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Temperature Based Automatic Cooling System for Livestock Farm in Western Region of Rajasthan using Arduino

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Abstract: Automation and Technology play a very big role in human life; we can't imagine our life without automation. Then how can Livestock/ cattle live without these technologies. In north-western region of Rajasthan temperature goes varies high in summer days (approx 50o C). This high temperature affects livestock/ cattle health. It reduces milk yields. This affects livelihood as well as economy. There are many projects developed to avoid these types of critical situations using technologies like embedded-based, wireless sensor-based, IOT based. In this temperature-based cooling system for livestock and cattle farm in the western region of Rajasthan using Arduino system, the wireless temperature sensor senses the environmental temperature of cattle/ livestock shed and if the temperature goes high then the cooling system Fogger system start and when the temperature goes low then the fogger system goes off automatically. This system is controlled by Arduino. The temperature is also displayed on LCD display. And the owner can set the threshold value of high-low temperature using mobile communication through Bluetooth.

Keywords: Livestock, Arduino, Temperature Sensor, Fogger/ Mister, Bluetooth Module

I. INTRODUCTION

Livestock/Cattle farming play a very important role in the economy of Rajasthan. This contributes 10% of the total GDP of the State. The rural population is 75.13% in Rajasthan according to 2011 Population Counting. Most of the rural population depends on Livestock Farming for their and their family livelihood. Demand for milk is increasing day by day. The High temperature in summer days is a very critical condition for livestock/ cattle health. It affects livestock health. The Human can't imagine their life without livestock. In north- western area of Rajasthan where the temperature goes very high in summer, this high temperature becomes a very critical problem for Livestock/ Dairy farming. Thus high temperature causes many health issues in dairy cattle. Also, affect milk yield in the summer month. The Easy way to take them cool in these summer days is to bathe them in a pond or lake leave them few hours in that pond or lake. For buffalo, bath time is approx 4-5 hours because of their thick skin. But it is not possible because of the unavailability of a pond or lake near all livestock/cattle farms. Especially in the north western region of Rajasthan, It affects the livelihood and economy of our state. Now a day's when a human can't think their life without automation and technology. So we need to use this automation and technology for livestock also. In this research, we worked on temperature based automatic cooling system for livestock/ cattle sheds/farm using Arduino. Using this system in livestock sheds/ farm owners can maintain milk yields on hot days of summer. Livestock can be protected from many diseases caused by heatstroke.

This increased temperature affects the quality and quantity of milk yields. Sometimes cattle die because of heatstroke. For example, the regular body temperature of the cow is 38.5o to 39.5o when the temperature goes high above 41o – 42o they can be affected by two types of diseases Influenza and anthrax. If the temperature goes high then sometimes they can die. So using this technique of cooling livestock/ cattle shed in summer we can improve milk quality and reduce diseases.

II. LITERATURE SURVEY ON PREVIOUS RESEARCH

In this research, they developed a cattle health monitoring system for cows [1]. Sensors are used to detecting various types of health parameters like temperature, respiration, humidity. In this system sensors are interfaced with Arduino and graph of all parameters are display on hand-held device through Bluetooth or Wi-Fi module. It replaces the manual detection of these parameters. It is accurate and very useful to doctors and farmers.

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In this paper, they review the Temperature humidity index and its relationship with production Traits of Dairy Cattle and Buffaloes [2]. Temperature Humidity Index can affect the reproduction rate of the animal. Also, it can affect milk yields. According to this review paper, proper ventilation and proper cooling system can help to reduce heat stress. The proper cooling management system can reduce the effects of heat stress and maintain milk production in these high-temperature humidity days.

In this paper, Raspberry Pi and Wireless Sensor technology are used for cattle health monitoring. This system monitor parameters like cattle body temperature, humidity, heartbeat, and rumination [3]. Earlier day's people examine their livestock for a long time to understand their health issues or use a thermometer to examine their temperature. But these days wireless sensors are used to sense their temperature. And easily diagnose their health parameters.

This research is based on a GPS/GSM-based health monitoring system of livestock/ cattle [4]. In this system sensor sense, various parameters of livestock/cattle and the output of these sensors transmitted this server system or owners mobile using GPS/GSM. It can also track the location of animals their health parameters.

In this research work, the temperature is automatically controlled using Arduino. These days Automatic temperature control system plays important role in smart homes [5]. In this system temperature control is based on Arduino Uno-based microcontroller system. Temperature sensor LM 35 is used and this sensor and Arduino UNO are interfaced with the computer. The temperature is displayed on LCD display.

This research is based on A Wi-Fi based Animal Health Monitoring System [6]. In this system, Wi-Fi devices and the RL78 RENESAS microcontroller are used for the implementation of the sensor module. This Wi-Fi-based health monitoring system monitors various physical parameters of livestock like body temperature, rumination, heart rate with environment temperature. The owner can monitor these health parameters using the android app.

The following Table is showing body Normal Body temperature of Various Cattle/ Livestock

TABLE I NORMAL BODY TEMPERATURE OF VARIOUS CATTLE/LIVESTOCK (Data from Internet)

S. No.	Various Animal	Temperature in ^{o}C	Temperature in ^{o}F
1.	Calf, Young	38.5- 40.5	101.3-104.9
2.	Young cattle up to 1 year	38.5 - 40.0	101.3-104.0
3.	Buffalo	37.5 - 39.0	99.5 - 102.2
4.	Kid (goat)	38.5-41.0	101.3-104.9
5.	Goat, Adult	38.5 - 40.5	101.3-104.9
6.	Lamb (sheep)	38.5 - 40.5	101.3-104.9
7.	Sheep over 1 year	38.5 - 40.0	101.3-104.0
8.	Camel	35.5 - 38.6	95.0-101.5
9.	Dairy Cow	38.0-39.0	100- 102.4

Effect of Climate change on Livestock;
Climate change affects directly health. It is due to temperature increment or heat waves. By these change heat stress conditions occurs. Heat stress affects negatively livestock health. This may cause metabolic alterations, immune suppression, oxidative stress, and sometimes death of livestock. It directly affects owner's livelihood and their economy.

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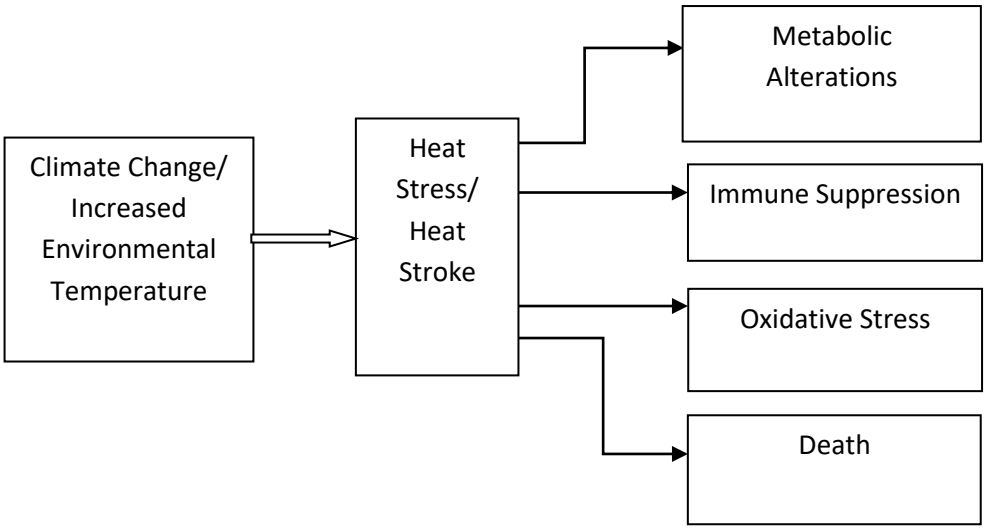

Fig 1 Effect of Climate change on Livestock Life

III. MAIN CONTENTS OF THIS SYSTEM

A. Arduino:

UNO variant of Arduino is used in this system. Arduino is a microcontroller board. It is an open-source electronics platform that contains both hardware and software. We can pre-program this Arduino according to our project. Arduino can read all types of inputs like light on the sensor, finger on the switch, and give output according to them.

B. Temperature/ Humidity Sensor

For measurement of environment temperature a factory-calibrated temperature/humidity sensor is used in this system. LM35DH. The output voltage of this temperature/ humidity sensor is directory proportional to the temperature. This sensor can measure temperature from -55o to +150o C. This sensor is suitable for remote applications.

C. Bluetooth Module

Bluetooth Module is used in this system. By which owner can set the threshold values of low- high temperature and can monitor this using serial Bluetooth terminal android application. It is the communication channel between the owner and the controlling system. It can receive and transmit data.

D. Relay Module

The relay module is interfaced with Arduino/Microcontroller. It works like a switch for Fogger/Mister pump.

E. Power Supply Module

This power supply module is used for operating the Arduino or Embedded System. This power supply module converts 220 Volt AC to 5Volt DC.

F. Fogger/Mister

Fogger and Misters are used in this Temperature based Automatic cooling system of Livestock Sheds and Cattle farm system. Their work is based on evaporative cooling. Water droplets evaporate in warm air its effects like natural cooling.

IV. PROJECT METHODOLOGY

This system is mainly based on Arduino and Temperature Sensor. In this system, the UNO variant of Arduino is used and LM35DH Factory Calibrated Temperature / Humidity sensor is used.

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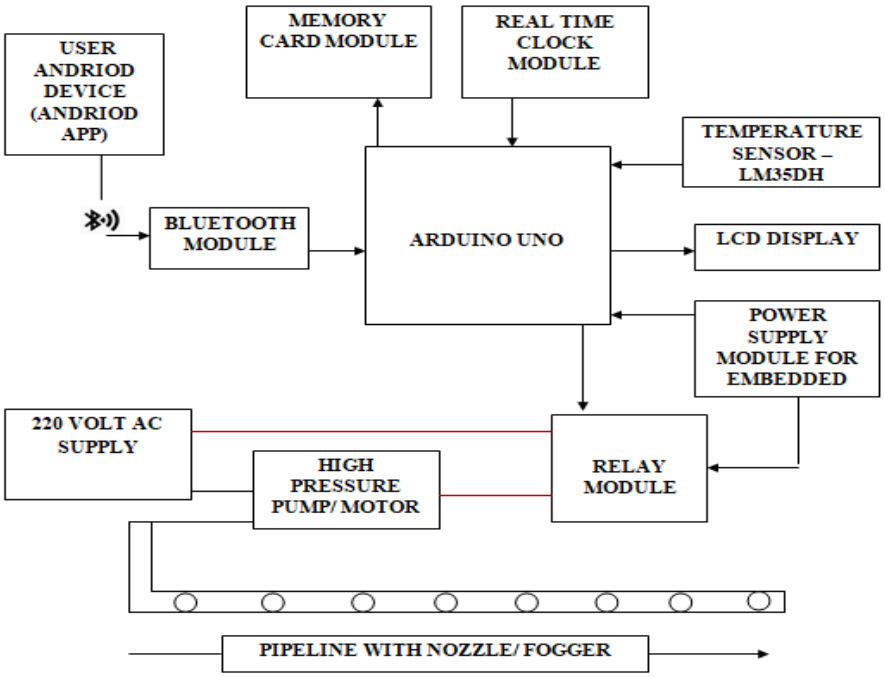

Fig 2 Block Diagram of Proposed System

This temperature sensor measures the temperature and humidity of the environment and livestock/cattle shed and transmit this Analog output of the sensor to Analog to Digital converter module of Arduino. This A/D converter converts this sensor output into digital form and transmits it to Microcontroller. The Real-time clock module and SD card module are also interfaced with a microcontroller. This real-time clock module provides the real date and time. And this SD card module is used to store actual environment temperature and humidity data with real timestamps. Bluetooth module is also interfaced with Arduino. This Bluetooth module is used for communication between the owner and this microcontroller. Users can set threshold values of temperature and humidity using an android app through a Bluetooth module. This android application is also used to retrieve all data with temperature/ humidity and real-time. Owners can also retrieve data from SD card which interfaced with Arduino Board. The Relay module is interfaced with the microcontroller. Relay is acting as a switch for a high-pressure Fogger pump. This Fogger Pump/Motor is powered by 220 Volt Analog Current. This relay is activated by Arduino Uno.

Fig 3 Fogger System in Livestock Shed

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V. WORKING METHODOLOGY

When a temperature sensor measures the environmental humidity and temperature and sends this output to the Arduino module. If the temperature is higher than the set-point or threshold value set by the user then Arduino activates the relay module. And this relay module turns on the high-pressure pump and it turns on Fogger/ Mister. These Foggers and Misters are installed below the roof of the shed/ animal house. Small water droplets the look like fog/mist are produced from Fogger/Misters. These small water droplets evaporate before they reach the surface of the shed. By this, the temperature of the shed and animal house starts decreasing. The shed's temperature reaches the lower set-point of temperature. This sensor captures the temperature and again sends it to the microcontroller module. This time relay turns off the pressure pump. And these pressure pumps turn off the Fogger/Mister. This Fogger system Pipeline is usually made of 20 mm PVC pipe. The thickness of this pipe is 2.5 mm. The Fogger/ Misters are fixed on these pipelines. The distance between each Fogger/Mister should be 8 to 10 ft.

VI. CONCLUSION

In this research work, we have developed Temperature Based Cooling System for Livestock Farms in the Western Region of Rajasthan using Arduino. In this system factory calibrated temperature/ humidity sensor is used for detecting environmental temperature and humidity of the Livestock shed. The sensor is with high accuracy. This system turns on-off fogger automatically. This system can use for a small dairy farm as well as a big dairy farm. This system can replace the manual process of cooling livestock sheds or it may reduce water wastage. This system is useful in those areas where the temperature is very high in summer. This system can reduce the diseases that occur from high heat or heat stress. This system also maintains the milk yields n hot days of summer. Farmers can maintain the quality and quantity of milk using this system. This system is easy to use and reliable. Users can maintain and control temperature set points using an android application through a Bluetooth module which is interfaced with a microcontroller.

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