BINDURA UNIVERSITY OF SCIENCE EDUCATION

ELECTRONIC ENGINEERING DEPARTMENT

(BSc) Degree in Electronic Engineering

FINAL YEAR PROJECT

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE BACHELOR OF SCIENCE DEGREE IN ELECTRONIC ENGINEERING

Student Name: Kudakwashe Tandare

Registration Number: B190423B

Project Title: Automated Poultry Farming System

Project Supervisor: Mr Takawira

RELEASE FORM

NAME OF STUDENT: KUDAKWASHE BERES TANDARE

PROJECT TITLE: AUTOMATED POULTRY FARMING SYSTEM

DEGREE TITLE: ELECTRONIC ENGINEERING

YEAR OF COMPLETION: 2024

Permission is hereby granted to BINDURA UNIVERSITY OF SCIENCE EDUCATION to produce single copies of this project and lend or sell copies for private, scholarly or scientific purpose only. The author does not reserve other publication rights for the project nor may extensively extracts from it be printed or otherwise reproduced without the authors written permission

SIGNED:…………………Tandare…………………………………………………………………..

AUTHORS ADDRESS : **239th Street, Stand Number 6473**

Western Triangle

Highfield

Harare

APPROVAL FORM

PROJECT TITLE: AUTOMATED POULTRY FARMING SYSTEM

The undersigned certify that they have read this project and have approved its submission to the department for marking after confirming that it confirms with departmental requirements.

STUDENT'S SIGNATURE……Tandare……………………………………………………

SUPERVISOR'S SIGNATURE……………………………………………

CHAIRPERSON'S SIGNATURE____________________(P.P)

DECLARATION FORM

I, Kudakwashe Beres Tandare declare that this is my work and has not been copied or lied from any source with out acknowledging the source.

Signed……Tandare……………………

Date……24/10/04……………………

Table of Contents

i. Abstract

Nowadays, the industrial revolution is changing many aspects of life, including how to keep animals. The development of modern breeding methods for broilers is by using closed-house system innovations. This system has several advantages, including temperature and humidity which must be maintained for broilers. In addition, to temperature and humidity, the broiler brooding systems also need to be controlled because it will improve the quality of the broilers. It is caused by the utilization of the majority of conventional feeding systems. Therefore, this research will develop a prototype of an automated poultry farming system for the closed-house system that is affordable for conventional chicken farmers.

ii. Acknowledgements

I would like to express my utmost sincere gratitude to my supervisor Mr Takawira for seeing me through this whole project. He would give me eye-opening advice on how to tackle this project correctly so that the whole process becomes a success. I also thank my classmates for the encouragement they gave me to work tirelessly to finish the project at the right time. Last but not least I would also like to thank my parents for the unwavering financial and spiritual support they have been giving me.

CHAPTER 1: INTRODUCTION

1.1 Background

It is critical for poultry farmers to provide suitable shelter for the birds, allowing them to grow and perform at their best. The key to achieving the best possible control of their production process is to automate and monitor how they grow.

Poultry farming is the process of raising domesticated birds such as chickens, ducks, turkeys, and geese for purposing of farming meat for food. Brooding is the period immediately after hatching when special care attention must be given to chicks to ensure their health and survival and the process by which heat is supplied to newly hatched chicks, until such time that their thermo-regulatory mechanism is functional. The degree of hotness or coldness of a broader has been the major necessity for day-old chicks which has been a constraint to the farmers.

1.2 Justification

By maintaining optimal environmental conditions and correct feeding patterns, the system will promote healthy chicken development, leading to:

1. Animal welfare: Keeping chickens in optimal environmental conditions is essential for their health and well-being. By monitoring and controlling environmental factors such as temperature, humidity, and gas, the system can ensure that the fowl runs provide a comfortable and healthy environment for the chickens.
2. Disease prevention: Poor environmental conditions can increase the risk of disease outbreaks among chicken flocks. By monitoring and controlling factors such as ventilation and gas, the system can help prevent the spread of diseases and reduce the need for antibiotics or other medical interventions
3. Improves efficiency: This project will reduce the need for manual intervention, resulting in more efficient automated monitoring and control operations.

1.3 Problem Statement

The recently experienced heat waves have caused high temperatures to be experienced throughout the country and this has killed the chickens (broilers) in many backyard fowl runs in rural and urban areas. Many people have over the years started rearing broiler chickens for sale as a source of regular income. This is done to avoid heat stress on the chickens as this affects their growth causing stranded growth.

Temperature is also directly related to the amount of food the chickens consume. When it's cold, they tend to eat more as they try to generate internal heat and feed is more costly compared to heat, therefore saving the cost of food.

Traditional chicken brooding systems require significant manual intervention, making them prone to errors and labor-intensive and prone to errors. The proposed system aims to automate and optimize the brooding process, ensuring optimal conditions for the chick's growth and reducing human effort. Additionally, manual brooding often leads to inconsistencies in providing the ideal environment for the chickens, resulting in variations in their growth rates and increased risk of diseases. The lack of a standardized, automated system also makes it difficult to scale up the brooding operation and maintain consistent quality across multiple poultry farms.

The air quality content in the fowl run should also be monitored and controlled to avoid respiratory diseases that can be caused by the building up of ammonia gas in the fowl run.

Therefore, there is a need for the proposed system that can accurately control and maintain optimal environmental conditions, ensuring the health and growth of the chickens. The system should have the capability to monitor temperature, humidity, and gas levels in real-time and automatically adjust them based on predefined parameters. It should also be user-friendly, reliable, and easily scalable to accommodate different brooding requirements and scale-up operations.

As reported in the Sunday News by Mhlupheki Dube, poor management also contributes to chick mortalities, especially if no proper attention is given to critical factors such as temperature control, ventilation, and humidity of the brooding place. Both too-high and too-low temperatures can cause chick mortality. Too high temperatures within the fowl run will cause chicks to dehydrate and there can be blockage of the vent due to droppings pasting on the vent. Dube M, (2019), *Farmer-driven research on village chicken production in Sanyati, Zimbabwe* *183*

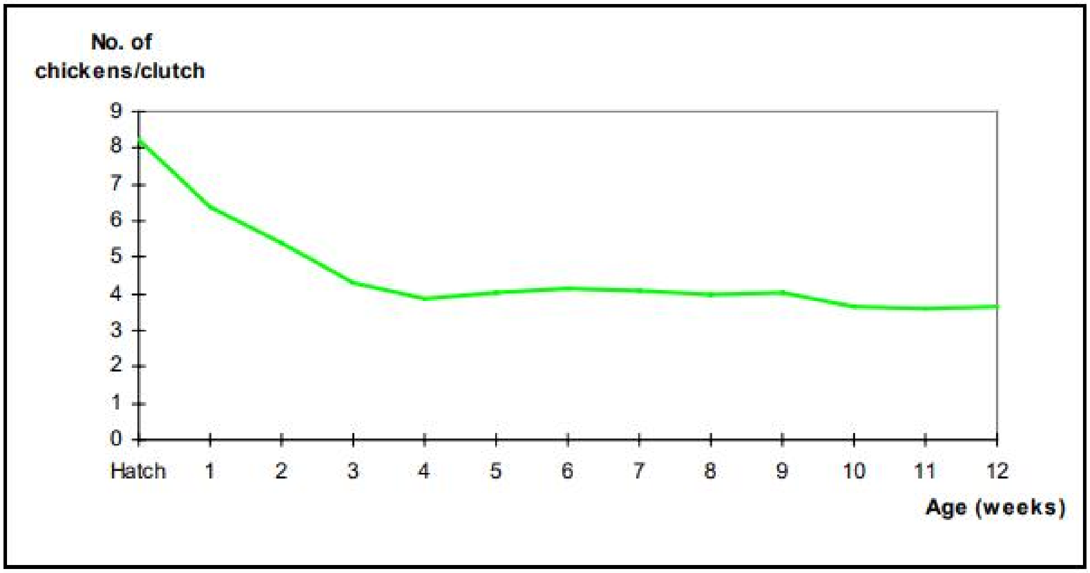


FIG. 1. Average number of chickens per clutch surviving during the first 12 weeks.

Fig 1.1 A graph showing the mortality of chicks in the first 12 weeks after they have been hatched Pedersen C V,

One of the chick suppliers Mr Firk Muller who runs Big Brother Chickens blamed the increased mortality and poor growth rate on the fluctuating weather characterized by high temperatures. “It has been very hot from November to the beginning of December, and now we have this miserable weather (rains and overcast conditions) at the moment. It is extremely difficult to get the chickens to perform the way they should because the environment is not allowing us to keep the chickens in the right temperatures or ventilation. The challenge is prevalent at this time of the year,” he said, which was reported in The Chronicles newspaper. Ncube M, (2021),

Many farmers are always found wanting when it comes to general management of the birds, the poultry house, and adherence to bio-security protocols. Agri-Universe Zimbabwe

According to Okonkwo et al. The majority of poultry farmers often use a collection of kerosene bush lamps/stores or a combination of both to supply the heating requirements of hatcheries and box nurseries for brooding day-old chicks. Though the farmers are in the majority, they have their scope of the operation seriously limited by the high cost of heating power or the total absence of it.

By addressing these challenges, the automated system aims to improve the efficiency, productivity, and sustainability of poultry farming by providing an optimal brooding environment for the chickens, reducing labor requirements, and enabling consistent quality across farms.

1.4 Aim

The project aims to design and implement a system that can monitor and control the environmental conditions in chicken fowl runs. The system senses the level of feed and water in the respective trough and intelligently dispenses water and feed in response to the sensed levels. The current system can effectively sense and predict the level of feed and water in the container.

1.5 Objectives

The section outlines how the system is going to be developed step by step in chronological order.

- Develop an automated system that regulates temperature and humidity within the fowl run or brooding area.
- Develop a system that feeds the chicken and provides the chicken with water.
- Designing the system architecture and developing the program code for processing and controlling the system.
- Finally, to develop a prototype for the system.

1.6 Summary

The goal is to create an efficient and automated system for brooding chicks in poultry farms. Addressing the challenges related to maintaining optimal temperature and air quality. Environmental condition monitoring system utilizing modern technology and sensors to detect poultry farm temperature, humidity, and gas levels.

Automatically, providing food and water to chickens, therefore, eliminating human errors in the whole process.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The main objective of this chapter is to outline the theory that explains how the chicken system's design. This included a general overview of other chicken brooding systems. The various components that make up the chicken brooding system are looked at in greater detail to try and come up with suitable working conditions for the system.

Joan discussed one of the methods of using an infrared heat lamp. These lamps are designed for higher infrared heat lamps. These lamps are designed for higher infrared energy output and a lower light output that can be compared to ordinary electric light bulbs. The infrared energy passes through the air without heating it, the energy is absorbed and transformed into heat, the litter is also heated and the surrounding air is warmed by heat converted from the heated bodies. Callahan J R ,(2002).

Fakorede has observed that the development of poultry production in Nigeria has been indeed impressive but problems like inefficient management, exposure to disease (Zoonotic disease), and temperature regulation problems with the occurrence of stressful environment for chickens that are not yet acclimated due to the sudden problem listed afore cannot be ignored. The chicken adjusts to increasing temperature by behavioral changes like hyperventilation or panting and decreases in feed intake and this causes small production. Essential brooding should be given to the chicks from the time they are hatched up to the chicks from the time when their bodies can already control their heart requirement and are covered with feathers. Fakorede O A,(2015).

Durodola said the main problem is a controller, but also a design with a faster warm-up phase and quicker response to disturbance with minimal overshoot when the poultry set point changes. Durodola O I, (2015)

Adewumi et al (2013), have stated some of the problems associated with poultry brooding systems, which include inefficient management, exposure to disease (Zoonotic), and temperature regulation problems with a successful environment among others. Therefore, there is a need for agricultural engineers to be involved in the development of automated poultry brooding systems to help in the removal of human drudgery, to reduce farmers' exposure to zoonotic diseases, and to enhance of proper management of poultry brooding systems. The general objective of this research work is to construct an automated poultry brooding system with the specific objective of testing the constructed system to know its performance.[9]

By the delimitation of the current study, we present an overview of some of these technologies Olaniyi et al Adedinsewo, and Arulogun et al,(2015) developed technologies to improve the efficiency of feeding systems in poultry farms. However, these systems were characterized by hardware and software limitations such as the limited axis of movement for feeders and no feeder level detection functionality. Thus, resulting in wastage of feed. The system could not also notify users of the situation in the poultry farm.[10].

2.2 Types of Automated Poultry Farming Systems

2.2.1 Gas Brooder

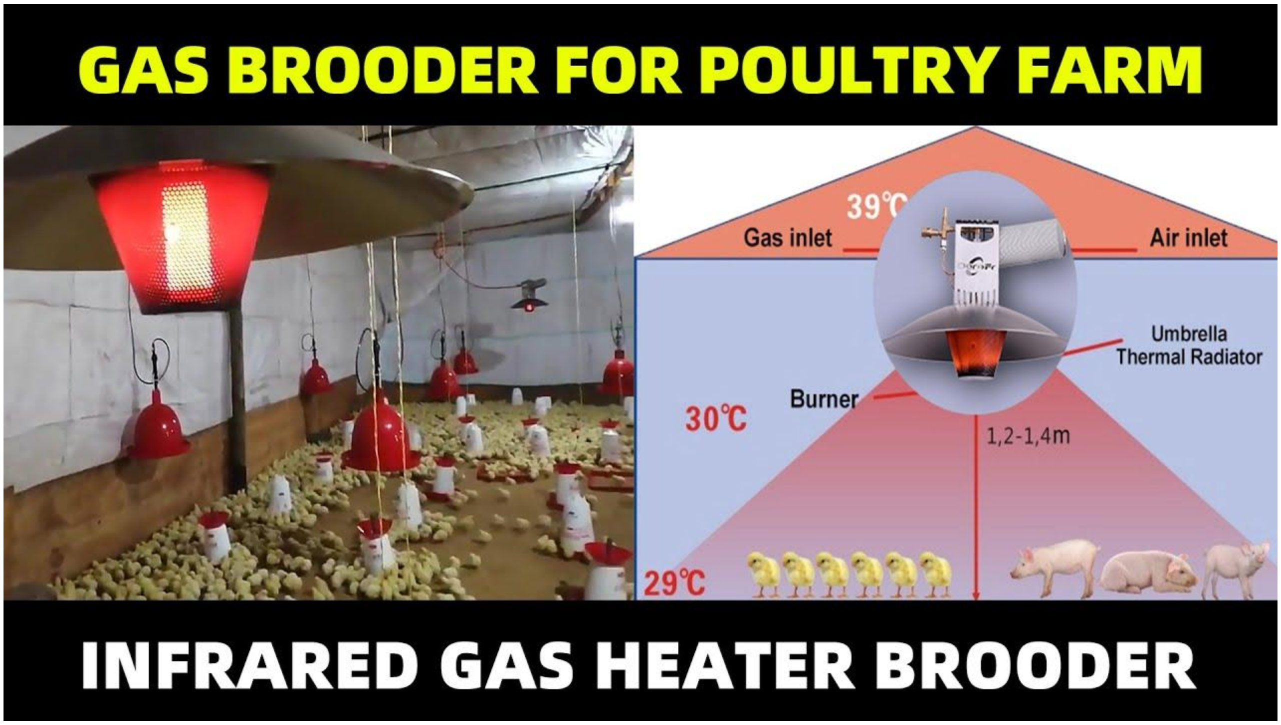


Figure 2.1: Showing the gas brooder

Gas brooder uses (LPG) Liquefied Petroleum Gas as a fuel for heating operations. If we consider the components used inside this farm then we have sensors, an exhaust system, control panels, etc. This system is also becoming an autonomous system but the only defect is that this system cannot provide necessary cooling and heating with precise value. If we consider the cost it is a most expensive system that is not affordable for the common farmers. As this is a fully automated system there is no need for extra manpower but there is the problem of improper electric supply in rural areas so which can cause the stopping of the system. Continuous increase in the price of LPG Liquefied Petroleum Gas cylinders affects the working cost. http://www.dhumal.com/img/in-img/gasinst.jpg

2.2.2 Radiant Tube Heater

Figure 2.2: Radiant tube heater

This system is based on the radiation of the heat. Radiant tube is used for heating purposes. It covers a large space with radiant heat. Require less amount of power. The floor area can't be required as the system is installed at the sealing. A simple exhaust system can be used. The main disadvantages are the possibility of overheating, temperature variation along the tube length, and discontinuous power supply can cause problems. This system cannot detect the exact temperature of chickens required and also proper maintenance is required if the dust collects over the tubes and acts as insulation and the heating is blocked. http://www.dhumal.com/img/in-img/gasinst.jpg.

2.2.3 Solar Heating System

It can be said as the most convenient way of the brooding system, as it uses solar power. The black absorber is used to concentrate sunlight. Which converts the sunlight to heat. Due to renewable sources of energy, this system is eco-friendly. Energy can be stored and used whenever it is required. It has some limitations, high initial cost, maintenance required, accessories cost, and temperature variation that may occur due to climate change. Chukwulozie O P , (2012).

2.2.4 Under Floor Heating

This system depends on conduction, radiation, and convection as means of heat transfer. Under-floor heating systems use underground electric heating and underground pipes for heat transfer. This system requires an external boiling and cooling system as it provides heating and cooling. However, this system requires more space and high installation costs.

https://insolare.com/wp-content/uploads/2017/02/IMG_20160724_182353.jpg.

2.2.5 Trombe Wall Poultry Chick Brooder

Figure 2.3: Showing the Trombe wall

Trombe wall forms an integrated part of the house duly oriented southward for maximum solar energy collection all year around This is made of a 0.22 m thick solid block to form the thermal storage system external surface of the wall which is exposed to the environment is treated with black paint for the absorption of radiation energy from the sun. Glazing through the glass reduces excess heat loss from long-wave radiation.

2.2.6 Kerosene Brooder

Figure 2.4: Showing the Kerosene brooder

Kerosene brooder plays an important role in rural and remote areas. This system requires 40 lit kerosene per day for approximately 1000 birds. Lamps are used in kerosene brooders for brooding operations. It creates health issues for chickens. Also, the availability of kerosene may create problems. The requirement of cost is more.

2.2.7 Pot Charcoal Brooder

Figure 2.5: Showing the Pot Charcoal Brooder

In this brooder, charcoal is used as a heat source which applies to remote & and rural areas. The charcoal brooder is widely used since it is easily available & and has low cost. In the economic sense charcoal is a very efficient fuel. It burns easily & and for longer periods. Along with such benefits, it carries some disadvantages that are, it creates smoke in high quantities which is harmful to chicken's health. In the rainy season there is a higher possibility that charcoal may get stuck due to rain so proper care of storage is needed. Charcoal takes some time for initial heat.

2.2.8 Arinifu Smart Brooder

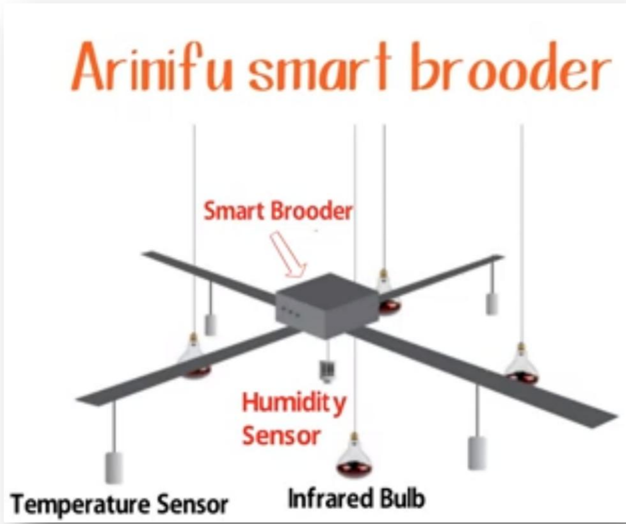


Figure 2.6: Showing the structure of the Arinifu Smart Brooder

The **Arinifu Smart Brooder** is like a digital mother hen, meticulously caring for chicks during their crucial brooding stage.

1. **Heating Control**:
    - The Smart Brooder can control **infrared lamps** and **infrared chicken gas heaters** for heating purposes.
    - It ensures that the chicks receive the **exact amount of heat required**, preventing overheating or chilling.
    - This precise control helps save on heating costs and reduces chick mortality.
2. **Temperature Monitoring**:
    - Temperature is a critical factor for young chicks.
    - The Smart Brooder has multiple temperature sensors that **constantly monitor the brooding space**.

- No more guesswork or manual checks to ensure the chicks are neither crowded nor too spaced out.
- Maintaining the right temperature directly impacts chick health and feed consumption.

2.2.9 IoT-based Chicken Monitoring System

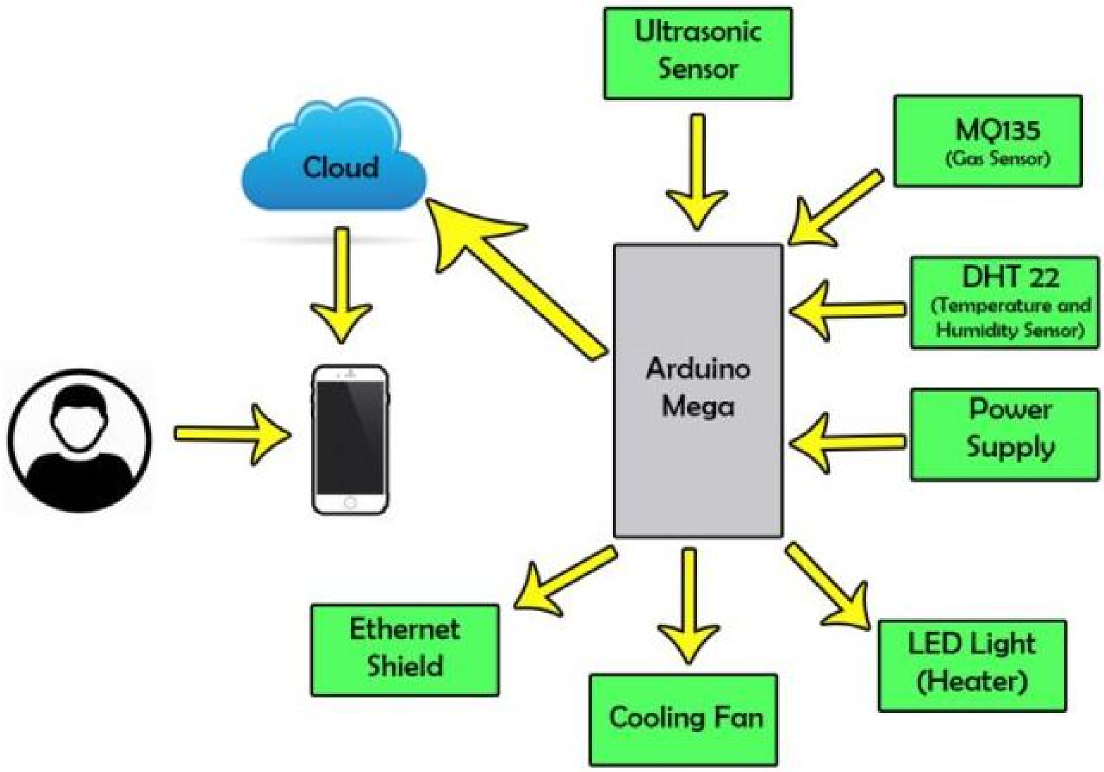


Figure 2.7: Showing IoT-Based Chicken Monitoring System

The different environmental factors that are affecting the growth of a chicken also affect the production of chicken meat for food consumption. This study aimed to determine the different sensors and materials that can be included in the system architecture for smart chicken farming which focuses on the monitoring of the environmental parameter literature survey. The result of the literature survey was used as a basis for the design of the system architecture for Smart Chicken Farming. Based on the literature survey, some different sensors and materials could be used to monitor the environmental parameters in a chicken farm. Thus, the following factors are considered such as low cost, effectiveness, and positive use of the sensors and materials which are the reasons that they are included in the system architecture.

2.3 Summary

Automated Poultry Farming Systems offer numerous advantages in terms of improved efficiency, labor reduction, and enhanced welfare. The integration of advanced technologies, such as environmental control systems, feeding and watering systems, and monitoring and management systems, has the potential to revolutionize the poultry industry. However, further research is needed to address technical challenges, optimize system performance, and evaluate long-term economic and welfare implications.

CHAPTER 3: METHODOLOGY AND DESIGN

3.1: Introduction

In this chapter, the main design specification of the components used will be carried out, including the necessary calculations. This included the calculation of the expected inputs and outputs of the expected results using various equations. The input values that were used are approximations of the actual AC mains voltage. The engineer also used formulae for ideal components. This meant that the real output would vary slightly with the calculated values.

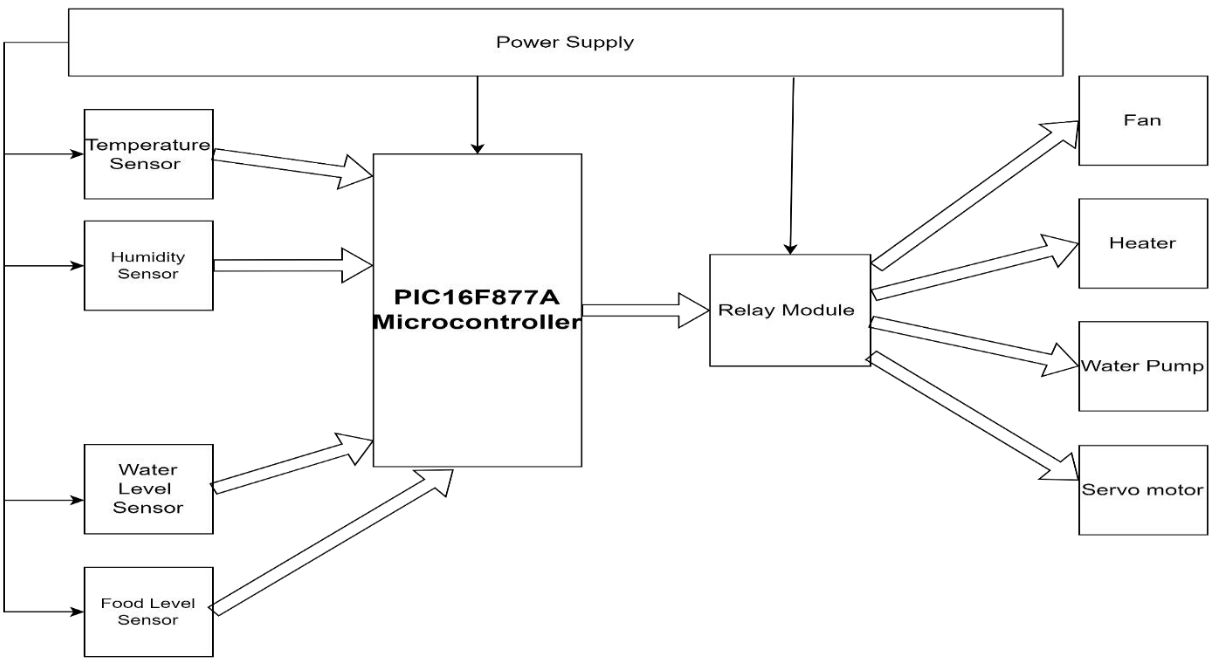


Figure 3.1: Showing block diagram of the automated chicken brooding system

The system block diagram shows the setup and layout of the whole project in blocks. The inputs are fed to the microprocessor, microcontroller connecting with other peripherals and other devices. This block diagram helps to design and develop the baby monitoring system easily.

3.2 Methodologies

These methodologies ensure a systematic and well-structured approach to the development of the project, ensuring its successful implementation and effectiveness in improving the environmental conditions and welfare of the chickens.

- Research and Requirement Analysis:
  This involves conducting extensive research to understand the existing environmental conditions in chicken fowl runs and identifying the specific requirements for the monitoring and control system.
- System Design:
  Based on the research and requirements, a system design is created, which includes the hardware and software components required for the monitoring and control system. It involves designing the sensors, actuators, communication modules, and data processing algorithms.
- Hardware Development:
  In this phase, the hardware components of the system are developed, including sensors for monitoring environmental parameters such as temperature, humidity, and gas. The actuators for controlling ventilation, heating, and feeding are also developed.
- Integration and Testing:
  The hardware and software components are integrated to create a working prototype of the monitoring and control system. This prototype is then extensively tested to ensure its accuracy, reliability, and functionality under various environmental conditions.
- Deployment and Evaluation:
  Once the prototype is successfully tested, it is deployed in actual chicken fowl runs. The system's performance and effectiveness in monitoring and controlling the environmental conditions are evaluated over some time to assess its impact on the health and productivity of the chickens.
- Feedback and Improvement:
  Feedback from users and stakeholders is collected and analyzed to identify any shortcomings or areas for improvement in the system. Based on this feedback, necessary modifications and enhancements are made to enhance the system's efficiency and effectiveness.
- Documentation and Reporting:
  Throughout the development process, documentation is maintained to record the various stages of development, including the design, implementation, and testing details. A final report is

prepared, outlining the methodologies used, the challenges faced, and the results obtained during the project.

3.3 Flowcharts

The two flowcharts for two programs that run simultaneously. A flowchart is a visual representation of a process that uses different symbols to represent the steps, decisions, and actions involved.

3.3.1 Feeding and Watering Control and Monitoring System

In the case of an automatic feeding and watering system, a flowchart can be created to illustrate the sequence of operations and interactions between components. Here's a summary of what a flowchart for an automatic feeding and watering system might look like:

1. Start: The flowchart begins with the start symbol, indicating the initiation of the system.

2. Check Sensors: The system checks the sensors to gather information about the current conditions. This may include sensors for water level, food availability, and any other relevant parameters.

3. Are Sensors Active? This decision point checks whether all the required sensors are active and functioning properly.

4. Watering Decision: If the water level is low or insufficient, the system proceeds to activate the water pump or valve to refill the water container.

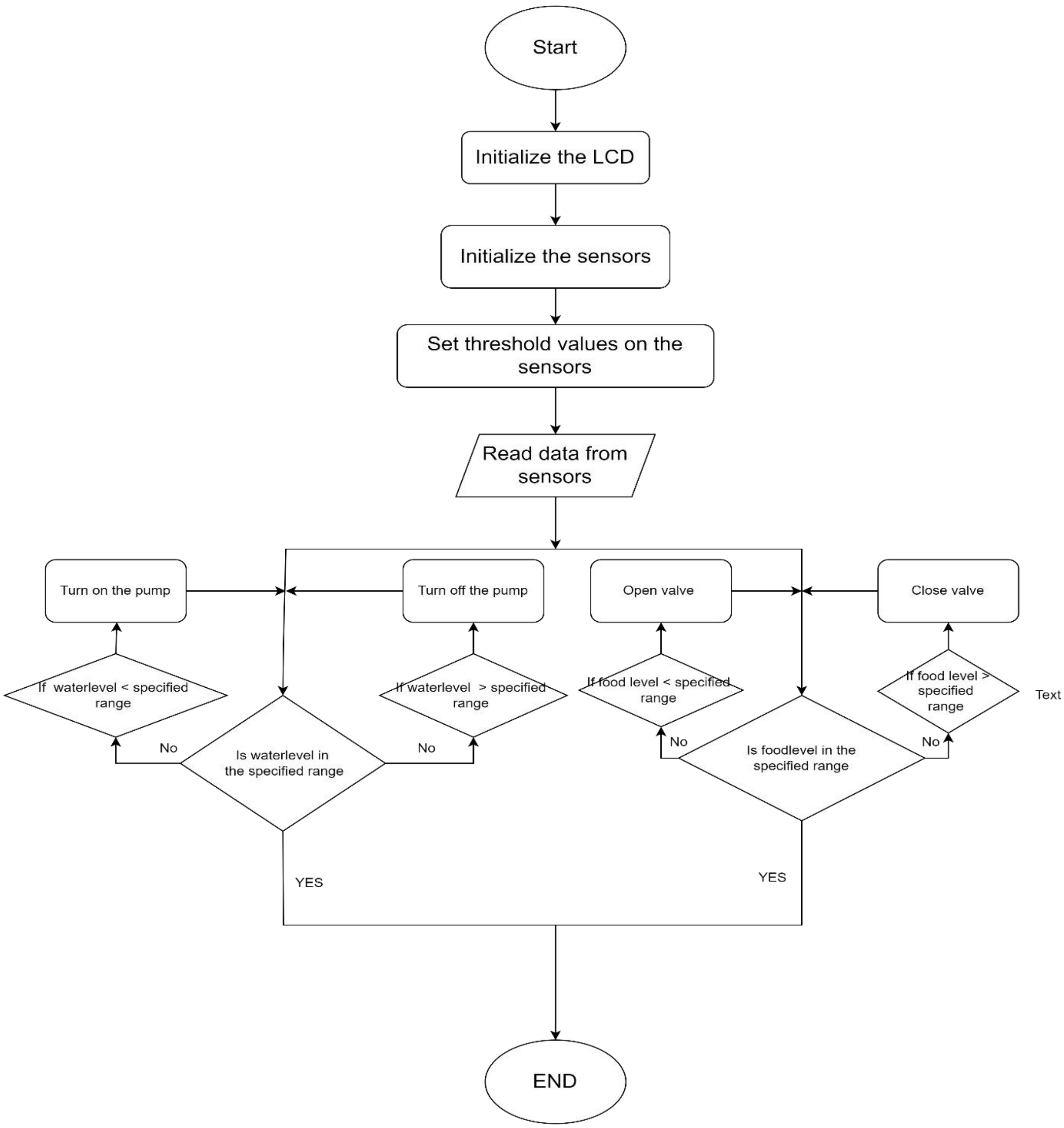
5. Feeding Decision: If the food level is low or empty, the system triggers the feeding mechanism to dispense an appropriate amount of food.

6. Wait: After performing the necessary actions, the system waits for a specified period before rechecking the sensors.

7. Loop: The system loops back to the "Check Sensors" step to continually monitor the conditions.

8. Stop: If the system receives a stop command or encounters an error, it proceeds to the end symbol, indicating the termination of the process.

.



3.3.2 Temperature and Humidity Control System

A flowchart for an automatic humidity and temperature control system represents the sequence of operations and decision points involved in maintaining desired environmental conditions. Here's a summary of what such a flowchart might look like:

1. Start: The flowchart begins with the start symbol, indicating the initiation of the system.

2. Read Sensors: The system reads the sensors to obtain current humidity and temperature values.

3. Compare Values: The system compares the obtained values with the desired humidity and temperature setpoints.

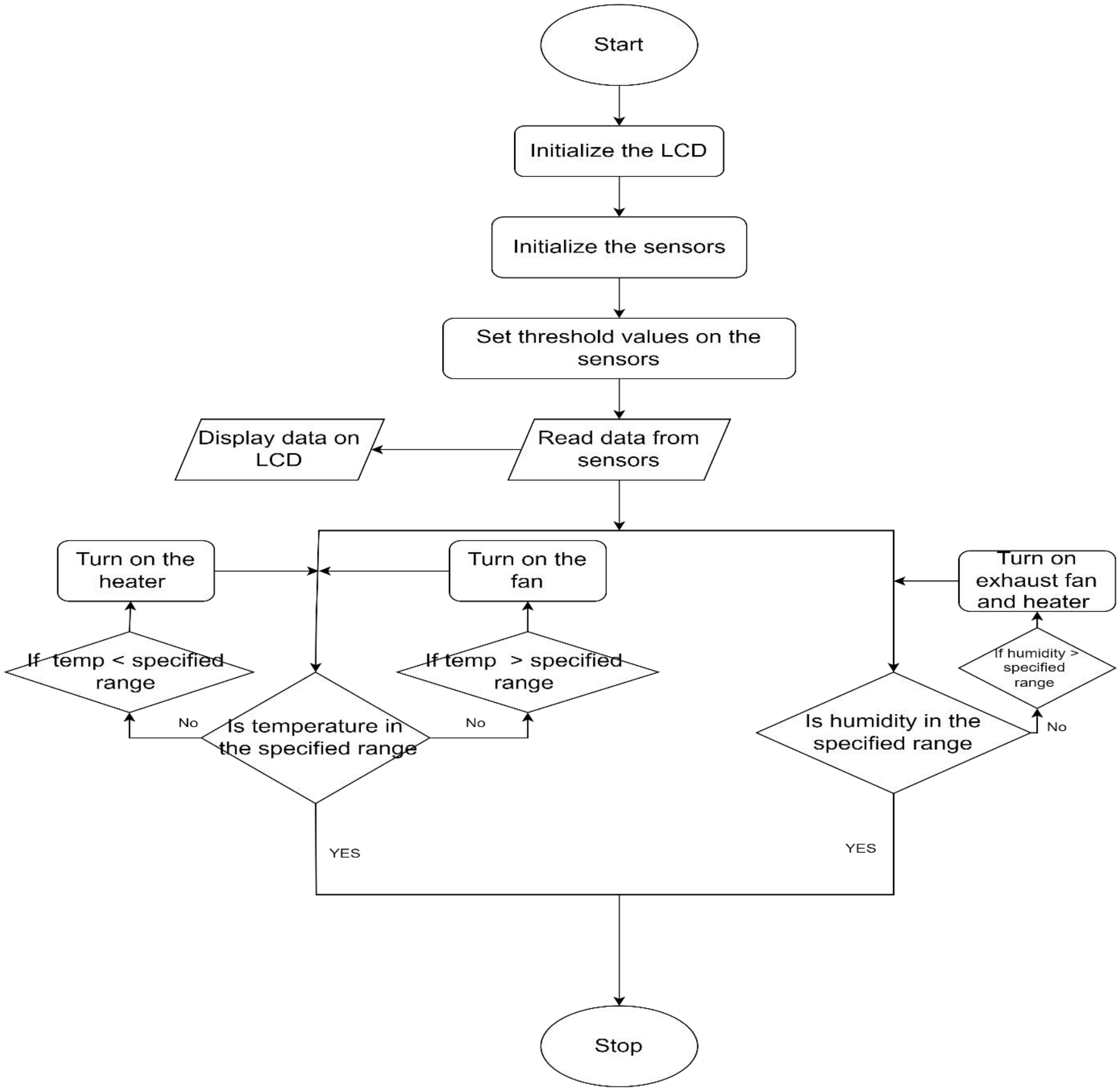
4. Adjust Humidity: If the current humidity is outside the desired range, the system activates the appropriate control mechanism.

5. Adjust Temperature: If the current temperature is outside the desired range, the system triggers the necessary control mechanism (e.g., heater or air conditioner) to adjust the temperature.

6. Wait: After making adjustments, the system waits for a specified period before rechecking the sensors.

7. Loop: The system loops back to the "Read Sensors" step to continuously monitor the environmental conditions.

8. Stop: If the system receives a stop command or encounters an error, it proceeds to the end symbol, indicating the termination of the process.



3.4 Temperature Control Design

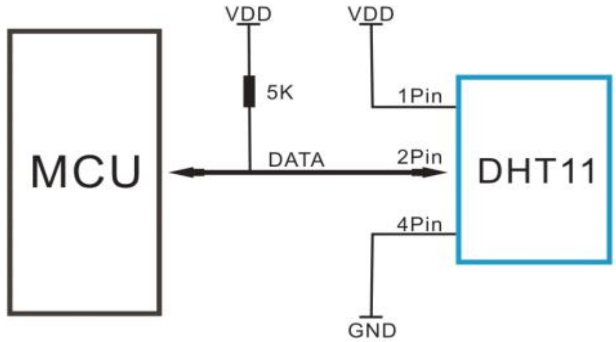


Figure 3.2: Showing the interfacing of the DHT11 sensor with the microcontroller

When the connecting cable is shorter than 20 meters, a 5K pull-up resistor is recommended; when the connecting cable is longer than 20 meters, choose an appropriate pull-up resistor as needed

The ability to maintain a constant temperature inside the fowl-run or brooder is one of the most important design considerations for this project. To, avoid the need for human testing procedures and regulations, the majority of the design work will be done using simulations.

Sensing: The DHT11 sensor is used to measure the temperature and humidity levels in the environment. It provides the sensor readings as digital values to the microcontroller.

Microcontroller: A microcontroller, such as an Arduino, PIC microcontroller, or Raspberry Pi, receives the digital readings from the sensor. The microcontroller acts as the brain of the system and processes the sensor data.

Control Algorithm: The microcontroller implements a control algorithm based on the desired temperature and humidity setpoints. The control algorithm compares the current sensor readings with the desired setpoints to determine the necessary action.

Actuators: Depending on the control algorithm's output, the microcontroller can activate or deactivate various actuators to control temperature and humidity. For example:

Heating: If the temperature is below the setpoint (24℃), the microcontroller can activate a heater using a relay or a solid-state relay (SSR) to increase the temperature.

Cooling: If the temperature is above the setpoint (28℃), the microcontroller can activate a fan to decrease the temperature.

3.5 Humidity Control Design

The DHT11 sensor consists of a humidity-sensing component. It communicates with microcontrollers (such as Arduino or microcontroller) via a single digital data line. The sensor provides real-time readings of humidity.

Sensing: The DHT11 sensor is used to measure the humidity levels in the environment. It provides the sensor readings as digital values to the microcontroller.

Microcontroller: A microcontroller, such as an Arduino, PIC microcontroller, or Raspberry Pi, receives the digital readings from the sensor. The microcontroller acts as the brain of the system and processes the sensor data.

Control Algorithm: The microcontroller implements a control algorithm based on the desired humidity setpoints. The control algorithm compares the current sensor readings with the desired setpoints to determine the necessary action.

Actuators: Depending on the control algorithm's output, the microcontroller can activate or deactivate various actuators to control the humidity. For example:

Humidification: If the humidity is below the setpoint (45%), the microcontroller can activate a fan to increase the humidity level.

Dehumidification: If the humidity is above the setpoint (55%), the microcontroller can activate a ventilation system to reduce the humidity.

3.6 Water Level Control Design

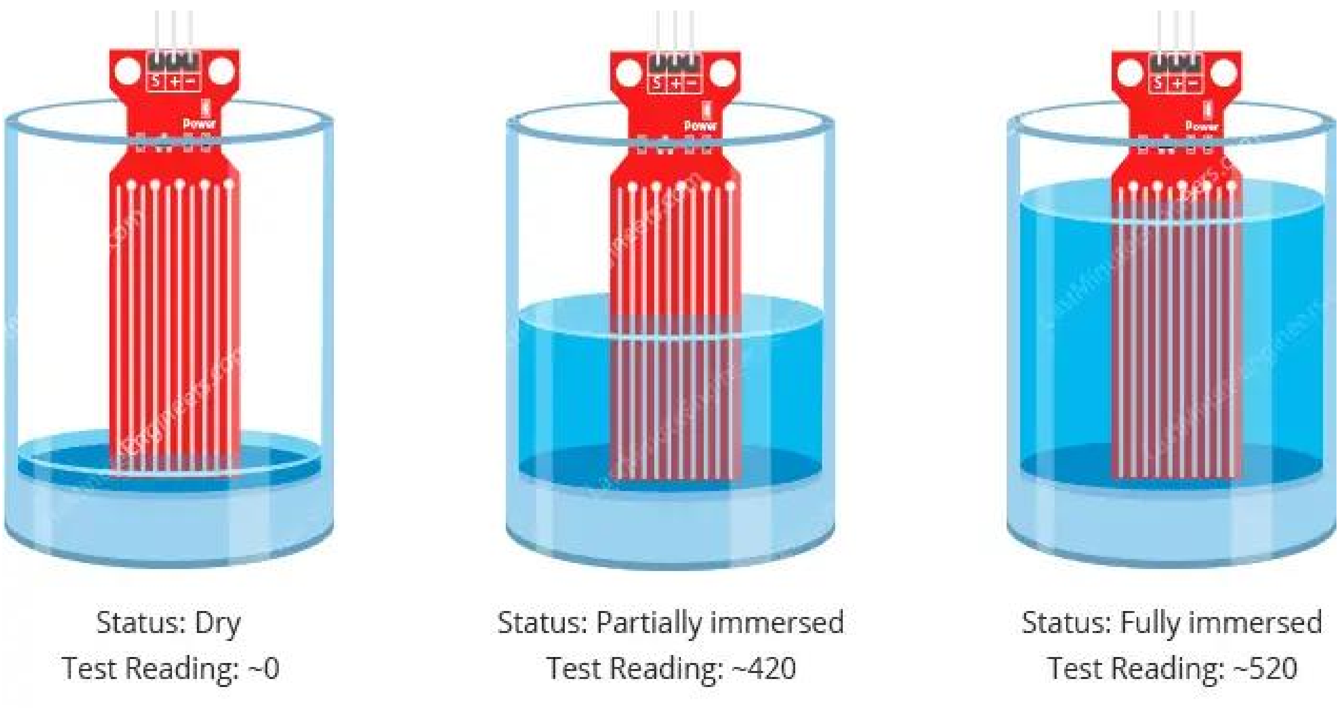


Figure 3.3: Showing the working principle of the water level sensor

The resistance-type water level sensor, also known as a resistive level sensor or resistive probe, operates based on changes in electrical resistance caused by the presence of water. Here is a general working principle of the resistance-type water level sensor:

- Construction:

The resistance-type water level sensor typically consists of a conductive probe or electrodes made of a corrosion-resistant material, such as stainless steel.

The probe is installed vertically in the container or tank, with the bottom of the probe positioned at the desired minimum water level.

- Electrical Circuit:

The probe forms part of an electrical circuit, usually in conjunction with a reference electrode or a common ground.

The electrical circuit can be either a simple two-wire configuration or a more complex multi-wire configuration, depending on the sensor design.

- Variation in Resistance:

When the water level is below the probe, the exposed portion of the probe is not in contact with water, and the resistance between the electrodes is relatively high. As the water level rises and makes contact with the probe, it creates a conductive path between the electrodes, resulting in a decrease in resistance. The resistance decreases in proportion to the increase in the submerged length of the probe, thus indicating the water level.

- Electrical Output:

The change in resistance is measured by an electrical circuit or a control system connected to the water level sensor.

This measurement can be used to generate a corresponding electrical signal or converted into a digital reading representing the water level.

1. **Threshold Logic**:
    - Threshold distance is between 4.5cm to 6cm to determine the water level.
    - If the measured distance is below the threshold, the container is empty.

- If above the threshold, the water will be switched off using a relay switch.

2. **Control Mechanism**:

   Use a relay module to control a water pump or valve.

   - When the water level drops below the threshold, activate the pump/valve to fill the container.
   - When the water level reaches the desired level, turn off the pump/valve.

3.7 Food Level Control Design

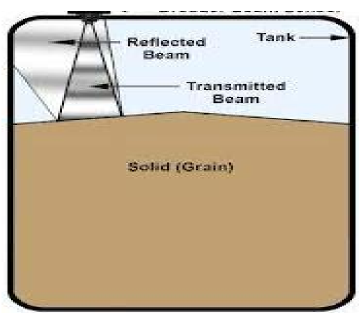


Figure 3.4: Showing food level sensor

This project model is used for feeding the birds in any type of poultry farm. The ultrasonic sensors motor and servo-motor are interfaced with the microcontroller as inputs. The ultrasonic sensor starts sending the signals into the feeder trays, and when the signal gets stuck by some layer of grains it reflects to the transmitter.

During this process of transmission and reception, it measures the distance between the outlet of the feeder and the quantity of grains present in feeder trays. If the grains are below a certain set level the outlet of the feeder starts to rotate with the help of the DC gear motors that are interfaced at the outlets. The motor driver drives the two DC motors alternately.

This process of closing and opening the outlet of the feeder continues till the feeder trays are filled. On the other side, the main container is also analyzed by the ultrasonic sensor. In this also the same transmission and reception process is done.

3.8 Summary

The automated chicken brooding system was designed using the components mentioned in this section. All the various theories of the components were useful in making sure the specifications of the power supply were known before the actual design began. Since this power supply has to be affordable for the available market, the components used are commonly found and are relatively cheap. With that being said the engineer moved on to the next stage which is the design stage. In this, chapter, the design was carried out with the use of derivations and mathematical modeling equations in a bid to come up with the values of the components that were required for the system to function. Therefore, extra care was required to avoid any silly mistakes, as these mistakes would cause difficulties in simulating the circuit.

CHAPTER 4: RESULTS AND ANALYSIS

4.1: Introduction

The working circuit was created using the circuit designing software called Proteus 8 Professional. This tool allowed the engineer to create a working prototype and test its working conditions using different simulating values. Each component was developed on the schematic and the results were noted. This was done to ensure that all the components were in working order. The circuit was simulated using the values that it would operate under in the real world. To understand how each component in the automated poultry farming system functions, some background information will be required. this chapter serves the purpose of theoretical elaboration (of components or circuits from their block-diagram form, construction to function of how the chosen circuit components) to have an automated chicken brooding system circuit that will work according to circuit calculations or simulations.

4.2 Simulations

All of the simulations from the first s were done using Proteus Design Suite software which is a free version.

4.2.1 Interfacing LCD with PIC16F877A

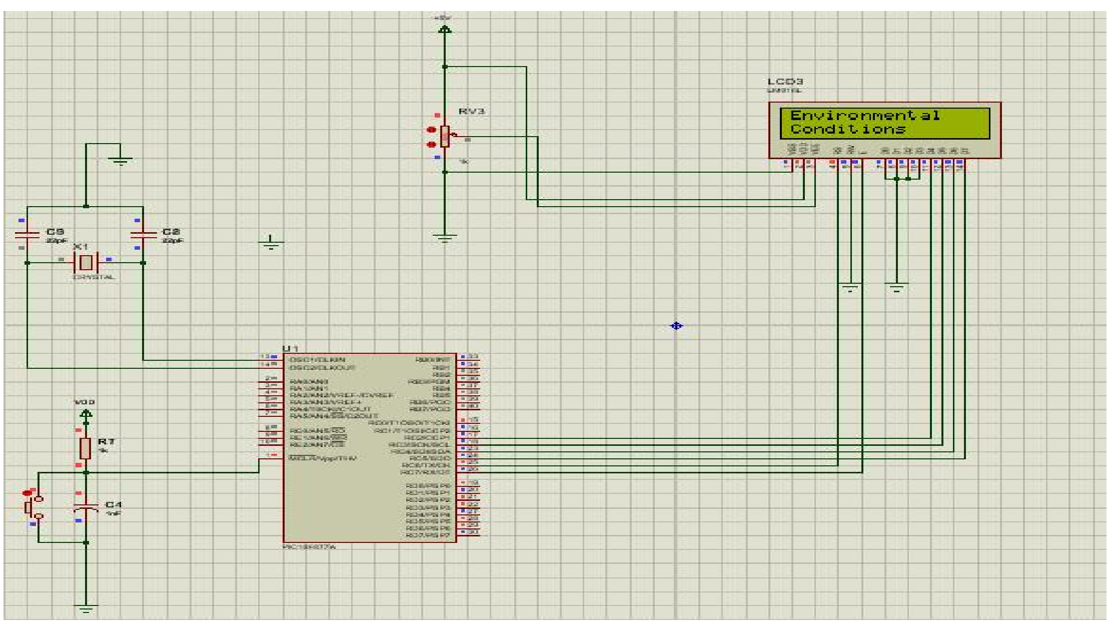


Figure 4.1: Interfacing LCD with PIC16F877A

The LCD module is connected to the PIC16F877A microcontroller. The LCD module typically has 8 data pins (D0-D7) and control pins (RS, RW, E). Connection of the data pins to the appropriate port pins of the microcontroller and the control pins to specific pins as per circuit design.

LCD Initialization: LCD modules typically require initialization commands to set them up for communication and operation. Initialize the LCD by sending a series of specific commands to configure its internal registers. Common initialization commands include setting the display mode, cursor mode, and clearing the display.

Delay and Timing: LCD modules require specific timing delays to ensure proper operation. Delay functions or timers can be used to create the necessary timings between various LCD operations, such as initialization, data writing, or command execution.

4.2.2 Temperature and Humidity Control Simulation and Results

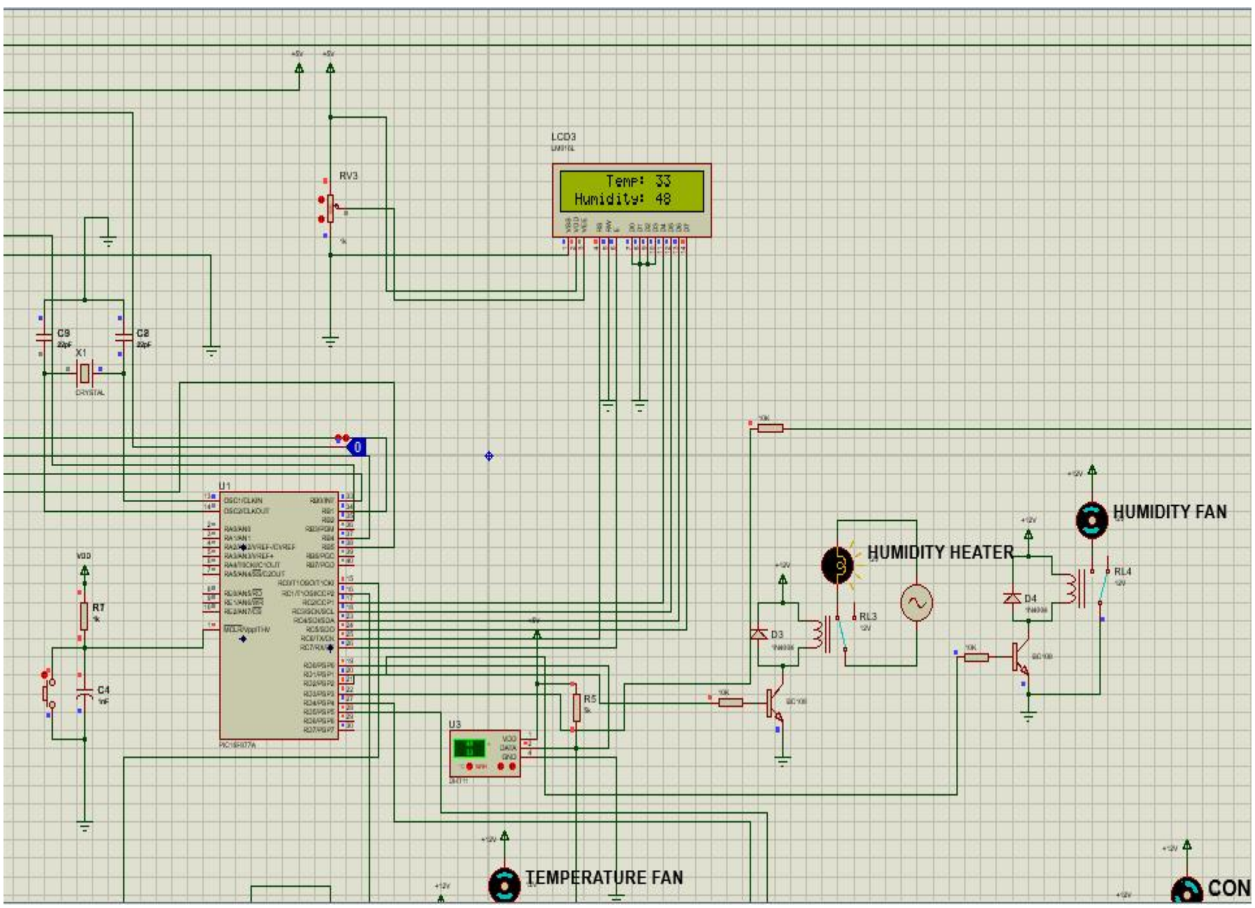


Figure 4.2: Showing the interfacing of DHT11 to the pic-microcontroller

The diagram above shows the simulation of the temperature and humidity control circuit when the temperature read by the DHT11 sensor is at 33 degrees Celsius. When the temperature is above 35 degrees, the fan is turned on as shown above. When the temperature is below 33 degrees, the fan is turned on as shown by the diagram above. This system regulates the temperature and keeps it between 33 and 35 degrees Celsius.

The diagram above shows the simulation of the temperature and humidity control circuit when the temperature read by the ultrasonic sensor is at 48 percent. When the humidity is above 65 percent, the fan and heater are turned on as shown above. When the temperature is below 45 percent, the fan is turned on as shown by the diagram above. This system regulates the humidity and keeps it between 45 and 65 percent.

4.2.3 Food Level Control System Simulation and Results

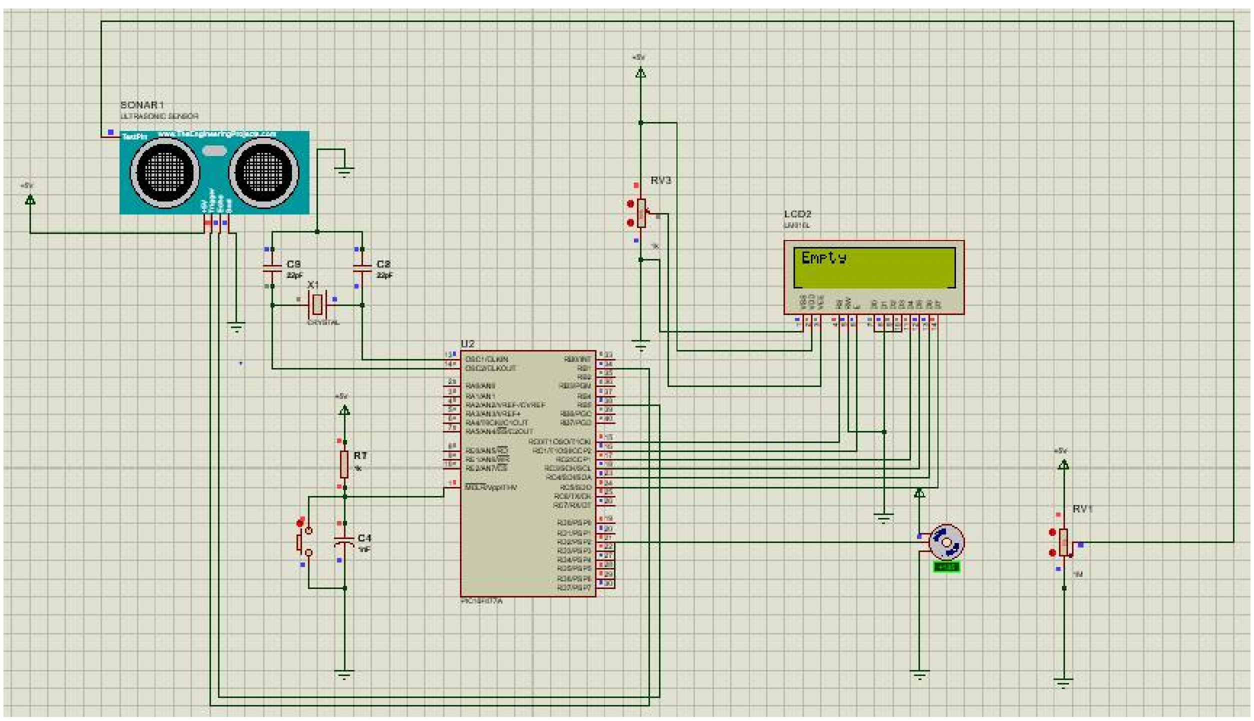


Figure 4.3: Showing the food level control system

To configure an ultrasonic sensor with the PIC16F877A microcontroller, you can follow these steps:

Connection of the ultrasonic sensor module to the PIC16F877A microcontroller. The ultrasonic sensor typically has two pins: Trigger and Echo. Connect the Trigger pin to a digital output pin of the microcontroller, and connect the Echo pin to a digital input pin.

The PIC16F877A has built-in timers that can be utilized to measure the duration of the ultrasonic pulse. Configure a timer module of the microcontroller to measure the time interval between sending the trigger signal and receiving the echo signal.

When the level of the food goes below the specified level the servo-motor is activated to close the valve. Also, when the level of the food goes to the specified level the valve is opened to allow food to flow into the feeding container

4.2.4 Water-level Sensor Simulation *and Results*

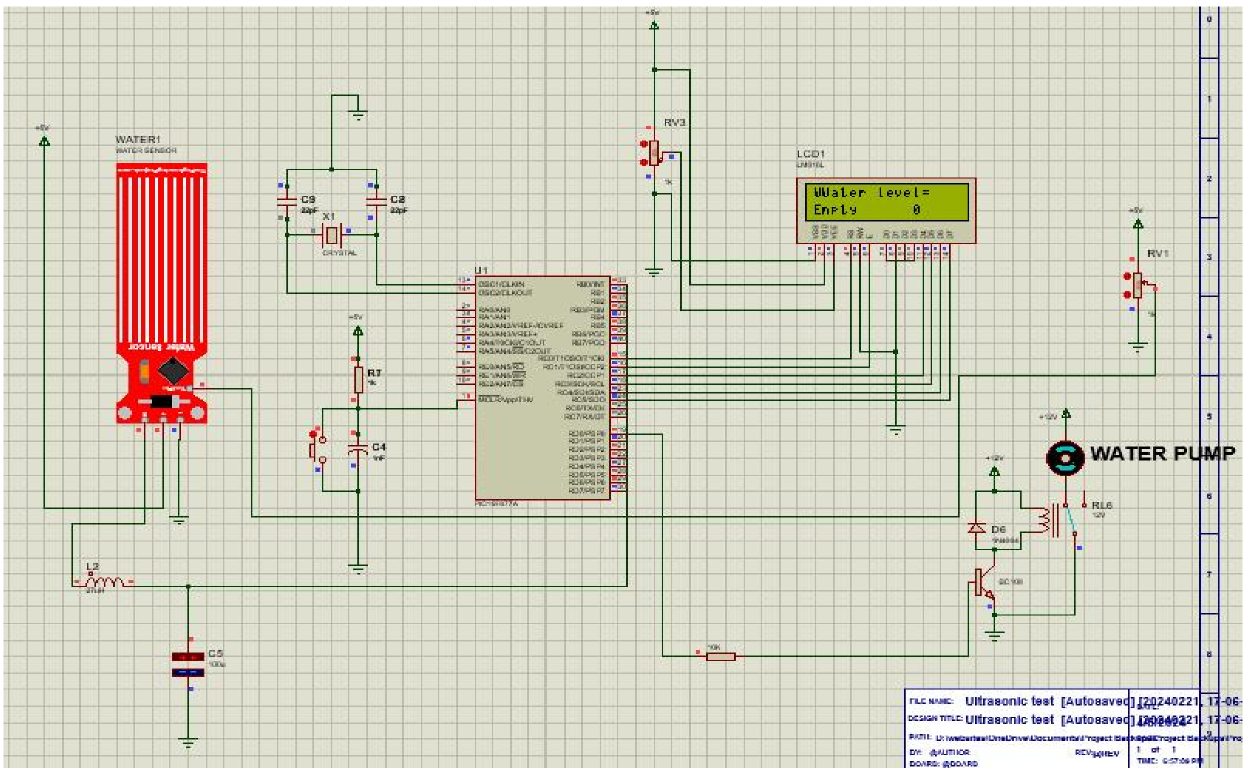


Figure 4.4: Showing the water-level control system

To connect a resistive water level sensor to the PIC16F877A microcontroller, you can follow these general steps:

The resistive water level sensor typically consists of two metal probes, where the resistance between the probes varies based on the water level. Connect one probe of the sensor to an analog input pin of the PIC16F877A microcontroller. Connect the other probe to the microcontroller's ground (GND) pin. Additionally, an inductor and a capacitor are added to the analog input pin for stability.

In the program, they need to initiate an analog-to-digital conversion to read the voltage at the analog input pin connected to the water level sensor. The ADC will convert the analog voltage to a digital value that represents the water level.

4.2.6 Automated Poultry Farming System Simulation

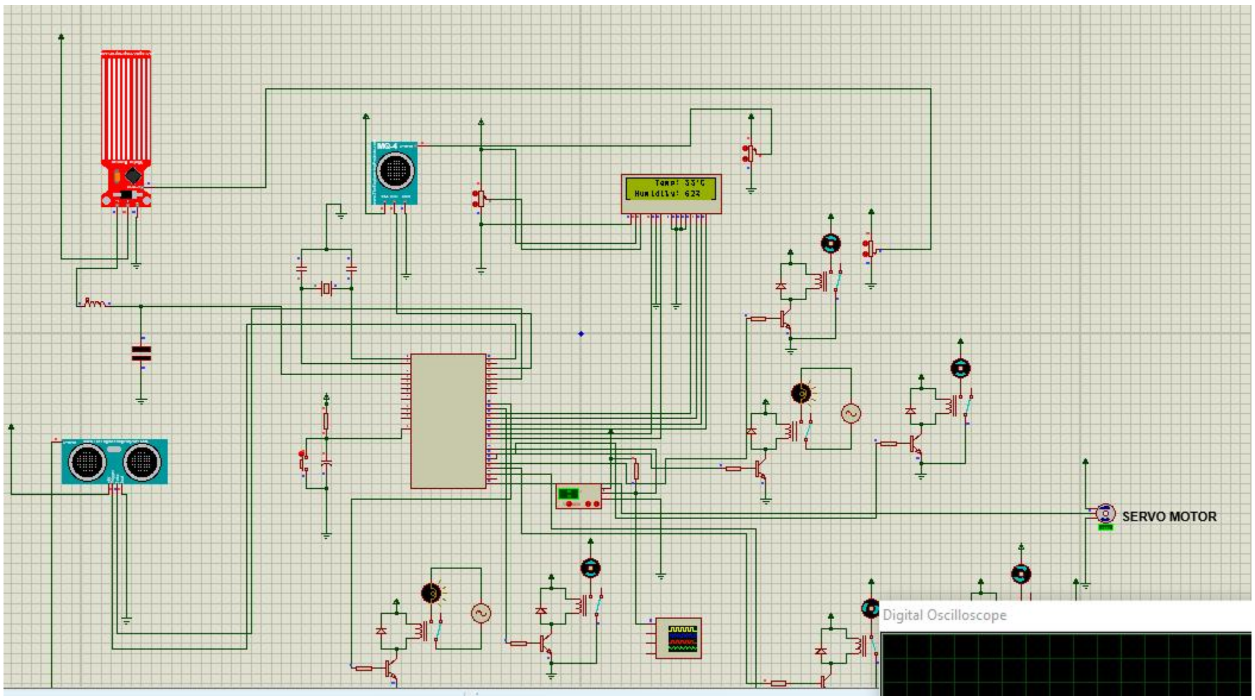


Figure 4.5: Showing the Automated Poultry Farming System Simulation and Results

All the sensors are interfaced with the PIC microcontroller to give out the whole system and also relay switches which switch on components that operate at higher currents.

This project consists of automation in poultry farms for monitoring and maintaining the inside temperature, feeding, monitoring water, and poultry feed. The temperature sensor always monitors the inside temperature if the temperature is not at the desired point, then the microcontroller controls the heater or cooling fan to set the temperature at the desired condition. The humidity sensor monitors the amount of water vapor in the air. When outside temperatures are low, relative humidity in the house is low, which often results in dry dust circulating in the air within the house. This process is continuously monitored and controlled.

4.3 Summary

This chapter of the Automated Poultry Farming System project reportdiscusses the results and analysis of the circuit simulation. The chapter begins by describing the experimental setup. The chapter then goes on to discuss the results of the testing, which showed that the system was able to maintain a more stable temperature, humidity, and gas level.

CHAPTER 5: IMPLEMENTATION

5.1 Introduction

This section shows the pictures of the hardware developments from the breadboard going to the vero board. These pictures were taken during the process of assembling the project. All the developments of the circuit which included assembling components on breadboard, soldering, and testing were carried out.

5.2.1 Testing LCD on Breadboard

The circuit below shows the testing of the LCD with the pic16F877A and it was a success because the LCD managed to display simple text written to the microcontroller “Automated Poultry Farming System ”.

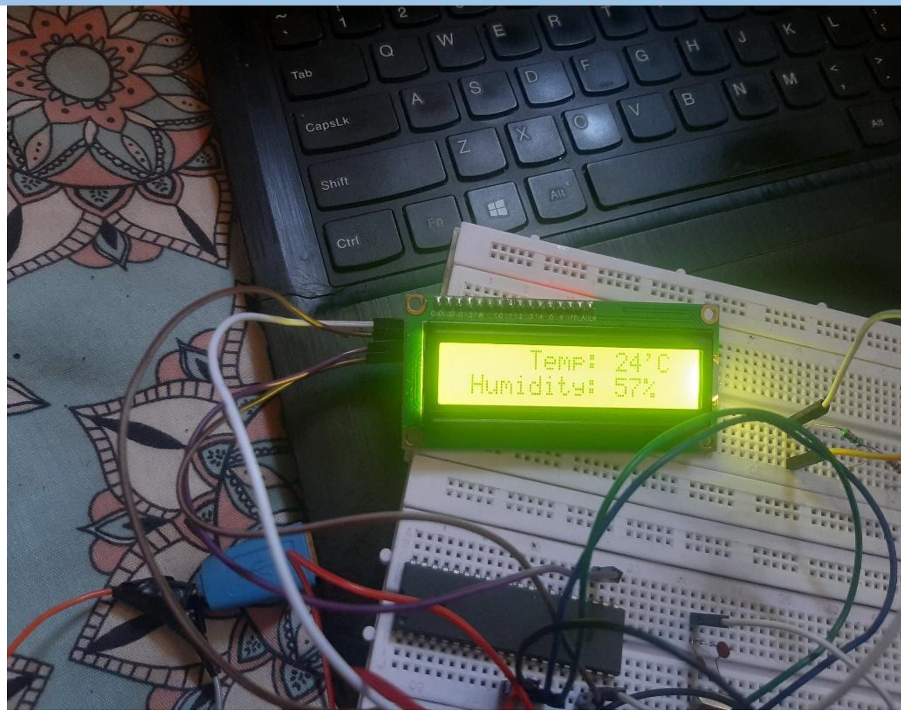


Figure 5.1: The circuit above shows the hardware interface of LCD and PIC16F877A,

5.2.2 Testing LCD, DHT11 on breadboard

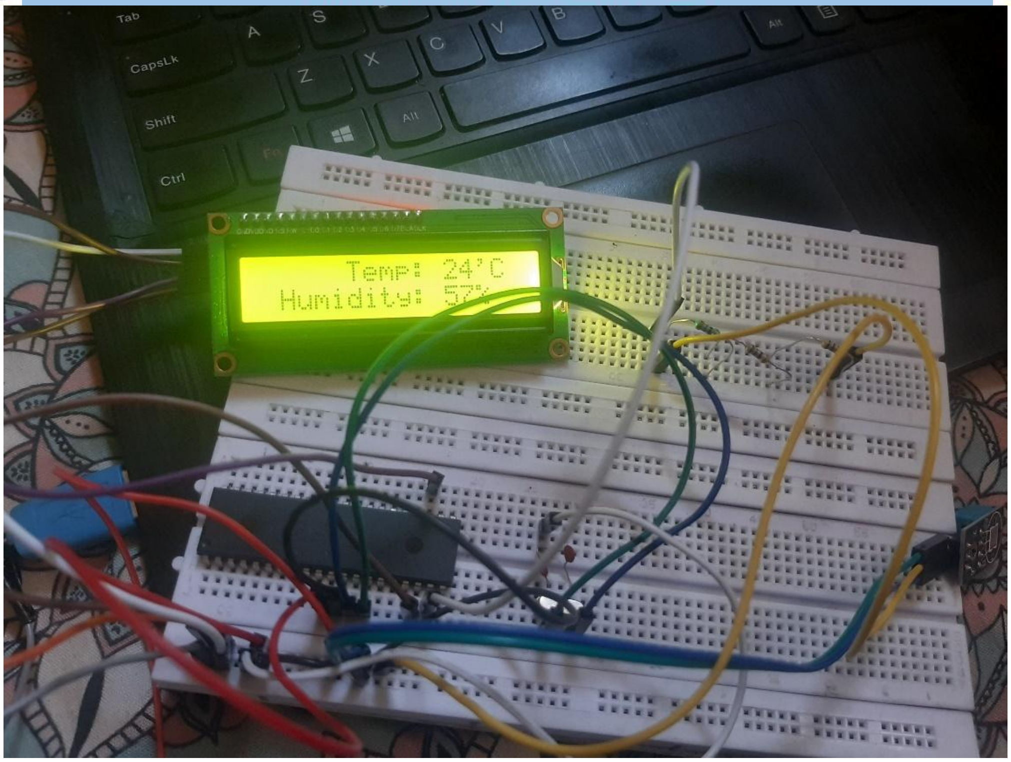


Figure 5.2: Showing the circuit above shows the hardware interface of DHT11, PIC16F877A,

shows a simulation of a LCD which displays voltage which the system is receiving and the current which it is drawing. It also shows the power factor as a percentage, 98.86% power factor is a good one for any system, no penalty charges from zesa. The last line on the LCD is the state at which the system is in, now it is on automatic mode which means it correct power factor on it's on depending on the reference power factor inserted.

5.2.3 Testing Ultrasonic sensor and Servo motor on breadboard

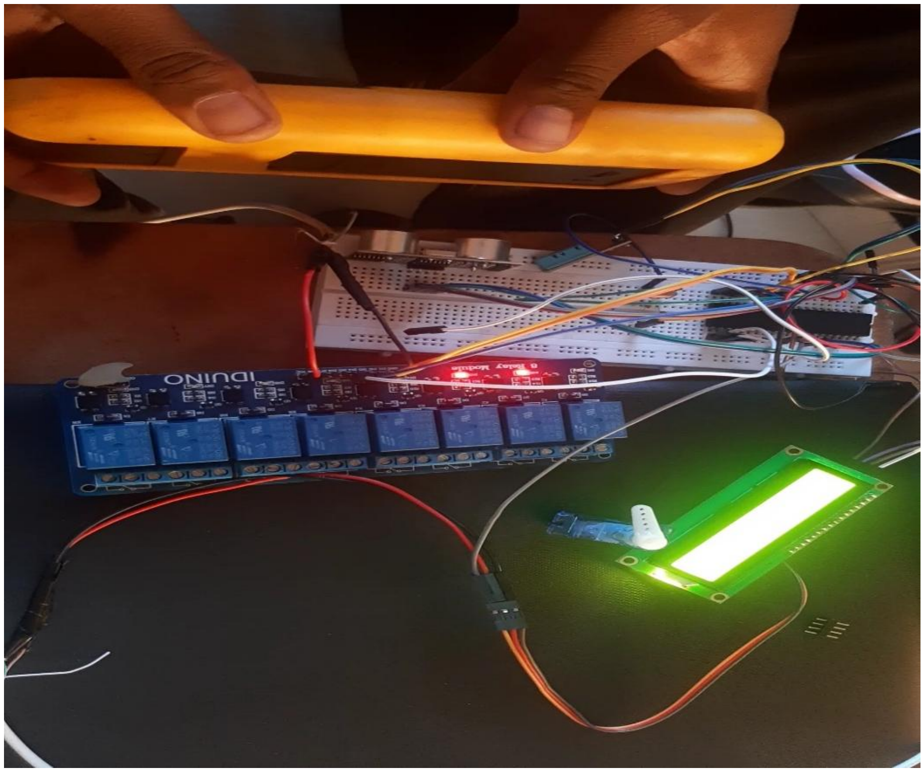


Figure 5.3: Showing the circuit above shows the hardware interface of DHT11, PIC16F877A,servomotor and Ultraasonic sensor

5.2.4 Testing Relay Switch 8 Module on Breadboard

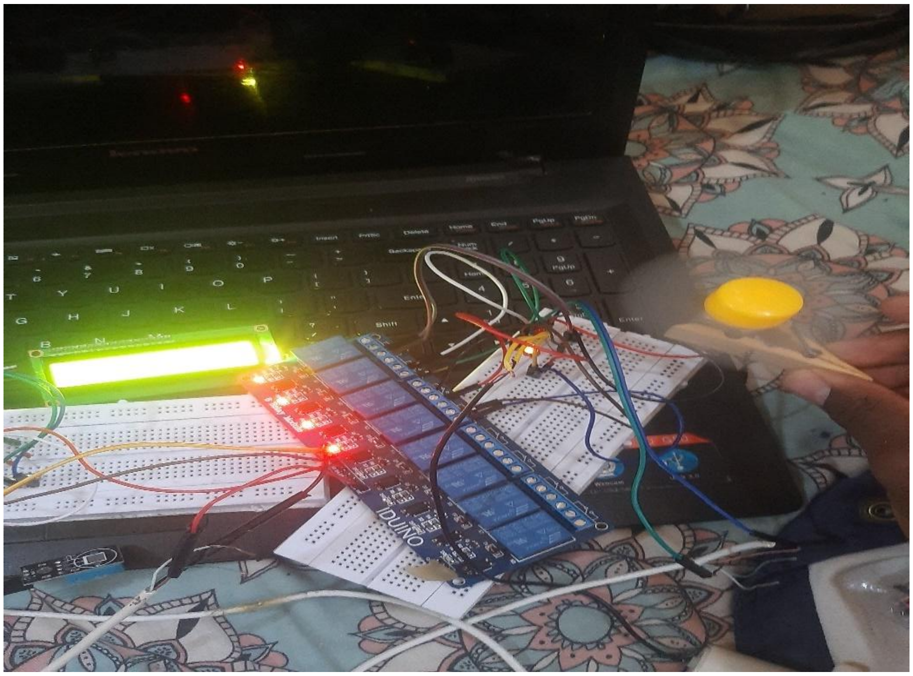


Figure 5.4 :The circuit above shows the testing and hardware interface of the Relay Switch 8 Module with PIC16F877A,

5.3.1 Testing LCD on Veroboard

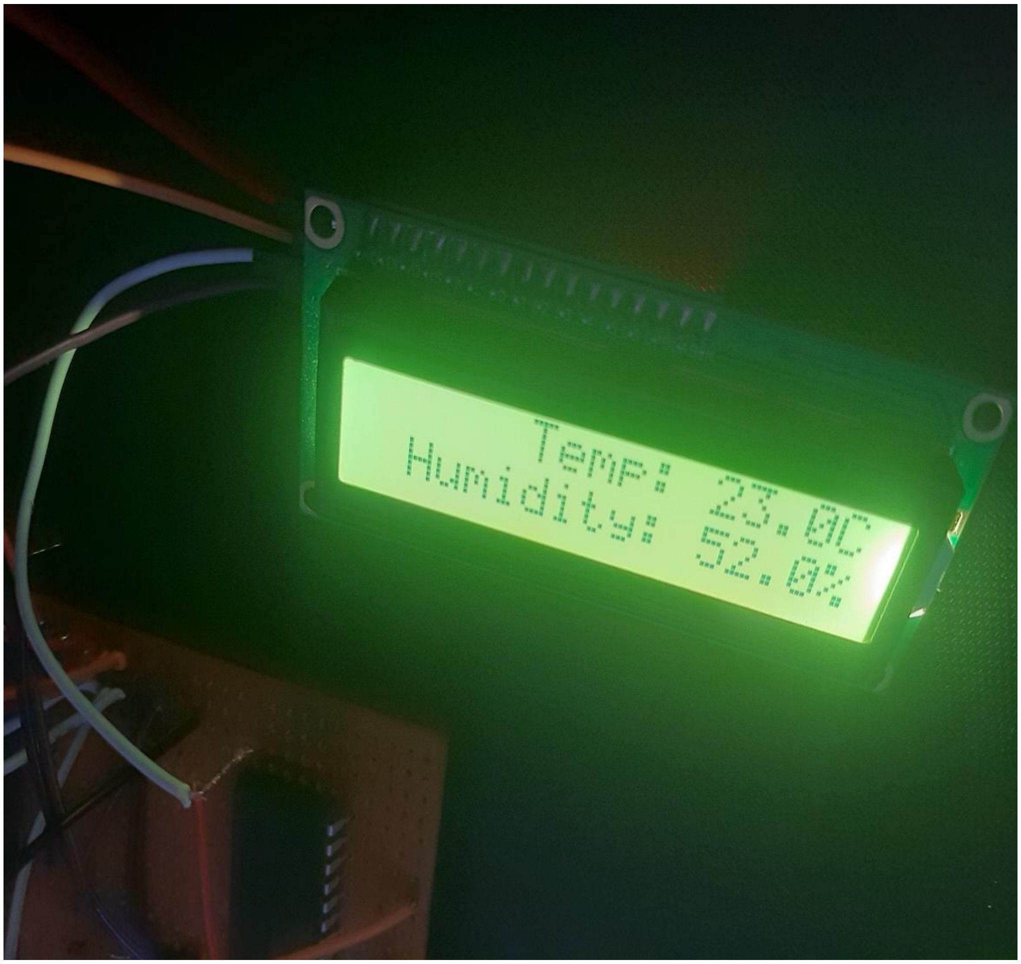


Figure 5.5 : The circuit above shows the testing and hardware on a Veroboard

,

5.3.2 Testing Ultrasonic sensor and Servo motor on Veroboard

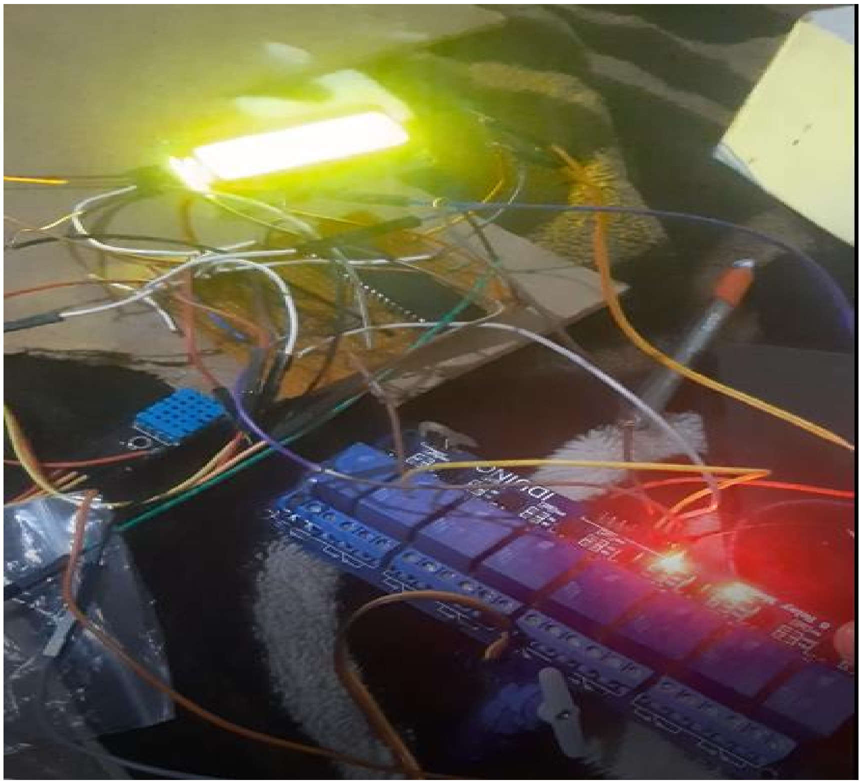


Figure 5.6 : Showing testing ultrasonic sensor and servo motor on veroboard

The circuit above shows the hardware interface of DHT11, PIC16F877A, servomotor, and LCD. The circuit uses an 8MHz crystal oscillator to give external frequency to the microcontroller to fetch data, process data, and refresh. The master clear pin is connected to the VCC so that the microcontroller resets after finishing the process currently running. When the temperature read is not in the range set inside the microcontroller, either a fan or a heater is turned on through the use of the relay circuit. This circuit requires 5V

5.3.4 The Final Prototype

Figure 5.6 : Showing the final ptototype model

5.4 Summary

The LCD requires a minimum of 4V DC voltage. With 3.3V, the LCD was not powering on and not showing anything. It was analyzed that the frequency of the external oscillator should be equal to 57 to the frequency set in the code to give synchronization to the circuit. The more we increase the size of the oscillator, the controller will process very fast. It has been observed that Proteus has some features that simulate well but when implemented on the hardware it malfunctions. The developed hardware is running reading temperature values very well, regulating these temperature conditions very well, food level is being monitored very well. This marks the end of simulation and implementation chapter of the project which was successful, with positive results. The next chapter will delves into pros and cons pertaining this prototype, and future improvements that can be done as there is room for improvement.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1: Introduction

This whole chapter is dedicated to evaluating the strengths, weaknesses, and recommendations of this project. The evaluation of these three issues is of such great importance so that the products which might be implemented in the future may be done properly.

6.2 Strengths and Limitations of the Implemented System

6.2.1 Strengths

Here are some key strengths and weaknesses of automated poultry farming systems:

- Improved Efficiency: Automated systems can streamline many tasks such as feeding, watering, and environmental conditions, leading to increased productivity and reduced labor costs.
- Consistent Performance: Automated systems can operate with high precision and reliability, ensuring consistent output, feed ratios, and environmental conditions for the poultry.
- Reduced Human Error: Automated systems eliminate many of the manual errors that can occur with human-operated farms, leading to more consistent results.
- Improved Animal Welfare: Automated systems can provide a more controlled and comfortable environment for the birds, with precise temperature, humidity, and lighting control.

6.2.2 Weaknesses

- High Initial Investment: Transitioning to an automated poultry farming system can require significant upfront capital for the equipment and infrastructure.

- Dependency on Technology: The system's performance is heavily dependent on the proper functioning of the technology, which can be vulnerable to breakdowns, power outages, or software glitches.

- Reduced Flexibility: Automated systems may have less flexibility in adapting to changes in production requirements or unexpected events compared to manual operations.

- Potential Job Displacement: Increased automation may lead to a reduced need for manual labor, which could impact employment in the poultry farming industry.

- Lack of Personal Oversight: Automated systems may reduce the direct interaction and oversight from experienced farmers, which could limit the ability to respond to unique situations or make quick adjustments.

6.3: Recommendations

This method transforms conventional farms into intelligent farms. It increases production efficiency and reduces labor and maintenance costs. The smart monitoring of different parameters consists of food feeding, and water feeding. Production and health of the product increase

- I recommend DHT22 over DHT11 because, despite being more expensive, it is more accurate, has a wider temperature and humidity range, and has a lower tolerance.
- I recommend using a microprocessor instead of the pic16F877A microcontroller due to the microprocessor's larger RAM, improved processing speed, and ability to process multiple sensor inputs simultaneously, in contrast to the microcontroller, despite the microprocessor's higher cost.
- Consider using a cloud-based smart poultry farm solution that utilizes sensors and actuators to monitor environmental parameters ones.

Key components include:

- **Sensors**: Use temperature sensors, fire sensors, light intensity sensors, dust sensors, and gas sensors to monitor various parameters.

Gateway: Deploy an IoT gateway (e.g., NybSys IG100) to connect sensors and actuators to the cloud.

Gateway Extenders: Extend the range of your IoT solution by adding gateway extenders.

- In the future, we can add a fire alarm system, build an automated fire extinguisher system, and update the website with additional information about the poultry farm, such as reminders for bird vaccinations, worker information, etc. The same technique can be used for both food preservation and poultry houses
- As students we urge our University to fund our project for us to advance with the times and technology, already we are lacking in that aspect. We kindly ask to be helped in this department with equipment in the laboratories for technological advancement
- Last but not least, software which are recent updates and which has a wide range of components should be provided to the students, this is only achievable if the university can pay licenses for that software

6.4 Summary

This project was successfully designed, implemented, and tested. The project addressed the challenge of extreme hot and cold conditions by dynamically switching on heaters and fans based on real-time conditions and it also provides food and water automatically to the chickens, which will result in improved productivity. The project also provided valuable insights into the selection of appropriate components and control algorithms is crucial for effective Automated Poultry Farming System design. This project demonstrates the feasibility and benefits of Automated Poultry Farming System. By understanding the design principles, limitations, and future possibilities, this technology can be further developed to play a crucial role to poultry farming.

References:

Dube M, (2019), *Factors leading broiler chick mortality*, Sunday News.

Pedersen C V, *Farmer Driven Research on Village Chicken Production in Sanyati*, Zimbabwe.

Ncube M, (2021), *Alarming chicken deaths: Farmers blame chick suppliers for festive season losses,* The Chronicle,

Agri-Universe Zimbabwe, Causes of Chick Mortality,

Okonkwo WI, GUN. (2007), *The UNN Passive Solar Heated Poultry Chick Brooder-Further Improvement & Preliminary Testing,* Nigeria.

Joan Callahan R,(2002), *The use of natural feed additives as an alternative for an antibiotic. Growth promoter in broiler diet,* Britain Poultry Science.

Fakorede OA, (2015), *Construction of Poultry Brooding System. Unpublished ND Project work from Department of Agricultural Engineering, Federal College of Agriculture*, Ibadan.

Durodola O I,(2015), *Construction of Poultry Brooding System. Unpublished ND Project work from the Department of Agricultural Engineering, Federal College of Agriculture, Ibadan*,

Adewumi IO, Oluwatoyinbo FI, Augustus EO, Oladejo LF, Aremu DO. (2013). *Investigation of ICT Tools in Poultry Brooding System. International Journal of Innovative Research & Development*. www.ijird.com.; 2(13):110-118. ISSN: 2278-0211.

Olaniyi, O.M., Folorunso, T.A., Kolo, J.G., Arulogun, O.T & Bala, J.A. (2015)., *Towards the development of a mobile intelligent poultry feed dispensing system using particle swarm optimized PID control technique*. African Journal of Computing & ICT, vol. 8, no. 3, http://www.dhumal.com/img/in-img/gasinst.jpg (Accessed on 21 November 2023)

http://www.spaceray.co.uk/uploads/gallery/large_131 (Accessed on 24 November 2023)

Chukwulozie O P, *Design for temperature-controlled solar heated chick brooder*, International Journal of Scientific and Engineering Research, volume 3, issue 4, April 2012, ISSN 2229-5518.

https://insolare.com/wp-content/uploads/2017/02/IMG_20160724_182353.jpg (3 December 2023)

Components, "Components 101," 21 December 2020. [Online]. Available: https://components101.com/switches/5v-single-channel-relay-module-pinout-featuresapplications-working-datasheet. (Accessed 20 June 2023)