SMART CARE: CATTLE HEALTH MONITORING SYSTEM

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Abstract

According to the survey, it can be noted that most rural residents shift to the urban area by being dissatisfied by their rural life and by leaving their members of their family in the village. In line with this, human beings are undergoing major research through which we can obtain valuable information about parameters of health. But sadly, there are only a few researches working on the health monitoring of animals, with the aid of advanced technologies. Efficient online cattle health monitoring will benefit those farmers who are suffering regularly because of their cattle's poor health condition and lack of a good veterinarian. Farmers therefore have trouble tracking and comparing the current health parameters with the normal safe reference parameters. We would be able to detect any health problems in the health of the cattle by such a study. To prepare such a device for real time use, very few researchers use Node MCU, which is an open source IoT interface, Phase Counter and various sensor types. This project focuses primarily on the various established types of system used to track the cattle's health parameters such as temperature, heart rate, and body humidity.

Keywords: Node MCU, IoT interface.

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I. INTRODUCTION

In a developing country like India, rural areas are abundant where people still rely on the cattle as their source of income. Their way of living depends largely on the health of the cattle, as most people depend on the dairy products for their livelihood and also on those farmers who are unable to afford advanced machinery for the purpose of agriculture and still depend on the cattle for it. Since veterinarians are scarce in rural areas, people visiting the veterinarians with their cattle by driving a long distance that costs them a lot. Yet such a move can be a double-edged sword because if the health condition of the cattle is really poor, they can be handled. But if this is not the case, then this journey would be complete waste of time.

According to the survey, it can be noted that most rural people migrate to the urban area by being dissatisfied with their rural existence and leaving the village itself and the members of their family. We introduce such a system the online cattle health monitoring system that allows people to monitor the health condition and identify any signs of cattle health deterioration. Since a lot of work is going on, the human beings we are able to gain valuable information through. Despite an advanced technology improving, there are relatively few cattle researches. Therefore, this system represents a step towards tracking cattle well-being.

II. LITERATURE SURVEY

[1] Seung You Na, et.al., "Protection of orchard from wild animals and birds using USN facilities" proposed a method for protecting orchard products from wild animals and birds by ubiquitous sensor network devices that are applied to orchards along with conventional methods for improving the efficiency of defence. It also provides an early warning of possible intrusion and disruption by wild animals and birds through the use of USN nodes.

[2] T. Kobayashi, et.al., "ECG and heart rate detection of prenatal cattle foetus using adaptive digital filtering" stated a method for detecting prenatal cattle foetus electrocardiogram and heart rate. The system is considered useful in tracking the health status of cattle with a view to avoiding premature birth, abortion and seizing a symptom of apparent death.

[3] Ranjani Sampath Kumaran, et.al., "Design and evaluation of a low-cost intracranial pressure monitoring system" developed a minimally invasive ICP epidural monitor for use with a craniotomy of the 2 mm burr opening. For intracranial pressure measurements, a MEMS piezoresistive sensor is used in the device and its output is evaluated.

[4] Ankit Bhavsar, et.al., "ZigBee based network architecture for animal health monitoring" proposed the ZigBee-based Animal Health Monitoring network architecture The cattle body sensor sends data such as heart beats, respiration, body temperature in the WSN-based Animal Health Monitoring while Environment sensor sends data such as water contamination rates, soil infection rates, air and humidity dust levels.

[5] Myeong-Chul Park, et.al., "Design of cattle health monitoring system using wireless bio-sensor networks" designed a cattle health monitoring system that collects vital information about each entity of cattle farms, such as heart rate, respiration rate, and motion of quantities, to help with the prediction of animal diseases using wireless bio-sensors.

[6] Seema Kumari, et.al., "Development of IoT Based Smart Animal Health Monitoring System Using Raspberry Pi" developed a prototype of IoT-based smart animal health monitoring system for real-time monitoring of physiological parameters. Raspberry pi3 is used as the core controller, it processes the sensed data from different sensors and displays on the monitor.

[7] Kevin Smith, et.al., "An Integrated Cattle Health Monitoring System" proposed a system that not only improve the individual animal health, it would also help to identify and prevent widespread disease, whether it originated from natural causes or biological attacks.

[8] Sweta Jha, et.al., "E-Cattle Health Monitoring System Using IOT" designed a system that uses sensor technology that maps the special aspects of animal behaviour such as temperature, heart rate, etc. This data is aggregated and reported to the health center. This reduces the expense of limited safety checks and long-term animal treatment.

[9] Kavya Priya M L, et.al., "A Review on Cattle Health Monitoring in Wireless Sensor Networks (WSN)" stated a system using WSN, where cattle health can be monitored in real time based on some parameters with different types of sensors. This paper describes about various sensors that are used in wireless sensor network to monitor the cattle health in order to prevent the harmful diseases that can cause severe effects in Farming.

[10] Warren S, et.al., "Electrocardiographic pill for cattle heart rate determination" describes a pill concept that can remain in the reticulum of an animal and use electrocardiographic techniques to assess heart rate.

III. PROBLEM DEFINITION

People still depend on cattle as their source of income in rural areas. Their way of life depends largely on the health of the cattle, as most people rely on the dairy products for their livelihood. Since veterinarians are scarce in rural areas, people visiting the veterinarians with their cattle by driving a long distance that costs them a lot. To overcome this problem essentially, this project is designed which enables the people to monitor the health condition and recognize any signs of health deterioration in cattle. The project is designed in such a manner that it is supposed to work with cattle namely cow, buffalo, sheep and goat. This project includes online monitoring system which works on IoT platform. The parameters measured are temperature, humidity and heartbeat. If the measured value of any parameter goes beyond the safety limit, then it is indicated through a message.

IV. HARDWARE DESCRIPTION

PIC MICROCONTROLLER:

In the fields of electronics and robotics the PIC microcontrollers applied. Key features include wide availability, low cost, easy reprogramming with built-in EEPROM, a comprehensive collection of free application notes, abundant design tools, and much details freely available on the internet. The PIC Microcontroller used in this project is PIC16F877A.

HUMIDITY SENSOR:

A humidity sensor (or hygrometer) senses, monitors and records both humidity and air temperature. The ratio of humidity in the air to the maximum level of humidity at a given air temperature is called relative humidity. When looking for comfort, relative humidity becomes an important factor. DHT11 sensor is used for measuring humidity in this project. The DHT11 is a sensor for digital output, relative humidity, and temperature. To test the ambient air, it uses a capacitive humidity sensor and thermistor, and sends a digital signal to the data pin.

The moisture sensor is used to determine the changes that occurred under environmental conditions. Relative humidity should be between 30% and 70%.

TEMPERATURE SENSOR:

Temperature Sensors calculate the amount of heat energy or even coldness produced by an object or system that allows us to "feel" or detect any physical changes to that temperature that create an analogue or digital output. It can be used by any animal for both environment and body. LM35 is used in this project to measure the temperature. Temperature should be in constant condition for proper functioning of any system. If there is any variation, it shows that an ill health has occurred and also causes some seriousness in the health of cattle. Body will function properly only at specific temperatures. Standard cattle body temperature falls in range 101.5 ° F (38.6 ° C). LM35 sensor temperature range is over a −55 ° C to 150 ° C.

HEART BEAT SENSOR:

Heart rate is a window into the lungs and muscles, because it shows how hard they work. Heart rate is measured in various ways. The electrical and optical methods are two of the most common techniques; the latter is more cost-effective and convenient. Adult cattle natural heartbeat ranges from 48 to 84 beats per minute. The sensor can sense both stress and anxiety from animals. The heartbeat sensor commonly used is a stethoscope. Listening over the left side of the cow's chest is placed behind the elbow of the cow. The heart rate increase can lead to a sign of pain.

LOGIC LEVEL CONVERTER:

The bi-directional logic level converter is a small device that safely steps down 5V signals to 3.3V and increases 3.3V to 5V at the same time. The level converter is very user friendly. The board needs to be driven by the two sources of voltages that device is using (high voltage and low voltage). High voltage (e.g. 5V) to the 'HV' pin, low voltage (e.g. 3.3V) to 'LV' and ground to the ' GND ' pin from the device. Node MCU which has operating voltage in the range 7-12 volts is used in this project. The sensor operating voltage used is 5 volts, and the PIC16F877A is about 2-5.5 volts. The logic level converter is used to prevent damage to the devices. This bidirectional logic level converter translates from HV to LV, and vice-versa.

NODE MCU:

An open-source software and development kit that helps model an IOT system in just a few lines of Lua script. The NodeMCU (Node MicroController Unit) is an open source device with programming advancement condition that operates in an extremely low-cost system-on - a-chip (SoC) called ESP8266. The ESP8266 is composed and manufactured by Express, it contains all of the cutting-edge PC's pivotal components: CPU, RAM, organizing (wi-fi), and even an advanced working structure and SDK. Continuous gaining resolves a phenomenal decision on it outline for prudent minimum effort framework.

V. PROPOSED METHODOLOGY

BLOCK DIAGRAM:

The major blocks involved in this project are shown in fig 1. It comprises Power supply unit, Logic level converter, PIC16F877A Microcontroller, DTH11 sensor for humidity measurement, LM35 for temperature measurement, Heart beat sensor for heart rate measurement. It also includes Node MCU as WIFI module, which act as both transmitter and receiver and mobile as receiver.

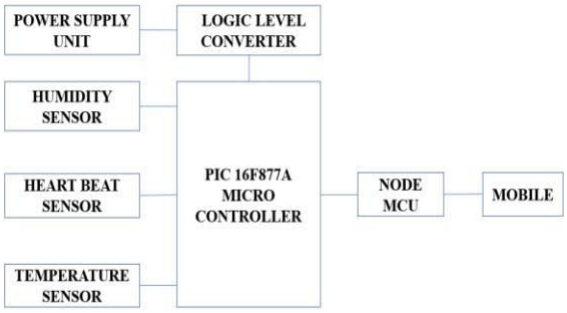

Fig 1 Block diagram

WORKING PRINCIPLE:

The entire setup is divided into two parts in this system: the segment Transmission and Receiver. The transmitting portion includes power supply, MCU node, various sensors, and Wi-Fi module. The component of the receiver is Mobile as a receiver. Secondly, a belt is used to position the sensors on the cattle. Using Node MCU, the sensors are interfaced, and the signal is then read and transmitted via Wi-Fi module. The sensor for rumination is mounted at the side of the mouth. The DHT11 sensor is mounted on the cattle's back. Now, when the data is sent from the transmission section, it is received in the receiver section by the Wi-fi module and then processed via Node MCU and presented in the device.

POWER SUPPLY UNIT

The incoming AC voltage is 230V, which is given as input to step down transformer. It converts high primary voltage to low secondary voltage i.e. it steps down the voltage. The output voltage from the transformer is 12V. Rectifier coverts AC input into DC output. It straightens the direction of current. Depending on the type of alternating current supply and the arrangement of the rectifier circuit, the output voltage may require additional smoothing to produce a uniform steady

voltage. The output of the rectifier is smoothed by an electronic filter, which is a capacitor, possibly followed by a voltage regulator to produce a steady voltage. Thus, the output from power supply unit is stabilized DC voltage which is shown in fig 2.

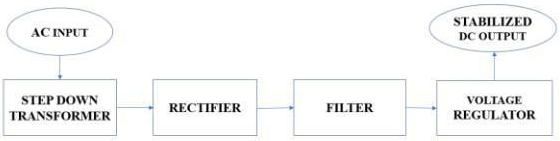

Fig 2 Power supply unit

SENSORS UNIT

The parameters measured are Temperature, Humidity and Heart rate. The temperature, humidity and heart rate are measured by LM35, DHT11 and Heart beat sensor respectively. The input voltage to sensor is 5V.

TRANSMITTER AND RECEIVER UNIT

The Node MCU is used as both transmitter and receiver. It read the data from the sensors and send it to the microcontroller. It also receives the data from the microcontroller and send it to mobile.

MICROCONTROLLER UNIT

The microcontroller compares the real time data received from the sensors with the reference data or threshold level. If the real time data value is lower than the reference then the message given in mobile will be "The rumination is normal". If anyone of these parameters go beyond a threshold level, it is notified with the message "The rumination is abnormal". The microcontroller is programmed with MPLAB v8.56. The program is uploaded using PIC KIT3, a simple in-circuit debugger.

LOGIC LEVEL CONVERTER UNIT

The logic level converter is used to prevent the damage of over heating effect due to higher voltage input in devices. Actually, sensors have input voltage limit as 5V and microcontroller has limit of 5.5V. Each device work on different input voltage. So, to prevent the device from the damage, the logic level converter is used.

DISPLAY UNIT

The display units are mobile and LCD display. To see the value of parameters and message in mobile, download BLYNK application from the playstore and login.

VI. SOFTWARE MODELLING

MPLAB

STEP 1: Open MPLAB IDE v8.56. Click project menu and go to project wizard. Click next and select device as PIC16F877A and click next.

STEP 2: Select a language tool suite as HI-TECH ANSI C Compiler and click next.

STEP 3: Create a new project and click next and if existing project, then add it and click next. Then click Finish.

STEP 4: Type the code in IDE as shown in fig 3 and click build button.

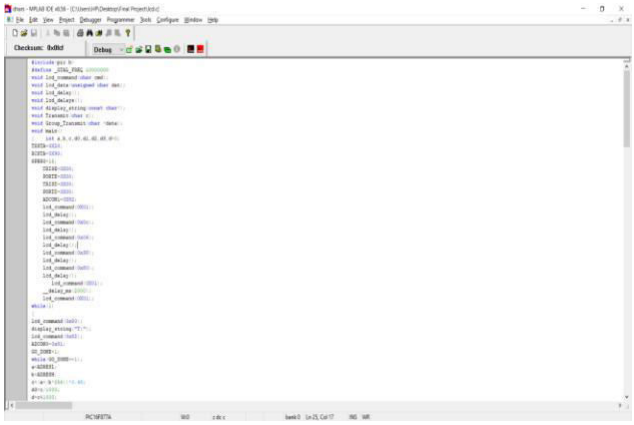

Fig 3 Source code in MPLAB.

PROTEUS SIMULATION

STEP 1: Open PROTEUS ISIS 7 Professional and click component mode and go to library. Pick devices such as PIC16f877A, LCD display (16*2), LM35(Temperature sensor), DHT11(humidity sensor) and Heart beat sensor. Instead of DHT11 and Heart beat sensor, variable Potentiometer is used.

STEP 2: Arrange the devices and connect it as per the circuit diagram as in fig 4. Go to terminals mode and pick ground and supply.

STEP 3: Double click the PIC16F877A and change the processor clock frequency as 10MHZ. Select program file from the system and click Ok.

STEP 4: Now save the project and to run the simulation click run button.

The parameters temperature, humidity and heartbeat will be displayed in LCD display as shown in fig 4.

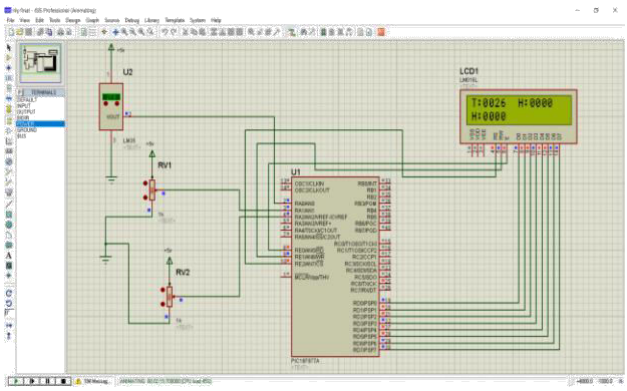

Fig 4 Simulation of Cattle Health Monitoring System in Proteus

VII. CONCLUSION

Online cattle health monitoring system provides reliable and real-time cattle health parameters that are incredibly helpful in tracking the state of health and identifying any changes in behaviour and health issues. This can therefore be a very useful device for people to analyse the situation on their own without relying on veterinarians for every small problem. In cattle specimens, this project recorded approximately 72 -75 per cent of accuracy.

VIII. RESULTS AND DISCUSSIONS

The picture shown in fig 5 is the entire setup of cattle health monitoring system. It displays the parameters such as temperature, humidity and heart rate.

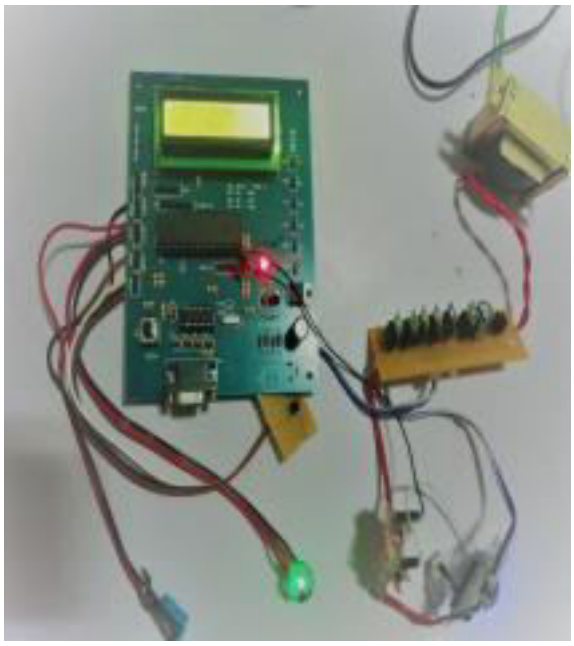

Fig 5 Cattle health monitoring system

IX. FUTURE SCOPE

This system uses the wired connections to determine the health of the cattle. So, it is accessible only from the place where the cattle are available with power supply unit. So, the farmers should have to face little complexity. Hence the future scope of this project will be wireless monitoring which uses gsm module and the sensors will be placed on the body of the cattle and it will be monitored. In addition to this, disease of the cattles also can be identified by including symptoms of the diseases. The labour power and cost can be reduced by this method.

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