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Animal Healthcare Neckband

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Abstract: *There is an increasing number of issues regarding various animal health condition and movements. And in recent era, animals have become an integral part of a human life. And hence, an animal health monitoring and tracking system using Bluetooth module is developed. Bluetooth Technology is more and more adopted in a wide range of applicative scenarios. To track the health of an animal, sensors such as the temperature sensor, heart rate sensor, pulse rate sensor and the respiratory sensor are used. The Bluetooth module would be connected to a Graphical User Interface (GUI) to show the digital data. With the advancement in technology and existence of internet, we practically can connect any device to internet and implement the concept of IOT.*

Keywords: Bluetooth, Android, Monitoring, Animal health, Detecting, IOT, etc

I. INTRODUCTION

In this paper they have interpreted the emotional state underlying canine behavior is essential in human-canine interactions, to achieve effective training, and to improve canine welfare. A non-invasive wearable sensor system combining electrocardiogram (ECG), photoplethysmogram (PPG), and inertial measurement units (IMU) to remotely and continuously monitor the vital signs of dogs is developed by researchers. To overcome the limitations imposed by the efficiently insulated skin and dense hair layers of dogs, they have investigated the use of various styles of ECG electrodes and the enhancements of these by conductive polymer coatings. They also studied the incorporation of light guides and optical fibres for an efficient optical couplingof PPG sensors to the skin. Combined with parallel efforts to use IMUs to identify dog behaviours, these physiological sensors will contribute to a canine-body area network to wirelessly and continuously collect data during canine activities with a long-term goal of effectively capturing and interpreting dogs‟ behavioural responses to environmental stimuli that may yield measurable benefits to handlers‟ interactions with their dogs. Using these methods the heart rate (HR), heart variability (HRV) and respiratory rate was measured successfully. The animal‟s skin or fur does not need to be shaved and the developed system is superior to the traditionalsystem. But it is applicable only in certain conditions. And can be used for only one animal i.e. dog. And, this system can be used only for certain conditions such as while the dog is sitting or running [1]. In this paper, in order to achieve early detection of each individual animal‟s illness, a wireless sensor network system is developed to monitor the animal‟s feeding and drinking behaviours. Electronic radio frequency identification (EID) s on the feedlot animal to record and study the cattle feeding and drinking behaviours. IEEE 802.15.4(LW-WPANs) based ear s are used for each animal. A directional antenna is used to allow one router to monitor multiple animals simultaneously, and an energy efficient mesh routing strategy is proposed to aggregate the monitoring data. The performance of the proposed system has been evaluated through numerical analysis and simulations [2].

In this paper, we have reported a novel design goal of the animal health monitoring system with a capability to monitor heart rate, body temperature, and rumination with surrounding temperature and humidity according to the IEEE802.15.4, IEEE1451.2, and IEEE1451.1 standards. It has a variety of features such as high speed, energy efficient, miniaturization, and intelligence, new materials at lower cost, portability, and high performance. The surrounding temperature and relative humidity based real time calculation of temperature humidity index (THI) and also has been classify the stress level of the animal. The output signal of the developed sensor modules are sent to a host computer through Bluetooth module. The values of body temperature, surrounding humidity, surrounding temperature, rumination, heart rate, stress level, and TH index (THI) can be displayed on the GUI PC. But, the transmission for heart rate data is only up to 5 meter. The heart rate sensor module‟s transmission range requiresmodification [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 s. Although s with embedded Andriod devices have been available allowing them to be scanned electronically because of cost, most s use low-frequency (LF) Andriod, so the scanner must be within a few inches of the . The researcher designed and built a prototype wirelessnetwork that combines long-range ultra-high-frequency (UHF) Andriod s with low-cost wireless and computing components. Thelong-range Andriod allows unmanned scans of multiple s, and the wireless network provides scalable data collection without costly infrastructure However, the load sensor, Andriod , and the Bluetooth communication has not been consolidated into a single processor causing overhead of being separate devices [4].

The existing system for Animal Health Monitoring uses either Bluetooth or Andriod for wireless communication link. And the sensors in few systems are implanted into animal causing inflammation. While in other they are used in the forms of collar, but however not all the parameters are taken into consideration for determining a healthy animal. The wearable based device varies from animal to animal. The proposed system will overcome the drawbacks of the existing system. Four important sensors called, heart rate sensor, temperature sensor, pulse rate sensor and respiratory sensor are used. And a GPS (Global Positioning System) is deployed to track the movement of an animal in case if the animal is missing or lost. The data from the microcontroller is taken via the Bluetooth transceiver and given to PC which will have software that would analyse the severity of the animal health issues. And later the same software can be accessed via various devices implementing Internet of Things.

II. SYSTEM OVERVIEW

The proposed model is indented to be helpful for all pet owners and doctors who can closely monitor animal health activities. And in case, of pet owners they can even search their pet animals if they are missing.

The figure 1 consists of four important sensors called, heart rate sensor, temperature sensor, pulse rate sensor and respiratory sensor. A GPS (Global Positioning System) is deployed to track the movement of an animal in case if the animal is missing or lost, which has not been proposed by any of the existing system‟s till now. The wireless communication technology used would be Bluetooth. Bluetooth has very low power consumption range of 10-3000 meters and it can support up to 64000 devices having a distance of 50 meters.

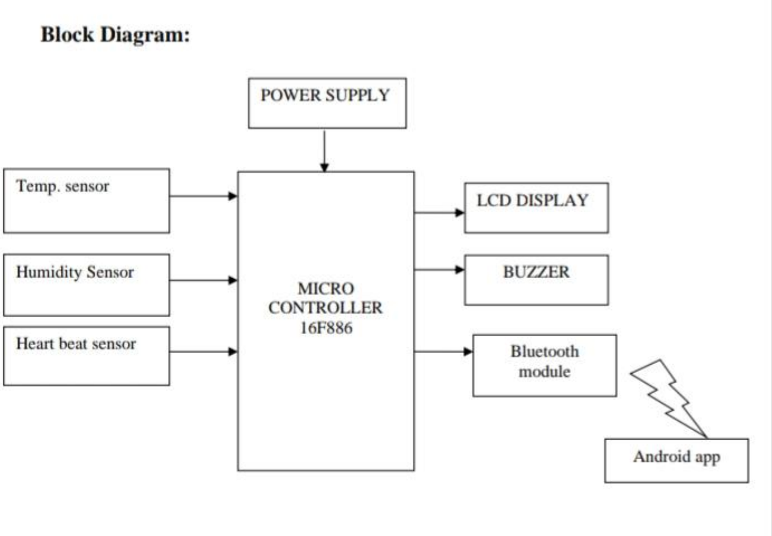

Figure 1: Block diagram of the transmitting end

In figure 2, the data from the Bluetooth transceiver receives the data from the microcontroller embedded in the system and sends the data to a PC using UART protocol. The data may be raw and needs editing. However, a software system will be developed in next phase to analyse the data.

In figure 3, the data values from the hardware will be given to a website to be processed. The website/webpage will have all the 5 data values along with analysis of it. And once the data is analyzed, we can monitor based on some threshold (temperature of a dog should be between 37.9-39.9 degree) if there is any threat to animal health. For example, a sudden increase in temperature after monitoring for hours can suggest that the animal may be suffering from fever. And suggestion of medicines can be given. If there is a critical condition then the regular doctor may be alerted. To develop and match the system with current trends, the system would be available on any device using IOT. IOT will bridge the gap between devices and will also enable users and owners to freely check upon their pets or animals from anywhere. Since the data receiving from the device is live and continuous, the data would be stored in cloud

2.1 Temperature Sensor Module

Domestic animal has a core body temperature (CBT) which gives an indication of their body temperature. Any deviation from their usual temperature is a cause for abnormality. For example, a domestic cow has body temperature between 38.0-39.3 degree Celsius. Whereas, for a dog it is between 37.9-39.9 degree. And any deviation from these temperatures can tell us that there is an abnormality. And hence to measure this, we use LM35 temperature sensor. The LM35 is rated to operate over a −55° to +150°C temperature range.

2.2 Heart Rate Sensor Module

Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heartbeat. This digital output can be connected to microcontroller directly to measure the beats per minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

2.3 Pulse Rate Sensor Module

The sensor clips onto a fingertip or earlobe and with some jumper cables. It also includes an open-source monitoring app that graphs your pulse in real time. It essentially combines a simple optical heart rate sensor with amplification and noise cancellation circuitry making it fast and easy to get reliable pulse readings. It calculates the pulse rate over a minute.

2.4 Respiratory Sensor Module

The Respiration Rate Sensor includes a Relative Pressure Sensor and inflatable belt, which wraps around the chest. As the person breathes, respiration rate and pressure changes can be displayed in a graph on a computer. When the belt is connected to the Relative Pressure Sensor, the Pressure sensor measures the pressure in the bladder of the belt as the lungs expand and contract. The pressure of the lungs and chest cavity expanding causes pressure against the bladder of the belt, but the pressure measured is not the actual pressure change in the lungs.

2.5 Global Positioning System

The Global Positioning System (GPS) is a satellite based navigation system that can be used to locate positions anywhere on earth. Designed and operated by the U.S. Department of Defence, it consists of satellites, control and monitor stations, and receivers. GPS receivers take information transmitted from the satellites and uses triangulation to calculate an animal"s exact location.

2.6 Bluetooth Transceiver

Bluetooth is an enabling technology providing low data rate, low battery consumption with low cost based on the standard IEEE 802.15.4. It is contributing to wireless personal area network and wireless sensor network. . Bluetooth have capability to make a large network, it can support up to 64000 devices having distance 50 meters. It needs very low power.

2.7 Internet of Things

The Internet of Things (IoT) is the network of physical objects—devices, vehicles, buildings and other items embedded with electronics, software, sensors, and network connectivity—that enables these objects to collect and exchange data. IoT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration between the physical world and computer-based systems, and resulting in improved efficiency, accuracy and economic benefit.

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III. IMPLEMENTATION

The proposed animal health monitoring and tracking system was implemented in real mode with all the four mentioned sensors. The received values from sensors was transferred over the wireless Bluetooth communication channel through UART protocol and is shown in both the LCD as well as the computer through the putty software. As a result, it is proved that the integration of GPS and sensors in the same microcontroller is possible without any complications and also, the data retrieved is accurate and there is no interference in the data. However, the GPS works only when there is movement in the model. And also, the accuracy and precision could not be achieved in previous models whereas this model achieves them. The implementation is shown in below figure 4. The software for this system as well as IOT implementation is under development

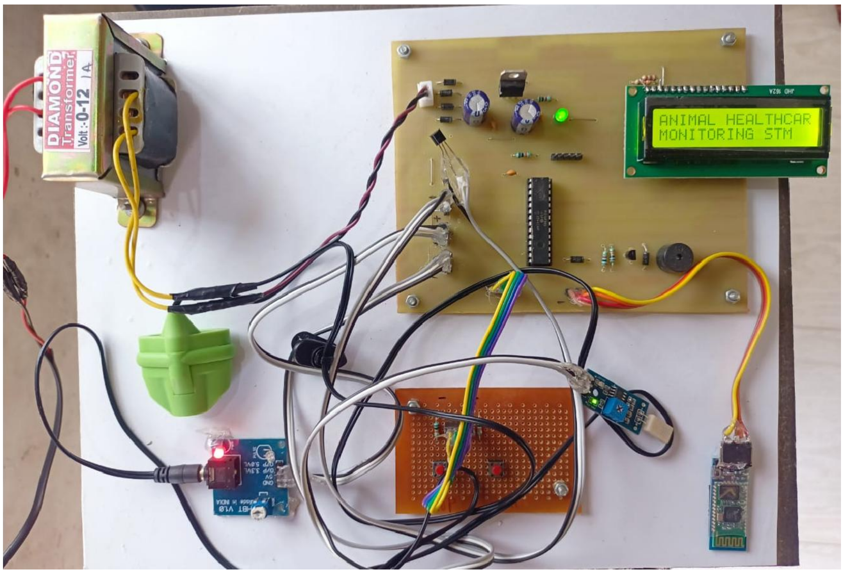

Figure 4 Implementation of hardware

IV. CONCLUSION

The main idea of this paper is to integrate two existing modules developed in different platform and technology to a single module and platform. The four different sensors along with GP module are compatible to perform in an embedded system. The accuracy of the values relies on the microcontroller which uses explicit ADC to give the accurate details in case of health monitoring and location tracking. This model will work as a strong backbone in case of analysing any health related issues for an animal.

The future of this paper will lie in developing the hardware further to a wearable device which can be connected to any device using the internet of things. But since the wearable device can possess as a serious security threat i.e., the device can be removed from the animal‟s body and can result in theft. And hence, a smart theft detection system or burglar alarm can be placed on the hardware to alert the user and sending a notification to their device in case if someone hampers with the wearable device.

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