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## International Journal of Intellectual Advancements and Research in Engineering Computations

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### Animal health monitoring, rumination and location tracking by GSM module and MQTT based cloud server

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#### ABSTRACT

In this venture we will build up a product which is going to screen the different wellbeing parameters of animals which incorporates pet animals and furthermore animals in the havens utilizing diverse sensors. The wellbeing of the animal can be observed by estimating the temperature, stickiness and rumination of the animal by utilizing the separate sensors. This would likewise enable the clients to follow the area of the animal, utilizing the GPS. The observed information will be gathered and sent to the client by MQTT Protocol convention from the cloud. This additionally gives the preferred standpoint that it very well may be actualized for a number of animals by making distinctive ID numbers.

**Index Terms:** Sensors, MQTT protocol, GPS, Physiological parameters, Android application.

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#### INTRODUCTION

Presently it is assessed that animals are becoming extinct at a rate 1000 to multiple times the normal rate. In 2018, the world lost some striking animals including a few birds and mammal species. In spite of the fact that 2019 has just barely started, one species has just been announced extinct while a few others have been added to the list of those likely to disappear sometime this year.

The extinction of these species is mainly due to poaching and various health issues. These problems can be overcome by the implementation of our project. The health issues can be identified by continuous monitoring of animal's parameters like temperature, humidity and rumination. The poaching can be reduced by tracking the location of animal. The domesticated animal ranchers confronted cow's medical issues, far and wide on account of persistent ascent in air temperature in the troposphere. The varieties in temperature on animal's wellbeing have unsafe impact prompting maladies.

For example, foot and mouth ailment, hypomagnesaemia, clostridia ailment and hypoglycaemia. The body temperature and heart rate parameters are used as a malady investigate for various animals. An adjustment in the temperature of the body is the indication of sick wellbeing. The body can just work legitimately at a specific temperature. The wellbeing checking relies upon two techniques namely, co-ordinate contact (obtrusive) or backhanded contact (non-intrusive). Essentially a model telemonitoring framework comprises of detecting unit and receiving unit.

This paper presents 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. The hardware will be of neckline structure and will be mounted around the neck of animal.

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## LITERATURE SURVEY

### Wireless Sensor Network

In this paper, so as to accomplish the early recognition of individual creature's disease, a remote sensor framework is produced. This system framework is utilized to screen the creature's feeding and drinking practices. A directional radio wire is actualized which will enable one switch to screen numerous creatures at the same time. The checking frame work has a remote sensor arrangement which is to screen the dairy cattle's body temperature, pulse and portability information. The information will be overhauled through a ZigBee correspondence module. The proposed framework have the components that incorporate creature's ear tag (battery powered), feed bunk, water trough switches and database arrangement (mesh network).

The ear tag and the switches are associated through a remote system. All the observed information will be put away in the ear tag. From this ear tag, the information will be sent to the switches after that to the sink hub which has wired association with the database server. Through the database server the data can be analysed and viewed.

### Smart Health Monitoring

This paper focuses on early diagnosis and prevention of widespread diseases in animal. The

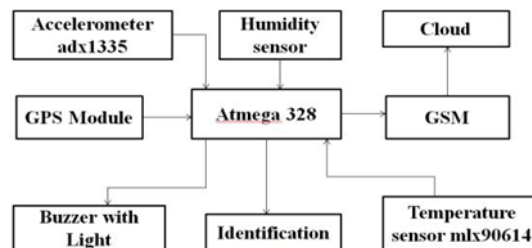
illness can be distinguished by observing the parameters like temperature, pulse, dampness and rumination which are estimated by individual sensors. These sensors together structure sensor module. To actualize the sensor modules, ZigBee and Arduino microcontroller are utilized. The checked information from the sensors is fed to the PC that will be shown by GUI (Graphical User Interface). The hardware is mounted on the creature's body.

## PROPOSED SYSTEM

To overcome the drawbacks of various methods of animal health monitoring systems, we are implementing a hardware with three sensor modules i.e. temperature, humidity and rumination. Along with this, location tracking is done by GPS system using MQTT protocol which overcomes the problem of long distance transmission. The yield can be seen through android application which is easy to use. The equipment will be of neckline structure and will be mounted around the neck of animal.

## METHODOLOGY

The detailed working of the project is given in the block diagram as shown below



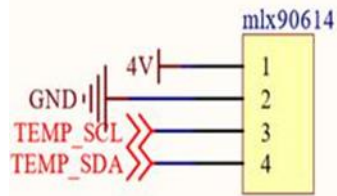
**Fig. 1 Block diagram of Animal Health Monitoring System**

## SENSOR MODULES

### Temperature Sensor

Animals have their own core temperature and if any temperature rise happens in the animal's body, it will not be healthy. Deviation in temperature

range leads to changes in metabolic activity of the animal and also the cellular physiology. The mlx90614 sensor measures the temperature without any contact to the animal's body. This sensor is a non-contact infrared thermometer.



**Fig. 2 Temperature Sensor**

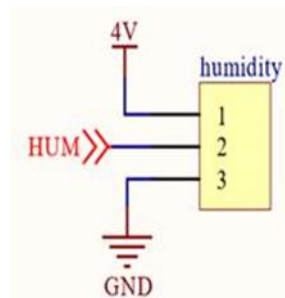
The temperature ranges from -40 to +125 °C with the Resolution of 0.02 °C. The average Power supply of the sensor is 4.5 V to 5.5 V and its current consumption is 2.5 mA. During sleep mode, current consumption is reduced to 2.5 μA.

### Humidity Sensor

The health of the animal is affected by the environmental factors such as humidity,

temperature and air movement both directly and indirectly. If humidity of the environment is more, the sweat from the animal's body will not evaporate and causes health issues.

In this paper, we have concentrated only on the environment humidity. It can be measured by using DHT11 sensor which produces the environment temperature and humidity as a digital output.



**Fig. 3 Humidity Sensor**

The advantage of this sensor is that the transmission range of 20 m can be done and also it works on digital signal collecting technique.

### Rumination Sensor Module

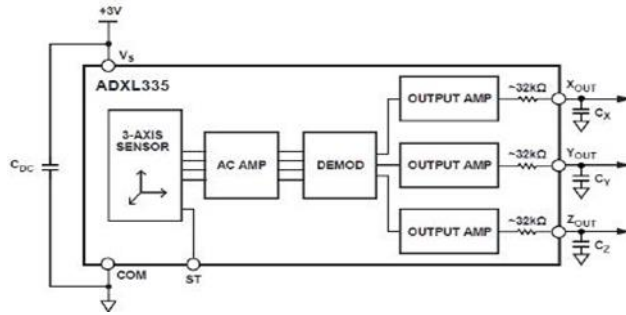
The rumination reflects the health of animal and is highly sensitive to the state of wellbeing. The deviations due to rumination and eating patterns are measured to know the health status of the animal. Any abnormal state of the animal can be detected by monitoring the rumination because animal ruminates around 8 to 10 hours per day. The rumination is measured by accelerometer

adxl335 in X axis, Y axis and Z axis. The adxl335 measures both the static and dynamic acceleration with input power supply of 1.8 V to 3.6 V. The current consumption of sensor is 350 μA. The output if sensor is based on factors such as Motion, Shock and Vibration.

$$\text{Axout} = (((X \text{ axis ADC value} * V_{\text{ref}}) / 1024) - 1.65) / 0.330$$

$$\text{Ayout} = (((Y \text{ axis ADC value} * V_{\text{ref}}) / 1024) - 1.65) / 0.330$$

$$\text{Azout} = (((Z \text{ axis ADC value} * V_{\text{ref}}) / 1024) - 1.65) / 0.330$$



**Fig. 4 Accelerometer**

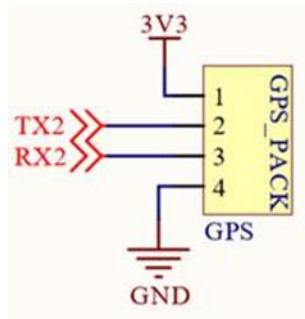
**Communication Module**

**GPS Module**

Global Positioning System (GPS) is a satellite navigation system that furnishes location (both latitude and longitude data from the Satellite) and time information in all climatic conditions to the user.

The working of GPS is based on the ‘trilateration’ mathematical principle. We are using Neo 6M module which has an anti-jamming technology. Neo 6M is LCC Package.

Power supply to the GPS module is 2.7 V to 3.6 V and the power consumption is 111 mW at Continuous mode and during power saving mode power consumption is 33 mW.

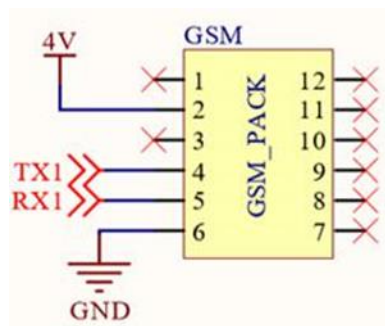


**Fig. 5 GPS Module**

**GSM Module**

We are using GSM module in order to transfer all the data to the Android application or cloud through Message Queuing Telemetry Transport

(MQTT). SIM800L is a quad-band GSM/GPRS module with the Power supply of 3.4 to 4.4V and current consumption is 2A.



**Fig. 6 GSM Module**

Transmission speed of the data from the controller to cloud is 200 bps to 115200 bps. The Power consumption in sleep mode is 0.7 mA. Temperature ranges from -40 °C to +85 °C

### Indication

#### Buzzer with light

Buzzer along with light is used to detect the location of the animal in dark places. Light is attached to the collar of the animal and it can be tracked (ON and OFF) by Mobile application and

Web pages. Similarly Buzzer is also controlled by Mobile application and Web pages.

### Identification

It is used to give notification to the user about the battery percentage of the micro controller. This is also used to know if the tag is broken or not.

## USER INTERFACE

The display unit of the android application is shown below

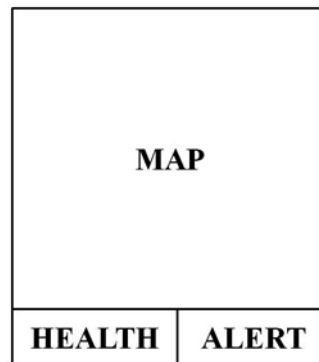


Fig. 7 User Interface: Application

### Map

Map gives the location of the animal with the help of Global Positioning System. The individual animal can be tracked by its unique ID which can be assigned by the user to identify the animal.

### Health

This section has the output of all three sensors that is temperature, humidity and accelerometer. The output will be displayed one by one. This section also has the range of normal value hence the abnormal factor can be identified and intimated to the user through Mobile Application or Web server.

### Alert

This section is used to identify the status of Collar. Whether the collar is broken or not can be

identified by the microcontroller. If the collar is broken it can be identified by reading the micro controller pin. If the pin reads one then it is not broken, if the pin reads zero the collar is broken. When there is any break occurs in collar it can be delivered as alert to the user. This also provides information about battery percentage of the Micro controller. When the battery percentage reduces below the range it gives the alert message.

## CONCLUSION

In this paper, we have displayed a model of an animal's wellbeing checking framework. The model comprises of the sensor module and communication module. This framework is tried for observing the physiological.



**Fig. 8 Collar tag**

In the development of sensing device, we have utilized the low power electronic parts to limit the power utilization and the device could run consistently for maximum period. In future we are planning to measure much more health parameters

such as pulse rate, drinking and eating patterns to predict the health parameters accurately which helps in prevention of diseases. In addition to this, the collar can be replaced by biochip which can be injected in the epidermis layer.

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