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Automatic Cooling System for Cow Shed by Using Solar Energy

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Abstract: Advancements in electronics have made devices smaller, cheaper, and faster in recent years. This project aims to control the speed of a fan based on temperature sensors, which are essential in smart home applications. Home appliance fans require manual operation with regulators, which can be time-consuming and uncomfortable. To reduce this effort, the project designs an "Automatic Temperature Controlled" fan. The fan is controlled by heating the sensor, the Thermistor, which is dependent on the temperature of the device. As the temperature increases or decreases, the fan's speed increases or decreases. This can be used for cooling the animal shed or controlling room temperature based on the Thermistor's properties. The Thermistor decreases its resistance with increasing temperature, increasing electrical conductivity and voltage across it. This allows for automatic fan control when the device's temperature varies. Experiments can be conducted to evaluate the efficiency of this circuit, utilizing temperature sensors to save energy and promote efficiency.

Keywords: thermistor, fan speed, temperature sensor

I. INTRODUCTION

High temperatures in summer days are crucial for livestock and cattle health, affecting milk yield and causing health issues. In the north-western area of Rajasthan, high temperatures pose a significant problem for dairy farming, affecting milk yield. To cool livestock, bathing them in ponds or lakes is an easy solution, but this is not possible during summer days.

As farms grow, automation of cattle housing processes, digital systems for process control and management, cow productivity, and climate change become more important factors to consider when choosing a barn design and ventilation system. Barns should be well-constructed and have efficient ventilation systems to create good conditions for animals. In summer, direct sunlight must be controlled, and cows must be protected from cold winter wind, rain, snow, and hot summer sun. Modern farms keep cows in barns year-round, and climate changes pose challenges in creating a good microclimate in cowsheds. Optimizing ventilation intensity is crucial to reduce emissions and ensure a good microclimate in cowsheds.

The ventilation system is crucial for maintaining a good microclimate in a barn, removing excess moisture and gas, and controlling water vapor condensation. The health and productivity of cattle depend on the microclimate. Rising ambient temperature and relative humidity disrupt the animal's thermoregulatory mechanism, causing overheating. To protect animals, reducing relative humidity and increasing air movement through natural or artificial ventilation are essential measures.

The comfortable zone refers to the temperature range where animals can live and reach acceptable production levels. Dairy cows typically live between 40 and 70°F (4.5 and 21°C), with minimal adverse effects until temperatures drop below 5°F (-15°C). The optimal temperature range is 16-18°C. Heat stress in dairy cattle is a major cause of decreased production and fertility. Cows are most productive when temperatures are between 5 and 15°C, with small degrees of production loss occurring between 15 and 25°C. Excessive temperatures can lead to significant production losses.

A. Objectives:

- To understand the basic principal of the our project
- Describe the construction and working of various parts of our project
- Development of the working model of the our project
- To reduce time spent on this activity.
- To analyze the technology according to needs and capabilities.

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B. Problem Definition

In the animal shed higher temperature in the summer season there we have need the temperature controlling in automatically.

C. Scope of Study

- It is economical and easy to handle
- It can be used to control the temperature of devices, rooms, electronic components, etc
- It is easy to install in heat dissipating devices to cool them down
- Saves energy by turning off fan automatically at room temperature.

II. LITERATURE REVIEW

Temperature is a fundamental quantity that reflects the level of hotness or coldness of matter. It is important for everyone to know their body temperature and ambient temperature, as it reveals microscopic information about matter. Temperature is an ever-changing parameter due to exposure to various stimuli from their environment. When measuring temperature in a system or confinement, it is crucial to avoid generating heat from the measuring instrument. In some cases, heat from the instrument can cause a temperature gradient, causing the measured temperature to differ from the actual temperature. The most commonly used thermometer is the Analogue Liquid-in-glass.

The circuit focuses on a microcontroller-based automated temperature controller system, replacing analog and digital electronic circuits. The microcontroller is a versatile system that can be programmed and reprogrammed at any time, making it ideal for controlling various activities within the circuit. This technology is rapidly replacing traditional electronic circuits.

Microcontrollers are increasingly used in various products, including motor cars, watches, mobile phones, robots, and measuring instruments. The AT89C52 Microcontroller IC, part of the 8051 family, is the core of this design. The 8051 family is optimized for embedded control systems, making them suitable for temperature control and monitoring. It is used to achieve automatic power ON and OFF switching systems based on preset values. For heating and cooling electrical systems, automatic temperature monitoring, display, and control sub-circuits are desirable to regulate temperature within a preset value or range. For example, a sub-circuit can switch a relay OFF at 00C and ON at 40C, and then power a refrigerator compressor when the evaporator temperature cools down to 0^0C.

The temperature controller aims to utilize microcontroller and embedded systems to monitor and control the temperature of electrical cooling or heating systems. It uses a 40C sensor and energizes a relay to power the compressor, ensuring the refrigerator maintains the temperature range. The system also features a digital display of measured temperature values, transforming the world from analogue mercury-in-glass thermometers to modern digital thermometers, allowing instrumentation to keep up with technological advancements.

Kyi Kyi Khaing and et al., (2020), presented the Automatic temperature control system is an important application used in almost all modern gadgets and smart homes. The system for controlling temperature automatically is achieved by using Arduino Uno-based microcontroller system. Arduino Uno due to its increased popularity finds its varied range of applications. Temperature sensor LM35 and Arduino Uno are the hardware used interfaced with computer, and the temperature is controlled in the room. Temperature is displayed on LCD display employing A1 pin of hardware with the help of analog pin utilizing pulse width modulation (PWM). We have designed temperature control as an automatic system that has been not attempted before the way it has been implemented.

III. SYSTEM DESIGN

System design deals with the formation of an arrangement required to get desired output or performance from the system. This includes design and constructional details for the same. There is variety of components used for development of this system. However, in this chapter we are going to highlight uncommon components only.

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D. Proposed System

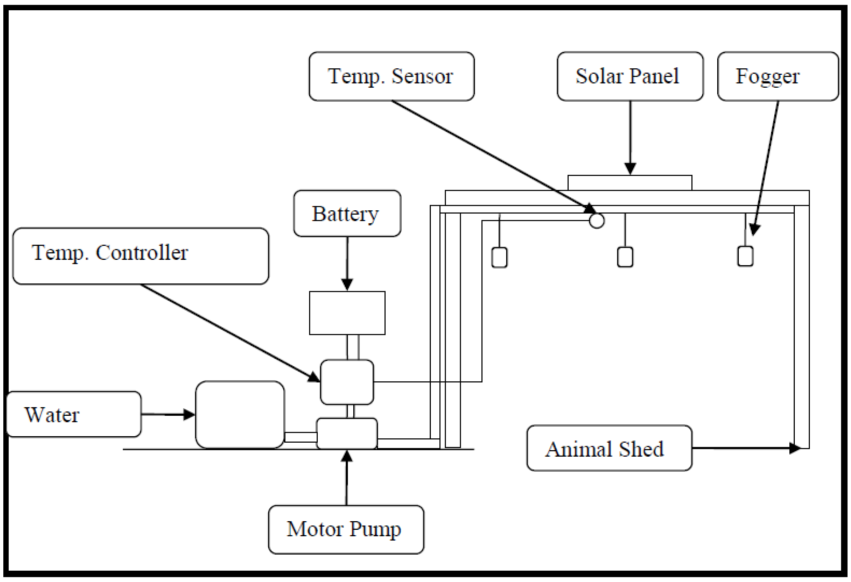

Figure 1: System Design

E. Constructional Details

The list of components is as follows;

- PMDC Motor Pump
- Fogger
- Wires
- Solar Panel
- Battery
- MS Pipes for Structural Fabrication
- Temperature Controller Circuit
- Thermistor
- Drip Pipe
- Digital Thermometer

F. Working

The LM358 Op Amp circuit is a comparator that measures voltage levels at Pins 2 and 3, producing a relevant output. Pin 3 (IN+) is the non-modifying input, connected to the THERMISTOR Temperature Sensor, while Pin 2 (IN-) is the inverting input, and connected to a potentiometer. The output is LOW, connected to transistor BC547, ensuring the circuit remains turned off. When the temperature increases, the output of the Temperature Sensor increases. If the temperature reaches a certain threshold, the non-inverting input of the Op Amp becomes higher than that of the non-inverting input and as a result.

G. Material and Methodology

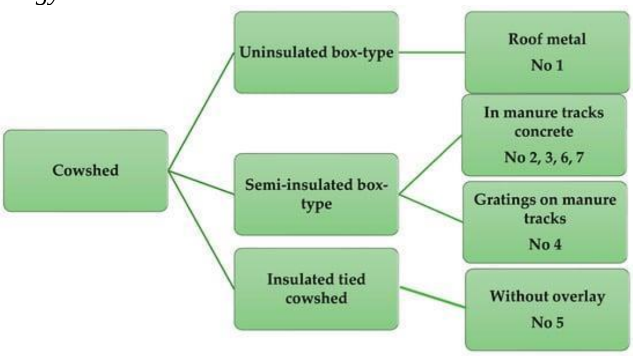

Figure 2: Technological structure of most popular cowsheds Lithuania

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Cowsheds are boxed, boxed, and equipped with insulation, manure removal, and microclimate formation systems. Some cowsheds have fans, while others have air humidification.

IV. TYPES OF COWSHED

H. Un-insulated box-type

Figure 3: Un-insulated Box Type Cowshed

The walls and roof of the barn are not insulated; the roof is covered with tin. The barn is equipped with a ridge slit ventilation system. Air enters the barn through cracks in the walls covered with netting, removed through a crack installed in the ridge. Air circulation is controlled by changing the area of cracks in the walls.

I. Semi-insulated Cowshed

Figure 4: Semi-insulated Cowshed

The roof of the barn is insulated, the walls are 1.2 reinforced concrete structures, and above it is covered with netting and 6 mmm thick polycarbonate panels. Air circulation is controlled by changing the area of cracks in the walls and the area off cracks in the ridge.

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J. Insulated Tied Cowshed

Figure 5: Insulated Tied Coeshed

The barn is insulated, without overlap. The barn is equipped with a natural ventilation system, clean air flows through the cracks in the walls and is removed through the crack in the barn ridge. Ventilation intensity is controlled by hanging the areas in the air supply crack walls and the crack rid.

V. RESULT AND DISCUSSION

K. Observation Table:

Initial Temperature: 37.2 ˚C

Start Time: 01:00 PM

Sr. No.	Fogger (Quantity)	Time (Min.)	Temperature (˚C)
01	1	10	37.2
02	1	20	33.2
03	1	30	29.4
04	1	40	26.3

Note: Reading for only one fogger

- Water consumption per fogger is 900 to 1000 ml per 5 (five) min.
- Area covered per fogger is 5 × 5 sqft from the center of fogger.
- Height of Fogger : 9 ft

VI. FUTURE SCOPE

The project has covered almost all the requirements. Further requirements and improvements can easily be done since the as per requirements is mainly structured or modular in nature. Improvements can be appended by changing the existing modules.

VII. CONCLUSION

In this research work, we have developed Temperature Based Cooling System for Livestock Farms. 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. We have designed a simple method of temperature control system automatically. Utilizing the concept cooling after certain temperature, the work is focused mainly on temperature control, and no other parameter is involved. This seems to be robust way of handling only temperature control on automatic basis.

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