

**FACULTAD DE INGENIERÍA**

Escuela Académico Profesional de Ingeniería Mecatrónica

Tesis

**Design of a Thermal Control System for Stables in  
Rural Areas of Peru**

Joseph Junior Rojas Vila  
Sandra Fiorella Dionisio Ilactahuaman  
Sario Angel Chamorro Quijano  
Roberto Belarmino Quispe Cabana  
Mohamed Mehdi Hadi Mohamed

Para optar el Título Profesional de  
Ingeniero Mecatrónico

Huancayo, 2024

**INFORME DE CONFORMIDAD DE ORIGINALIDAD DE TESIS: EN FORMATO  
ARTÍCULO CIENTÍFICO**

**A** : Dr. Felipe Néstor Gutarra Meza  
Decano de la Facultad de Ingeniería

**DE** : Ma. Roberto Belarmino Quispe Cabana  
Asesor de tesis en formato artículo científico

**ASUNTO** : Remito resultado de evaluación de originalidad de tesis en formato artículo científico

**FECHA** : 16 de Enero de 2024

---

Con sumo agrado me dirijo a vuestro despacho para saludarlo y en vista de haber sido designado asesor de la tesis en formato artículo científico titulada: "Design of a Thermal Control System for Stables in Rural Areas of Peru", perteneciente al/la/los/las estudiante(s) Joseph Junior Rojas Vila, de la E.A.P. de Ingeniería Mecatrónica; se procedió con la carga del documento a la plataforma "Turnitin" y se realizó la verificación completa de las coincidencias resaltadas por el software dando por resultado 11 % de similitud (informe adjunto) sin encontrarse hallazgos relacionados a plagio. Se utilizaron los siguientes filtros:

- Filtro de exclusión de bibliografía SI  NO
- Filtro de exclusión de grupos de palabras menores (Nº de palabras excluidas: 1 ) SI  NO
- Exclusión de fuente por trabajo anterior del mismo estudiante SI  NO

En consecuencia, se determina que la tesis en formato artículo científico constituye un documento original al presentar similitud de otros autores (citas) por debajo del porcentaje establecido por la Universidad.

Recae toda responsabilidad del contenido la tesis en formato artículo científico sobre el autor y asesor, en concordancia a los principios de legalidad, presunción de veracidad y simplicidad, expresados en el Reglamento del Registro Nacional de Trabajos de Investigación para optar grados académicos y títulos profesionales – RENATI y en la Directiva 003-2016-R/UC.

Esperando la atención a la presente, me despido sin otro particular y sea propicia la ocasión para renovar las muestras de mi especial consideración.

Atentamente,

**La firma del asesor obra en el archivo original**  
(No se muestra en este documento por estar expuesto a publicación)

## DECLARACIÓN JURADA DE AUTORÍA

El presente documento tiene por finalidad declarar adecuada y explícitamente el aporte de cada estudiante en la elaboración del trabajo de investigación a ser utilizado para la sustentación de tesis: formato de artículo científico.

Yo: Joseph Junior Rojas Vila, con Documento nacional de identidad (DNI) N° 71541446; teléfono 927681659; estudiante de la Escuela Académico Profesional de Ingeniería Mecatrónica.

Yo: Sandra Fiorella Dionisio Llactahuaman, con Documento nacional de identidad (DNI) N° 72911758; teléfono 965445424; estudiante de la Escuela Académico Profesional de Ingeniería Industrial.

Yo: Sario Angel Chamorro Quijano, con Documento nacional de identidad (DNI) N° 72721011; teléfono 933415801; estudiante de la Escuela Académico Profesional de Ingeniería Mecatrónica.

Yo: Roberto Belarmino Quispe Cabana, con Documento nacional de identidad (DNI) N° 09612760; teléfono 964536385; docente investigador de la Facultad de Ingeniería.

Yo: Mohamed Mehdi Hadi Mohamed, con Documento nacional de identidad (DNI) N° 42433010; docente investigador de la Facultad de Ingeniería.

Ante Usted, con el debido respeto me presento y expongo:

Declaramos que hemos participado en la ideación del problema, recolección de datos, elaboración y aprobación final del artículo científico.

**La firma del autor y del asesor obra en el archivo original**

**(No se muestra en este documento por estar expuesto a publicación)**

# Design of a Thermal Control System for Stables in Rural Areas of Peru

---

## ORIGINALITY REPORT

---

<b>11</b> %	%	<b>11</b> %	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

---

## MATCH ALL SOURCES (ONLY SELECTED SOURCE PRINTED)

---

4%

★ Yoel Heinrich Chavez Paucarcaja, Stephany Rosales Astuhuaman, Luis Alexis Charapaqui Esplana, Giovane Perez Campomanes et al. "Design of a Control System for Energy Monitoring in Hydroelectric Power Plants with a Pumping System", 2022 International Conference on Mechanical Engineering and Power Engineering (MEPE), 2022

Publication

---

Exclude quotes  On

Exclude matches  < 1 words

Exclude bibliography  On

# Design of a Thermal Control System for Stables in Rural Areas of Peru

Joseph Junior Rojas Vila  
Department of Mechatronic Engineering  
Universidad Continental  
Huancayo, Perú  
71541446@continental.edu.pe

Sandra Fiorella Dionisio Llactahuaman  
Department of Industrial engineering  
Universidad Continental  
Huancayo, Perú  
72911758@continental.edu.pe

Roberto Belarmino Quispe Cabana  
Department of Mechanic Engineering.  
Universidad Continental  
Huancayo, Perú  
rquispe@continental.edu.pe

Mohamed Mehdi Hadi Mohamed  
Department of Civil Engineering  
Universidad Peruana Los Andes  
Huancayo, Perú  
d.mhadi@upla.edu.pe

Sario Angel Chamorro Quijano  
Department of Mechatronic Engineering  
Universidad Continental  
Huancayo, Perú  
72721011@continental.edu.pe

**Abstract**— This research presents the design of a system for temperature control with intelligent and automated systems for the final temperature balance that occurs between the body temperature of cattle and that of the environment in rural areas. The development of the project shows a remote control based on IOT for the control and monitoring of the temperature in the stables, composed of sensors, heat transmission ducts. It consists of 3 stages that are the reception of biogas, the validation and finally the distribution of heat, additionally a control panel was added to the heater for safety.

The design and control of the proposed system shows self-sustainability due to the fact that for the charging of electronic devices it has solar panels and for thermal energy the biogas produced by a biodigester is used, providing improvements in the livestock areas that are in rural areas through the use of renewable energy, reducing pollution and reducing the mortality of livestock species in these areas of Peru.

**Keywords**— Cold, renewable energies, automation, dead cattle, animals.

## I. INTRODUCTION

The world population is increasing with this, the need for resources such as food increases, for this the animals have an indispensable role either with the consumption of meat directly or its derived products, these animals suffer different health problems until they reach the mortality produced. by food, natural and induced exogenous factors. Given this, the exogenous factor on hypothermia will be evaluated in cattle evaluated in Peru that are in rural areas [1] [2].

Currently there are different ways to preserve animal life, for example, for the management of chicken breeding, a system was created capable of monitoring the climatic conditions of the environment, including temperature, humidity, climate quality using microcontroller and microcomputer technology [3]. In the case of stables, there is an intelligent stable control system, which monitors and controls various environmental factors in a stable and reliable manner, including variables such as temperature, humidity, etc.; making use of sensors and a controller STM32F103 [4].

Taking temperature as the main factor, there are studies such as the distribution of temperature for chicken coops through thermal

energy, using incandescent bulbs [5], a microclimate control system was also developed in a cattle barn. Focused on optimal reproductive conditions and guaranteeing the life safety of calves and cows. All this by performing analysis and automated regulation of microclimatic parameters by means of a PLC [6].

In the aspect of automation and IOT communication, they present a research for an animal farm using IOT technology, whose objective was to operate and monitor the farm remotely. The system makes use of microcontrollers, level, distance, gas, temperature and humidity sensors connected with internet connectivity [7]. In another study, it reveals an intelligent system for the automation and monitoring of poultry farms, in order to maintain the best environmental conditions with the minimum of human effort. Making use of hardware and software, which allows to control environmental parameters (temperature, water level, smoke, gas) automatically. The system encompasses a series of sensors, all interconnected with a raspberry pi, to control and monitor all the data [8] to convert a smart poultry farm, GSM and IOT were used, allowing the storage of data such as environmental factors through of IOT, whose real-time features allow preliminary steps to be taken before any danger occurs. This system provides real-time protection of the farm, notifying the farmer, notifying him constantly [9].

The use of microcontrollers is a quick solution to monitor and control as it happened in a system that monitors and controls a smart farm using Arduino and DC monitors. Since the lights in the farms use artificial light and have a high cost, that is why in this article a system has been proposed to control the amount of light input using the angle control of the reflector for which the monitoring will be carried out. . To the environmental information, temperature, humidity, carbon dioxide and light value to achieve an optimal intelligent agricultural environment [10], a solution to the cooling system that is used in the heating system in poultry farms was also identified, since a problematic evaporative cooling system is crucial for animal welfare. The objective of this study is an intelligent notification system that monitors the operation of the fans in the evaporative cooling system [11].

In pig and poultry farms that are located in remote areas, techniques such as making use of the digital twin are used, that is, a digital replica of the real world, whose purpose is to improve the