International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

IoT Based Fogger System for Dairy Farming

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ABSTRACT: -

This Paper Presents The productivity and health of dairy cow are highly sensitive to environmental conditions, particularly heat stress caused by high temperatures and humidity. Traditional cooling methods often lack the efficiency and automation required for modern, large-scale dairy farms. This research presents the development and evaluation of an IoT-Based Fogger System for dairy farming designed to monitor and regulate barn temperature using real-time environmental data. The system integrates temperature and humidity sensors, an ESP8266 microcontroller, a relay-controlled fogger unit, and a wireless interface for remote control and monitoring. When the sensed temperature exceeds a predefined threshold (e.g., 30°C), the fogger is automatically activated, providing evaporative cooling to reduce heat stress in the animals.

Keywords— Fogger System; Dairy Farming; IoT; NodeMCU.

1. INTRODUCTION

In recent years, the dairy industry has faced increasing challenges due to rising global temperatures and climate variability. Heat stress in livestock, particularly in dairy cow, has emerged as a critical issue, significantly affecting animal welfare, milk production, and farm profitability. Traditional cooling methods, such as fans and manual sprinklers, often fall short in delivering consistent and efficient cooling, especially in large-scale dairy operations.

This calls for the integration of smart and automated technologies to maintain optimal environmental conditions within cow shade.

The Internet of Things (IoT) has opened new opportunities for automation and intelligent monitoring in agriculture. An IoT-Based Fogger System for dairy farming is made of sensors, microcontrollers, and wireless communication to create an automated, responsive cooling mechanism. By continuously monitoring environmental parameters such as temperature and humidity, the system can autonomously activate fogger to initiate evaporative cooling when heat stress conditions are detected. Moreover, real-time data collection and remote control capabilities via mobile or web interfaces empower farmers with improved decision-making and operational efficiency.

This Paper explores the design, implementation, and performance evaluation of an IoT-based fogger system used for dairy farming applications. The system aims to reduce heat stress in cow, enhance milk productivity, and demonstrate the potential of IoT technologies in transforming traditional farming practices into smart, sustainable operations.

2. LITERATURE REVIEW

Investor interest in IoT-based diary farms has recently increased in hopes of improved and more profitable results that track the health of the cows. IoT helps in making accurate judgments, saving time and energy that would have been wasted on human and machine error, according to research by Sanjay Mate et al. [1]. Dairy farming is accepted by the agriculture-related sector in several nations. It illustrates how the monitoring and control of the IoT-based shed system will either improve or worsen the health of the cows, which is indicative of the expansion of the cow milk industry and related sectors.

According to Shanthi Kuchibhatla et al.'s research, the government needs to take the initiative to support dairy farming as a significant industry [2].

According to study by N. Akhila et al. [3], dairy farming is not only an additional livelihood for some people; for others, it is their primary source of income and sustenance. Dairy products are vital to farmers in India's rural areas, but severe droughts and climate change have reduced milk production in Tamil Nadu due to ongoing rainfall reductions. Dairy animals' reproductive and productive performance depends on their surroundings; give them a good home and feed them well to boost milk output.

According to a different study by Rehman Habib Ur et al. [4], the dairy industry is one of the sectors most impacted by climate change. Temperature and humidity have a significant impact on the dairy industry. Environmental stress has an impact on the health of dairy animals as well as the decline in milk output. Heat stress is a major factor in the decline of lactating dairy cow fertility.

According to a study by Prathap Pragna et al. [5], high temperatures and humidity can have a negative impact on cows' feed intake, which in turn can decrease their ability to reproduce and, eventually, lower milk output. In addition to lowering milk output, milk quality will also decline. It was determined that heat stress had a negative effect on both the amount and quality of milk.

According to a study by Sumitra Goswami et al. [6], the northwestern part of Rajasthan has summer temperatures that can vary by up to 30°C, which has an impact on the health of the animals and their ability to produce milk. Numerous strategies have been implemented to prevent this type of climate issue. This is prevented by employing technologies like IOT, wireless sensors, and integrated sensors. In this Arduino-based temperature-based cooling system for livestock and cow farms in western Rajasthan, a wireless temperature sensor measures the ambient temperature of the livestock shed. If the temperature rises, the fogger cooling system activates, and if it falls, it automatically shuts off.

Siqabukile Ndlovu and Sindiso M. Nleya, among others [7] The demand for dairy products is rising as a result of the world hunger crisis. The number of sensors, Internet of Things (IoT), broadband technologies, etc., is growing significantly in order to address this issue and develop new technologies and solutions. The creative solution will enhance the dairy process in addition to increasing milk production.

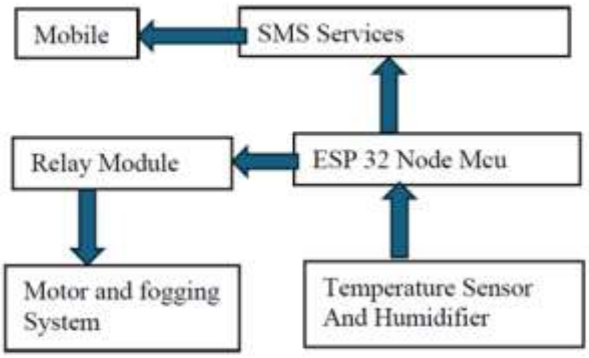
The sprinkler and fan system developed by Roshan Kumar Bhuradia et al. [8] lowers the animals' body temperature and promotes their typical behavior.

According to research by Muhammad Osama Akbar et al. [9], there has been a rise in the demand for milk and milk products since 2015. Farmers must contend with the global market and meet the growing demand for milk. In order to compete in the global market, smart dairy farms and IOT technology are essential for enhancing milk output, addressing cow health concerns, and managing climate variables like temperature and humidity.

G. Rajeshkumar et al. [10] highlight that traditional analog switches require physical presence to operate home appliances like lights and fans. This often leads to energy wastage when users forget to switch them off. Their proposed system enables remote control of appliances using a smartphone via the internet, reducing human effort, saving time, and improving energy efficiency—especially useful in places like dairy farms.

3. METHODOLOGY

Figure 1: Block diagram of methodology



Main contents of the project

1. ESP 8266 Node MCU: The system's NodeMCU enables wireless monitoring and control of the fogger system through a mobile app or online interface. By connecting to the Wi-Fi network, it provides the operator with real-time sensor data, such as temperature. The NodeMCU automatically activates the fogger system when the temperature rises above 30°C. In order to provide simple management and effective operation of the cooling system for the cow, the operator can also manually turn the fogger on or off and remotely check the system's status.

Figure 2: ESP 8266 Node MCU

2. Temperature and Humidity Sensor: The system's temperature sensor will keep an eye on the room's or barn's overall temperature while the cows are kept there. The sensor will detect a temperature increase of more than 30°C and instantly activate the fogger system. To do this, the system is set up to turn on automatically when the sensor detects a temperature threshold of 30°C or greater.

Figure 3: Temperature and humidity Sensor (DTH 11)

3. Relay: In this project, the relay is managed by the Node MCU and functions as a switch. The Arduino signals the relay to turn on the high-pressure pump or fogger when the temperature sensor indicates that the temperature has risen above the predetermined threshold. The relay enables the ESP 8266 to use a low-power signal to control high-power devices, such as the fogger. The relay stops the cooling operation by turning off the fogger when the temperature falls below the predetermined point.

Figure 4: Relay

4. Power Adapter 12V : A 12V charger is used to power various components in an IoT-based fogger system for Dairy farming, ensure stable and efficient operation. It provides the required DC voltage to run the ESP32 NodeMCU, relay modules, sensors, and the fogger unit (if compatible with 12V). The charger converts AC mains power (220V or 110V) into 12V DC, delivering a steady power supply for reliable system performance.

Figure 5: 12V Power adapter

5. Fogger : The Fogger system operates using evaporative cooling, where tiny water droplets are dispersed into the warm air. As these droplets evaporate, they absorb heat from the surrounding environment, creating a cooling effect similar to a traditional air cooler.

In this setup, the fogger is activated automatically when the temperature sensor detects a temperature exceeding 40°C.

Figure 6: Fogger Device or Mist device

6. Water Motor: This is a 12V DC diaphragm water pump, commonly used in agricultural spraying, water transfer, and IoT-based automation systems such as foggers and irrigation. The pump operates on 12V DC (nominal 9-14V) with a 1A current draw. It has a flow rate of 5 liters per minute (LPM) with an automatic cutoff feature. This means it shuts off when the pressure reaches its limit, preventing damage and ensuring efficient operation

Figure 7: Water Motor

7. BLYNK: Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, vizualize it and do many other cool things.

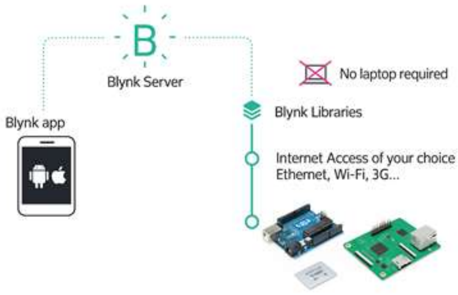


Figure 8: BLYNK Interface

4. Circuit Diagram

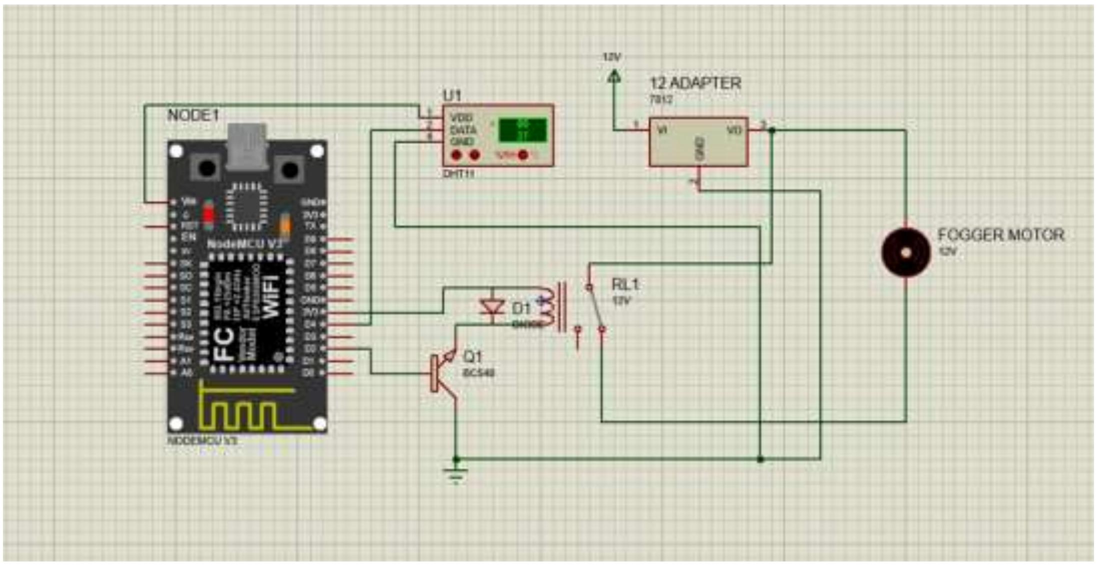


Figure 9: Circuit Diagram of Iot Based Fogger System for Dairy Farming

This circuit diagram represents an IoT-Based Fogger System for dairy farming designed to regulate humidity levels using a NodeMCU ESP8266, a DHT11 temperature and humidity sensor, a relay module, and a 12V fogger motor. The system is powered by a 12V adapter, which supplies power to the relay, motor, and other components. The NodeMCU serves as the central controller, processing sensor data and triggering the relay to control the fogger motor.

The NodeMCU (ESP8266) is responsible for reading humidity and temperature data from the DHT11 sensor. The sensor has three primary connections: VDD (power), DATA (signal output), and GND (ground). The VDD is connected to 3.3V from NodeMCU, DATA is connected to D2 (GPIO4) for communication, and GND is connected to the common ground. The sensor continuously measures environmental conditions and sends the data to the NodeMCU, which determines whether the fogger motor needs to be activated.

To control the fogger motor, a relay module (RL1) is used. Since the NodeMCU operates at 3.3V logic, it cannot directly switch the 12V relay.

Therefore, a BC548 transistor (Q1) is used as a switching device. The base of the transistor is connected to D4 (GPIO2) of NodeMCU through a current-limiting resistor. The collector is connected to one side of the relay coil, while the emitter is grounded. When NodeMCU sends a HIGH signal to the transistor, it allows current to flow through the relay coil, energizing it and closing the normally open (NO) contacts, which completes the circuit for the fogger motor.

The relay's common (C) terminal is connected to the 12V power supply, and the normally open (NO) terminal is connected to one terminal of the fogger motor. The other terminal of the fogger motor is connected to the ground. When the relay is activated, the motor receives 12V power and starts generating fog to increase humidity. To protect the circuit from voltage spikes caused by relay switching, a diode (D1) is placed across the relay coil in a flyback configuration.

The system is powered by a 12V adapter, which supplies power to the relay, fogger motor, and other components. A 12 voltage regulator ensures that a stable 12V output is provided to the relay and motor. This regulated power prevents fluctuations that could affect the performance of the fogger system.

The working principle of this system is simple: the NodeMCU continuously monitors humidity levels using the DHT11 sensor. When the humidity level drops below a predefined threshold, the NodeMCU sends a HIGH signal to the transistor Q1, which activates the relay. This, in turn, powers the fogger motor, increasing humidity. Once the humidity level reaches the desired threshold, the NodeMCU turns OFF the relay, stopping the fogger motor.

5. Flowchart

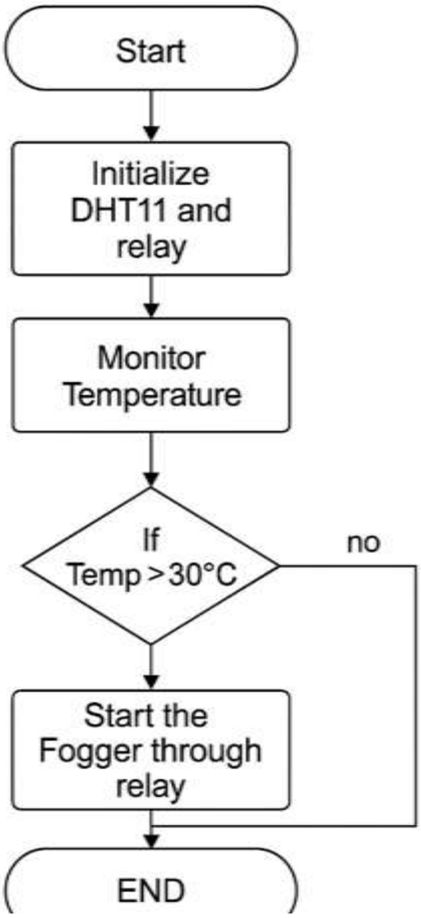


Figure 10: Flowchart of IoT Based Fogger System For Dairy Farming

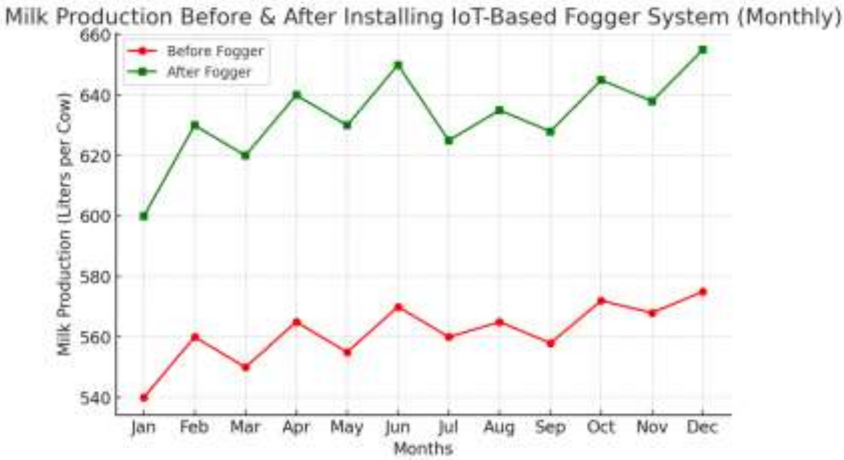
6. Algorithm

- Start: The process begins.
- Initialize DHT11 and Relay: The system initializes the DHT11 temperature and humidity sensor along with the relay module.
- Monitor Temperature: The system continuously reads the temperature data from the DHT11 sensor.
- Decision Making (If Temp > 30°C?):
- If the temperature is greater than 30°C, the system activates the fogger by turning on the relay.
- If the temperature is 30°C or below, the system continues monitoring without activating the fogger.
- Start the Fogger through Relay: When the condition is met (temperature >30°C), the relay module is triggered, activating the fogger to reduce heat via evaporative cooling.
- End: The process concludes, but in real applications, this would be a continuous loop to monitor temperature and control the fogger accordingly**.**

7. Results:-

1. Preventing dehydration and discomfort in cows.
2. **Increased Milk Production** – Helps cows stay cool, leading to a **10-20% increase in milk yield** by reducing heat-related productivity losses.
3. **Energy & Water Efficiency** – Uses **15-25% less energy and water** than traditional cooling methods by activating only when necessary.
4. **Automated Monitoring** – IoT sensors continuously monitor **temperature and humidity**, ensuring foggers activate at precise conditions for efficient cooling.
5. **Improved Animal Welfare** – Keeps cows **calm, comfortable, and healthy**, reducing stress-related diseases and improving overall farm performance.

➢ Graphical Represntation of Milk Production Data (Liters per Cow per Month)



➢ **Actual Circuit**

Figure 11: Actual Circuit

Figure 12: Actual Shed and Fogger System

8. Conclusions :-

IoT-Based Fogger System for dairy farming system is a revolutionary advancement in dairy farming that enhances cow comfort, increases milk production, and optimizes resource utilization. By integrating real-time temperature and humidity monitoring with automated cooling mechanisms, the system effectively reduces heat stress, which is a major concern in dairy farms, especially in hot climates. Traditional cooling methods often rely on manual operation and excessive resource consumption, leading to inefficiencies and high cost.

Automates the cooling process, ensuring water and energy are used only when necessary. This leads to significant cost savings while maintaining a stable and comfortable environment for the livestock. Ultimately, this system improves farm productivity and contributes to sustainable and smart dairy farming practices.

To maximize the benefits of an IoT-based fogger system for Dairy Farming, proper installation and maintenance are essential. Farmers should ensure that the temperature and humidity sensors are calibrated correctly and positioned optimally within the barn. Additionally, regular cleaning and maintenance of the fogger nozzles and water supply system can prevent clogging and ensure efficient misting. For better control, integrating AI-based predictive analytics can help anticipate weather changes and adjust fogger operation proactively. Furthermore, adopting solar-powered fogger systems can enhance energy efficiency, reducing reliance on conventional electricity sources and making the system even more cost-effective and eco-friendly.

IX. **References:**

1. Sanjay Mate1,Vikas Somani , Prashant Dahiwale, [Intelligent System for Cow Monitoring: A Smart Housing for Dairy Animal using IoT],Research Scholar, Sangam University Bhilwara and Dept. of Information Technology,Government Polytechnic Daman, India

2. Shanthi Kuchibhatla, Muskan Banu,Shaista Taskeen, Shama begum, Samreen Sultana, Geethanjali Karli,"Dairy Farming – a Case Study"5UG - Biotechnology, Indira Priyadarshini Govt. Degree College for Women(A), Nampally, Hyderabad, Telangana, India.1,6Associate Professor, Biotechnology, Indira Priyadarshini Govt. Degree College for Women(A), Nampally, Hyderabad, Telangana, India. ,e ISSN: 2584-2854 Volume: 02 Issue: 01 January 2024, Page No: 16-19.

3. N Akila and M Jothi Lakshmi,"Interventions to sustain dairy production and productivity in changing climate of Namakkal district, Tamil Nadu",Indian J Dairy Sci 73(4): 371-375,Received: 16 April 2020 / Accepted: 24 June 2020 / Published online: 10 September 2020. Indian Dairy Association (India) 202

4. Rehman Habib Ur , Kakar Asmat ullah , Kakar Niamat ullah , Rehman Fazal ur , Khan Deedar Ahmed , Ahmed Sarfaraz Khan and Ahmed Shakeel ,"Detrimental characteristics of climate change on livestock production and reproduction",World Journal of Advanced Research and Reviews, 2020, 05(03), 114–123.

5. Prathap Pragna,P.R. Archana, Joy Aleena, Veerasamy Sejian, Govindan Krishnan, Madiajagan Bagath, A. Manimaran, V. Beena, E.K. Kurien, Girish Varma and Raghavendra Bhatta,"Heat Stress and Dairy Cow: Impact on Both Milk Yield and Composition",International Journal of Dairy Scienc, Indian Council of Agricultural Research, National Institute of Animal Nutrition and Physiology, Adugodi, 560030 Bangalore, India.

6. Sumitra Goswami1 "Implementation of Automatic Cooling System for Cow Shed and Its Effect on Milk Production",Teaching Asso., Engineering & Technology Centre for Animal Sciences, RAJUVAS, Bikaner, Rajasthan Corresponding author e-mail : summy_15@yahoo.co.in,Paper Received on March 16, 2021, Accepted on April 17, 2021 and Published Online on May 01, 2021.
7. Sindiso M. Nleya and Siqabukile Ndlovu,"Smart Dairy Farming Overview: Innovation, Algorithms and Challenges"
8. Roshan Kumar Bhuradia, Navav Singh, Sanjita Sharma,Sanjay Choudhary, Nischay Singh, Gireesh Joshi and Anita Kavia1,"Effect of sprinkler with fan on growth, physiology and behaviour of Murrah buffalo calves",Indian J Dairy Sci 76(1): 78-83,Received: 27 June 2022 / Accepted: 17 October 2022 / Publishe online: 20 February 2023 Indian Dairy Association (India) 2023.
9. Roshan Kumar Bhuradia, Navav Singh, Sanjita Sharma,Sanjay Choudhary, Nischay Singh, Gireesh Joshi and Anita Kavia1,"Effect of sprinkler with fan on growth, physiology and behaviour of Murrah buffalo calves",Indian J Dairy Sci 76(1): 78-83,Received: 27 June 2022 / Accepted: 17 October 2022 / Published online: 20 February 2023 Indian Dairy Association (India) 2023.
10. G. Rajeshkumar, P. Rajesh Kanna, S. Sriram, S. Sadesh, R. Karunamoorthi, and Prasad Mahudapathi,"Home Automation System Using Nodemcu (ESP8266)",The Author(s), under exclusive license to Springer Nature Singapore Pte Ltd. 2023.