenced by neighboring antennas while the antenna in the corner is weakly affected from them. And hence, these can be corrected only by software [3].

The aim of the paper is to propose the first telemetry system based on BioNano-Sensors and reliable for remote and continuous single-metabolite monitoring of glucose, lactate, glutamate, and ATP in mouse models. A wireless electrochemical monitoring system has been realized to assess the sensor .The embedded system responds to the constraints linked to implants in animals. The materials used to build the Rats would sometimes lift one foot causing a shift of weight the system missed these changes [2].

When in comparison with human health system, it is reviewed the state-of-the-art in research and development of wearable sensor-based systems for health monitoring. As it is shown by the current technology status, WHMS have the potential to revolutionize healthcare by providing low-cost solutions for ubiquitous, all-day, unobtrusive personal health monitoring and are expected to enable early detection and better treatment of various medical conditions as well as disease prevention and better understanding and self-management of chronic diseases. However, the current study highlights the fact that there are still a lot of challenges and issues that need to be resolved for wearable systems to become more applicable to real-life situations and also to become accepted by patients and other users as a reliable, multifunctional, easy-to-use, and minimally obtrusive technology that can increase their quality of living [1].

II. PROBLEM DEFINITION

The environmental parameters are affected the performance and health of the animal both directly and indirectly. The heart rate is the most important parameter in the health assessment.

The environmental factor consists of air temperature, air movement, and radiation heat. In this paper, we have concentrated only on the environment temperature. The variation in heart rate normally reflects the stress, anticipation, movement, exertion, and various diseases.

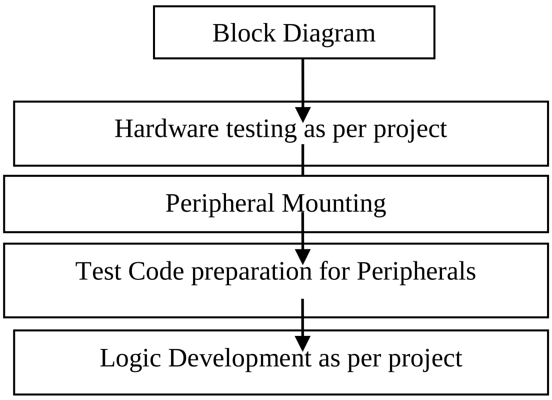

Fig. 1. Flow chart of animal health monitoring system

A. *Description*

Many embedded systems have substantially different designs according to their functions and utilities. In this project design, structured modular design concept is adopted and the system is mainly composed of a single microcontroller, temperature sensor, humidity sensor, accelerometer, heart rate sensor, and Wi-Fi.

The microcontroller, placed at the center of the unit, forms the control unit for the entire project. Embedded within the microcontroller is a program that helps the microcontroller to take action based on the inputs provided to it by sensors. The data received by the sensors are sent through the Wi-Fi.

In the block diagram, represents the entire unit which will be mounted on to the cattle. In the block diagram one temperature sensors are shown. One temperature sensor is used is used to determine the environmental temperature surrounding the cattle. Accelerometer sensor is also used to determine the change neck conditions .Accelerometer is placed on the neck of the movement the movement of the neck. Heart rate is used to analyze the heartbeat of the cattle to check whether there are any irregularities. The outputs of all these sensors are passed to the microcontroller. The microcontroller then passes these information to the server at regular intervals, via Wi-Fi. In this project, LCD is utilized in order to show the working of every unit.

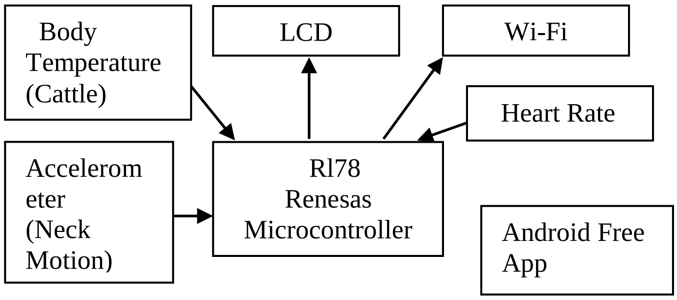

Fig. 2. Block diagram of animal health monitoring system

B. *Humidity Sensor Module*

The environmental parameters are affected the performance and health of the animal both directly and indirectly. The environmental factor consists of air temperature, air movement, humidity, and radiation heat. In this paper, we have concentrated only on the environment temperature and humidity. The circuit connection between the sensor and the microcontroller.

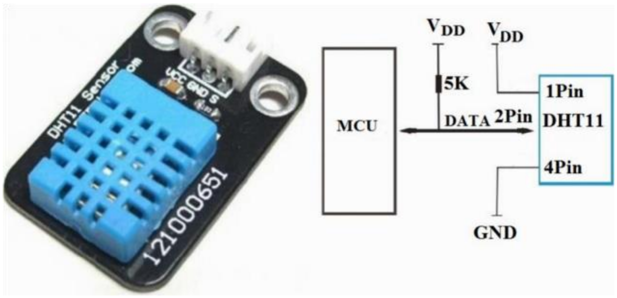

Fig. 3. Schematic diagram of the humidity sensor module.

C. *Heart Rate Sensor Module*

The heart rate is the most important parameter in the health assessment. The adult healthy cow has a heart rate between 48 and 84 beats per minute. The variation in heart rate normally reflects the stress, anticipation, movement, exertion, and various diseases. Basically, the heart rate measurement is an indirect method. The heart rate sensor module is shown in Fig. 4.

Fig. 4. Polar equine heart rate sensor module.

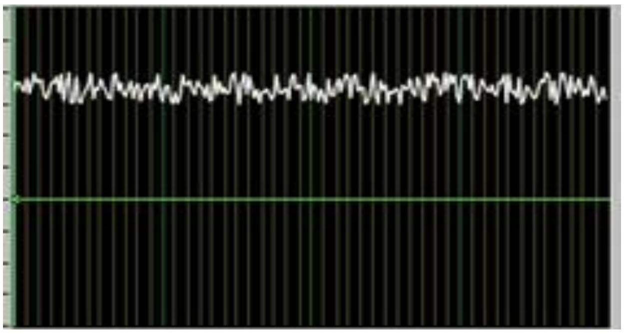

Fig. 5. The heart rate sensor output.

D. Rumination Sensor Module

In the rumination monitoring we have used the accelerometer. The rumination sensor module has been developed according to IEEE802.15.4 and IEEE1451.2 standards for provides the three axis response of the animals. The block diagram and photograph of the developed rumination sensor module are shown in Figs. 6 and 7, respectively.

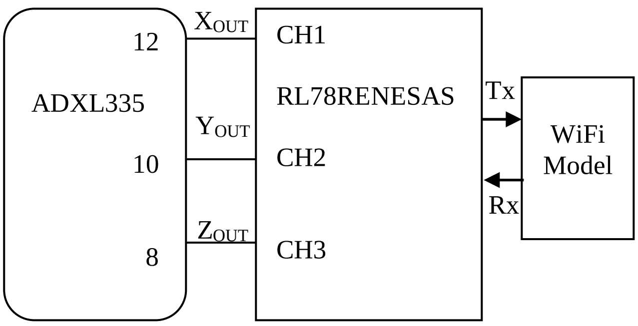

Fig. 6. Block diagram of rumination sensor module.

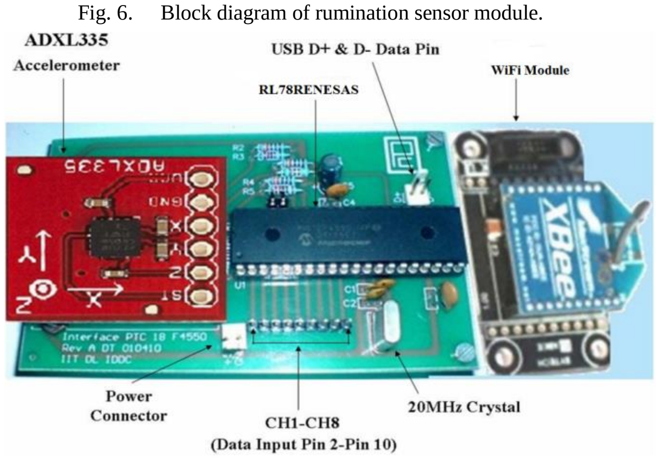

Fig. 7. Photograph of the rumination sensor module.

III. RESULTS AND DISCISSION

A prototype module will be developed for the project. It includes individual PCB boards for all interfaces according to the block diagram. Every PCB will be inter-connected with jumper wires. To demonstrate Accelerometer is used for neck movement. Changes in temperature will be shown through heating elements.

Apart from utilizing this system on cattle, such as cow, sheep, and other poultry animals, the system can be modified to be used on domestic animals as well. It can also be used by forest rangers to monitor certain animal health conditions, such as elephants in the wild.

Time required to monitor health conditions is less. Manual operation has been reduced to major extent. Efficient data management system. Easy to use. Less maintenance required Cost of the system is less.

Carrying power supply. System is a failure in the absence of power

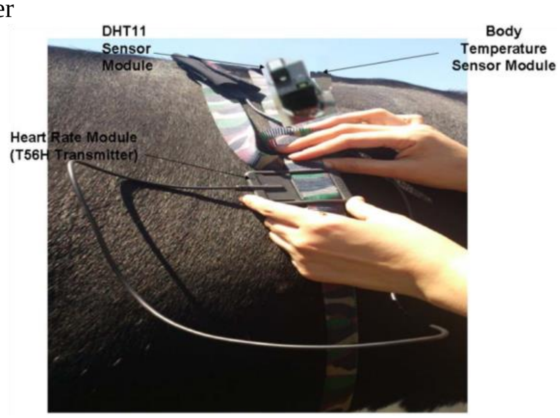

Fig. 8. Experimental setup of heart rate, body temperature, and surrounding temperature and humidity.

Fig. 9.Experimental setup of rumination sensor module.

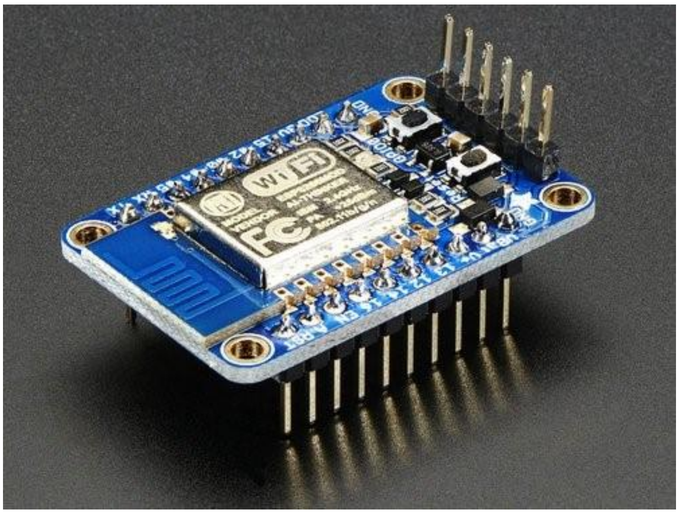

Fig. 10. Wi-Fi module.

IV. FUTURE SCOPE

For project demo concern, we have developed a prototype module. In future, this project can be taken to the product level. To make this project as user friendly and durable, we need to make it compact and cost effective. Going further, most of the units can be embedded along with the controller on a single board with change in technology, thereby reducing the size of the system.

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