INTELLIGENT ROOSTER MONITORING SYSTEM

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Supervisor: **Mrs. Ruvinga**

ABSTRACT

Chicken rearing has been widely spread in the country for both economic purposes and family consumption. In both cases there is need to reduce the labour and solve problems caused by inadequate water supply and stunted rooster growth. The Intelligent Rooster Water Monitoring System solves this problem by making sure that the roosters always have water to drink as well as making sure that they are in a bearable environment. The system measures the amount of water left in the rooster canister and refills it when there is need. Buzzer sounds are produced to notify the water has reached its minimum level and its being refilled. Temperature and humidity of the rooster run are measured as well; in cases where the temperature is higher than the norm a cooling fan is switched on and when the temperature is lower than the norm a buzzer rings to notify the users of the system that there is need to warm the rooster run.

DECLARATION

I, **Courage N. Jonhera,** hereby declare that I am the sole author of this dissertation. I authorize the **Midlands State University** to lend this dissertation to other institutions or individuals for the purpose of scholarly research.

Signature: ……………………………………………. Date: ………………………………..

APPROVAL

This dissertation, entitled **"Intelligent Rooster Water Monitoring System"** by **Courage N. Jonhera** meets the regulations governing the award of the degree of **BSc Computer Science Honours Degree** of the **Midlands State University,** and is approved for its contribution to knowledge and literary presentation.

Supervisor's Signature: ……………………………………………….

Date: ………………………………………………………………..

ACKNOWLEDGEMENTS

I'm indebted by the guidance that the Almighty God gave me throughout this project. My heartfelt appreciation goes to all Midlands State University academic staff for the knowledge they have equipped me with. I would like to thank Mrs. Ruvinga my supervisor for her unwavering support to the completion of this project. I also want to thank my family and friends for their support and encouragements.

DEDICATION

I dedicate this project to my sweetest daughter Zene. Your smile kept me going.

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LIST OF ACRONYMS

ACRONYM	DEFINATION
I/O	Input and Output
IDE	Integrated Development Environment
LCD	Liquid Crystal Display
OS	Operating System
DC	Direct current
LED	Light Emitting Diode
RFID	Radio-Frequency Identity
SRAM	Static Random Access Memory
EEPROM	Electrically Erasable Programmable Read-Only Memory
V_{CC}	Voltage at the Common Collector
GND	Ground

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CHAPTER 1

1.1 INTRODUCTION

This document serves to outline how the writer is going to tackle the research topic Intelligent Rooster Water Monitoring system using Arduino. The major goal of undertaking the project is to design a system that would enable poultry farmers to automatically fill in water for their roosters in order to avoid water shortages, starvation as well as providing the roosters with clean water. The system senses the need for water refill hence it automatically fills the water cans. Whenever the water pump has failed to supply water when it is needed a buzzer will alert the responsible personnel through the sound that is produced. More so alert messages will be displayed on the LCD screen to alert the need for water when the pump is not producing the desired amount of water. Apart from monitoring the water level the system also monitors the environmental parameters of the roosters and therefore controlling their water intake.

1.2 BACKGROUND OF STUDY

Lunenburg and Irby (2008) asserts that background of study is a context that clarifies the importance of a research and highlights the key theoretical constructs that will be discussed in depth later in the chapter. Research into rooster water intake has been energetically pursued for a number of years and is still being explored. Water intake is dependent of food intake; reduced water intake can result in a reduced food intake. More over the intake of water has been known to be controlled by the environmental temperatures surrounding the rooster run. More effort has been put so as to enhance the intake of water by roosters; this has been achieved by trying to provide as much water as possible as well as controlling environmental factors as required by the poultry. Riggs et al (2011) suggests that the material used to make the water canister is indirectly proportional to the rate of water intake. Metal canisters are easily influenced by the surroundings thus the choice of canisters is of greater importance. They also suggest that PVC materials are advisable for water canisters as they are noble and not affected by the surrounding temperatures. This study focuses on extending rooster water supply enhancement through the use of ultrasonic sensors, temperature sensors, buzzer module, LCD screen and Arduino UNO.

1.3 PROBLEM DEFINATION

- The existing cannot control the environmental parameters thus compromising the quality of the roosters.
- The current system relies entirely on human effort thus it is prone to errors and it lacks accuracy as to the required amount of water in a given environment.
- There is no way of keeping information about the water consumption by roosters as well as the climate conditions in the current system.
- The current system does not counter for water shortages and wastages.
- Monitoring of the rooster water is a manual process thus it is time consuming.
- It is impossible to monitor environmental parameters such as temperature without sensors.
- The existing system is not timely as the need for water can only be addressed when a person gets into the rooster run.

1.4 AIM OF THE RESEARCH

The aim of the research is to design a modernised and portable Intelligent Rooster Water Monitoring system. The major aim is to take care of water shortages well before they occur and creating a healthy environment for roosters using technical scientific methods. This will be achieved by designing a system that will note a decrease of water level through the use of ultrasonic sensors. The buzzer module will alert the responsible personnel of any discrepancies in the water supply as well as the environmental conditions through sound. More so a message is displayed on an LCD screen to clearly show what the buzzer alert is all about. At any given time, the authorities are able to know the environmental parameters and the water level that will be displayed on the LCD screens located in the rooster run. The system aims to improve the quality of roosters produced in any farm.

1.5 OBJECTIVES OF THE RESEARCH

Intelligent Rooster Water Monitoring system seeks to achieve the following objectives:

- To come up with a circuit that automatically detects the rooster water canister level.
- To measure and display the environmental parameter of the rooster run at any given time.
- To automatically cool the environment when there is need.

- To inform the consultants about a slacking water supply using a buzzer.
- To automatically refill the rooster water canister level.

1.6 INSTRUMENTS

Arduino UNO

Arduino Uno can be described as a microcontroller board built on the ATmega328P datasheet (Stewart, 2015). It consists of fourteen digital I/O pins where six can be used as PWM outputs, and six as analog inputs. It is made up of various components that support a microcontroller. To use this device a simple connection to the computer via a Universal Serial Bus cable or Alternating Current-to-Direct Current power adapter is required to get the circuit going. This device is programmed using several programing languages such as C, C++ and C#.

Ultrasonic Sensor

This device that is used measure the distance between the sensor and an object using sound waves. The principle used to measure distance involves gauging a sound wave at a known frequency and listens and measures how long it takes for that sound wave to bounce back. Of the two opening that the sensor has on its front, one is for transmitting ultrasonic waves like a tiny speaker whilst the other one receives the waves just like a microphone. This device uses the approximated speed of sound in the air that is 341 meters per second as well as the elapsed time between sending and receiving the sound pulse to calculate the actual distance to an object.

Buzzer Module

The role of a Buzzer is assimilated to the structure of electronic transducers, Direct Current voltage power supply. It is extensively utilized by computers, printers, photocopiers, alarms, telephones, timers, etc. it is basically an Electronic product for sound devices. It is connected on Arduino circuit to give the sound effect.

C++

It is a programming language that is object oriented in nature. It is mainly used to efficiently design embedded, resource-constrained and complex systems. C++ has imperious and generic features that secure low-level memory handling and code reuse. Balagurusamy (2008) stated that C++ widely utilizes concepts such as objects, classes, data abstraction and encapsulation, inheritance, polymorphism, dynamic binding and message passing. These features allow programmers to build clear programs that are can be used for various purposes and easy to maintain. One of the advantages of C++ is that it brings about productivity and good quality software.

Arduino IDE

This is open-source software designed to lessen the burden for programmers by making it easy to inscribe code and upload it to any Arduino microcontroller board. It works hand in hand with a number of operating systems that may include Windows, Mac OS, and Linux. The Arduino IDE comprises of a text editor for code composing, a text area, a text console, a toolbar that contains functionality buttons and as well as a series of menus. Programs in Arduino (IDE) are inscribed in the text editor and they are called sketches. File extensions for saving sketches is .ino. Attached to the IDE are several features that enable quick and efficient code writing.

1.7 JUSTIFICATION

This study of the Intelligent Rooster Water Monitoring system saves time and resources which were once used for attending to attend to roosters manually. The system is considerable since environmental factors around the roosters can now be controlled thus improving rooster growth. The proposed system can also be justified as it continuously provides water for roosters as required thus starvation is eliminated. Consultants will be able to check the climate conditions of the rooster run; if the condition needs attention they are also alerted. The study is therefore justifiable as there more benefits for the farmers as compared to the relative drawbacks.

1.8 CONCLUSTION

Problems associated with manually filling up water canisters for roosters will be solved by the proposed Intelligent Rooster Water Monitoring system. The study is mainly focused on designing an intelligent Rooster Water Monitoring system that will improve the existing system. This document outlines whether it is worthy to carry out the research by looking at costs of carrying out the study and the need for a new system by the users.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Machi and McEvoy (2012) assert that a literature review blends the existing knowledge with the research question. A literature review provides a breakdown as well as a discussion of the body of information within a precise research topic. The information can comprise of knowledge published by an individual or a group of people concerning a certain matter within a given time. The actual literatures reviewed for this research are books, journals, specialized publications thesis and projects. The literature review of this research focuses on the similar studies done concerning the challenges and problems faced by the farmers in trying to supply roosters with water on a large-scale farm continuously. This chapter gives an understanding of what other researchers in the similar field of study have done to place this research on standpoint.

2.2 INTELLIGENT ROOSTER WATER MONITORING SYSTEM USING ARDUINO

In order to provide semi-automatic poultry feeds but in contrast to automatic poultry water management, farmers carried out more work using various methods. Semi-automatic poultry feed involves the supply of food and water without the aid of a human being unlike automatic methods this method does not make of use electric circuits and software (Nelson, 2011). Automatic poultry water management is however, of supreme importance since the water intake of roosters controls the overall growth. Water intake controls the manner in which poultry takes in food hence efforts to improve the supply of water are being made. Intelligent Rooster Water Monitoring system is one of the current works acknowledged by the writer to enhance water supply. In this system, the water intake is also improved by monitoring the environmental parameters such as temperature. Once the temperature sensors have measured the temperature it is displayed on the LCD display for the responsible personnel to see. More so, the system will automatically cool the environment using an Arduino cooling fan whenever it senses the need. Buzzer module on the other hand will alert the responsible personnel that there is an outstanding condition that calls for attention. The Arduino UNO board input connects the temperature sensor, the LCD display and a cooling fan, where the board carries the programmed instructions for the relative components to perform the desired tasks.

A breadboard completes the circuit as it connects the components together that they may work to collectively control the water supply of roosters for better growth. Apart from controlling the temperature for water intake, the supply is a major concern; ultrasonic sensors will be used to measure the water level. As soon as the water level reaches the minimum set value the ultrasonic sensor, communicate with the water pump to open up and fill in the canisters. At any given time the water level of the canisters is displayed on the LCD screen. In cases where the water pump fails to supply water to the canisters a buzzer rings to alert the responsible personnel of the condition. This circuit completes with the mentioned components to automatically monitor the poultry water supply.

2.3 RELATED WORK: SMART ROOSTER POULTRY FARMING IN ASIA

Mahale and Sonavane (2016) have investigated an Intelligent System, which employed Food and Water Level Control Mechanism for Smart Rooster Poultry Farming. Here they focused on the integration of wireless sensors and mobile system network in order to remotely monitor and control environmental parameters in a poultry farm. The aim is to control environmental parameters like temperature and humidity. The responsible person can able to get the information about the internal environment of poultry farm by receiving a message on his mobile number. Subsequently the owner will able to observe the suitable environment for the growth of roosters in poultry farm. This system also design Water level control and food control mechanism using sensors. The quality of food given to roosters, which indirectly help to improve the quality and growth of the rooster, has improved. The detail record of poultry farm will able to view on a webpage with all environmental condition. This study is a success in food and temperature management although it is limited with the fact that it does not automatically supply food and water it is dependent on manual refills.

Jindarat and Wuttidittachotti (2015) designed an Intelligent System that deals with supervision of and problem elimination on a rooster poultry farm using Embedded Systems and Smart Phone for poultry farm. The study focuses on Raspberry Pi and Arduino Uno microcontrollers. The major functionality of the system is monitoring the surrounding environmental parameters like humidity, temperature, climate quality. These parameters of the rooster farm environment are controlled by a filter fan. The system has been seen fit and easy for farmers to use although it has it doesn’t cater for continuous supplication of water for better growth of roosters. In addition, Goud and Sudharson (2015) have focused on the wireless sensors and mobile system network to control and remotely monitor the poultry farm. The poultry owner is able to receive information about the climatic condition of poultry a mobile phone. To complete an action the owner can resend the message to the system to perform a failed task. Remote sensors pass the values to the server so that Google spreadsheets will later on display it.

Ammad-Uddin, et. al (2014) managed to come up with a well thought solution for Poultry Farming. Firstly, the authors have looked into controlling and monitoring the poultry diseases through the modern rooster farm using wireless sensors network. Solutions provided for poultry farming by this wireless network can institute an ideal farm with maximum productivity and economy. The anticipated solution works with wearable wireless sensor node which would be a useful detection tool for outbreaks of infected roosters. Furthermore, the overall production, quality and economy of the farm are improved by the wearable sensors nodes as well as fix sensor nodes in the shed and in the soil. Alternatively Islam et al. (2013) elaborates the idea of implementing biogas plant in poultry farm instead of using diesel or natural gas generators as backup support in Bangladesh since their costs are too high. Poultry farm requires unremitting power supply for monitoring of roosters. Poultry Roosters in farm can able to produce their own power from poultry wastage. The aim of is study is innovation of a biogas power plant in poultry by utilizing the poultry wastage. Although this project focuses on some innovative ways of the poultry farm uptake it doesn’t consider the uptake of the roosters themselves.

Dong and Zhang (2010) has designed equipment for monitoring an environment in Fowl Farm. This system monitors the environment parameters like CO_2 in air, temperature and humidity. They used CC2430 as a data processing chip and ZigBee protocol for transmission and communication of the system. In addition to that, Olaniyi, et al. (2014) has studied an Intelligent Poultry Feed and Water Dispensing System Using Fuzzy Logic Control Technique. Fuzzy logic system works in such way that it is able to provide feed and water for roosters during specified intervals of time. The strength of this system is that it reduces workload of poultry workers hence cost benefits increase. Boopathy et al. (2014) explained the performance of poultry farm using an embedded automation. This system measures different parameters such as temperature, humidity, level of water and valve control in the poultry farm. Help of two-point formula has done temperature sensor calibration. Analysis of the level sensor outputs with respect to fuel in the generator can be performed. Sensor result outputs linearization of the specific instrument as described.

Reyers et. al (2015) in designed an automatic feeder under the research topic MCU-Based Solar Powered Rooster Feeder. These tools were intends to feed roosters as required at a specified time and to give an alert when the feeds are running out of supply. The idea is to have solar as the main power supply for the prototype. This power will be taken from the sun using solar panels and will be stored in a car battery. Conveyors will be used for evenly distributing the feeds to the feeding bowl; the feeds will be coming from storage containers. This is an efficient method to continuously supply feeds although water supply is not concern in this project. The major advantage is that manual work is reduced thus less effort will be required in feeding the roosters and wastages are eliminated.

The mentioned authors in Asia published journals where they were looking into automatic, smart and intelligent methods used to monitor environmental parameters such as temperature and humidity. The aim of monitoring these parameters was to enhance poultry growth. Never the less monitoring these parameters was not good enough for some researchers therefore they developed systems that could also supply feeds and water. More work was done in automating farms not only for rooster growth but also to innovate poultry farming in this continent. However these studies have their weaknesses; therefore the writer seeks to disentangle them through the Intelligent Rooster Water Monitoring System.

2.3.1 MERITS AND DRAWBACKS

Some drawbacks have been noted as a result of working with previous water supply and temperature control mechanisms. Some of these drawbacks have been counteracted by the corresponding merits of the proposed system; the drawbacks of the previous work have fuelled the designing of the proposed system. The current study enhances the growth of roosters with adequate water and a healthy environment. Work is also made easier with the intelligent rooster water monitoring system, since to the need to manually fill in water and controlling the environment will be dealt with automatically. To add more continuous water supply increases productivity, little or no roosters die in the breeding process. High quality birds are yielded as a result of implementing this project. However there are drawbacks associated with this project, it doesn’t take into account the automation of feeds supply which is equally important in the growth of rooster.

2.4 FORE KNOWLEDGE WORK

Foreknowledge according Goodpasture (2010) is the concept of knowledge regarding future events. He also asserts that foreknowledge is associated with an event that will occur with certainty. In the recent years Nipple watering systems for roosters have been mainly used mainly because the ability to reduce labor by excluding the duty of cleaning water canisters. Even though labor is reduced with nipple watering systems, it doesn’t imply that less management is required. With the nipple invention at hand, autonomous system will be developed to counter the management aspect. Sensors will be used to detect the need for water supply and act accordingly in an autonomous manner. More so, Ziggity watering systems have been looked into to offer broilers the adequate amount of water without wastages at every stage of growth. Throughout the production cycle Easy side-to-side drinkers can be activated to accommodate day old, as well as 10lb./4.5kg birds to get all the fresh, hygienic water they need.

From a wearable sensor perspective, researchers and even farmers have gained a lot of insight into the health and well-being of roosters. Fitted with RFID tags, poultry could then be observed in a more natural environment, giving researchers the opportunity to learn from the animals. This information could be evaluated to determine everything from natural behaviors to inefficiencies in diet.

2.5 CONCLUSION

The intelligent Rooster Water Monitoring system has more paybacks as compared to the previous methods that were used to monitor poultry water supply. To add more the current study has the capability to overcome problems and limitations of other existing water management mechanisms. There is a need however to carry out the study since it has proved to be feasible basing on its advantages.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

The Intelligent Rooster Water Monitoring System has a considerable ability to continuously supply farm roosters with water as well as maintaining the best suitable temperatures for the water to be drinkable. Intelligent Rooster Water Monitoring System can be describe as the most efficient method that is used to automatically supply water in rooster runs continuously. Unlike the manual methods that were previously adopted by individuals this system comes with an automatic circuit that comprise of components which communicates to achieve the water supplication and temperature maintenance tasks. People using the manual system they have to fetch water from nearby water sources, in some cases a reservoir is placed near the rooster run for easy associability. In recent years nipples have been introduced thus abandoning the use of canisters. With nipples the roosters can offer themselves a safer and cleaner self-service, even though there are notable drawbacks including that water has to be manually turned on and off by the responsible personnel. There are a number of hardware components that will be used to achieve the desired tasks in the proposed project and these will be discussed in this chapter. The components may include Arduino board, ultrasonic sensor, and temperature sensor, cooling fan, relay module, submersible pump, buzzer, breadboard and 16*2 LCD display.

3.2 DEVELOPMENT TOOLS

3.2.1 ARDUINO IDE

This is open-source software designed to lessen the burden for programmers by making it easy to inscribe code and upload it to any Arduino microcontroller board. It works hand in hand with a number of operating systems that may include Windows, Mac OS, and Linux. The Arduino IDE comprises of a text editor for code composing, a text area, a text console, a toolbar that contains functionality buttons and as well as a series of menus. Programs in Arduino (IDE) are inscribed in the text editor and they are called sketches. File extensions for saving sketches is .ino. Attached to the IDE are several features that enable quick and efficient code writing.

3.2.2 C++

It is a programming language that is object oriented in nature. It is mainly used to efficiently design embedded, resource-constrained and complex systems. C++ has imperious and generic features that secure low-level memory handling and code reuse. Balagurusamy (2008) stated that C++ widely utilizes concepts such as objects, classes, data abstraction and encapsulation, inheritance, polymorphism, dynamic binding and message passing. These features allow programmers to build clear programs that are can be used for various purposes and easy to maintain. One of the advantages of C++ is that it brings about productivity and good quality software.

3.2.3 ARDUINO UNO

Arduino Uno can be best described as a microcontroller board built on the ATmega328P datasheet which permits connections with various components such as sensors (Stewart, 2015). It comprise of a Universal Serial Bus assembly, a power supply, an ICSP header, fourteen digital I/O pins where six pins work as PWM outputs, six analog inputs, crystal oscillator (sixteen MHz), and a reset button. Windows Universal Serial Bus drivers required to allow communication between the Uno and the windows operating system are pre-installed therefore there is no need to install them. To use this device a simple connection to the computer via a Universal Serial Bus cable or Alternating Current-to-Direct Current power adapter is needed for a notable progress. This device can be programmed using several programing languages such as C, C++ and C# using the Arduino Software (IDE).

Features:

- ATmega328 Microcontroller
- Working Voltage(5V)
- Recommended Input Voltage (7-12V)
- Input Voltage (limits, 6-20V)

- Digital I/O Pins -14 (of which 6 provide PWM output)
- Analog Input Pins (6)
- DC Current per I/O Pin (40 mA)
- DC Current for 3.3V Pin (50 mA)
- Flash Memory (32 KB of which 0.5 KB used by boot loader)
- SRAM (2 KB)
- EEPROM (1 KB)
- Clock Speed (16 MHz)

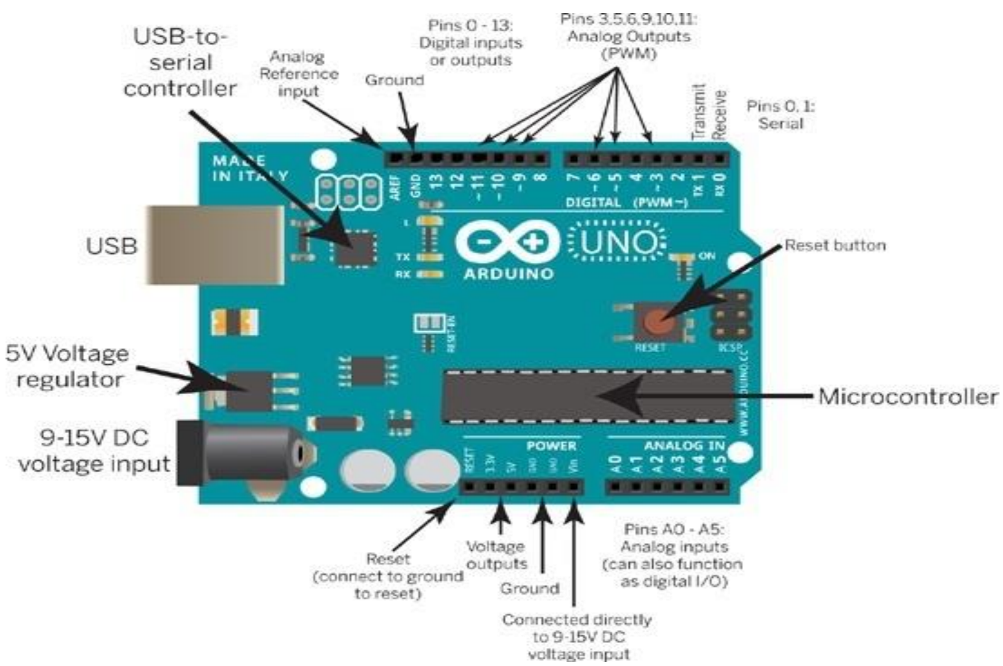

Fig 3.1 Arduino Uno labeled diagram

3.2.4 SUBMERSIBLE PUMP

A submersible water pump is a pump that is usable in fresh water or saltwater. It is also appropriate for use in aquariums, fountains, fish ponds, reservoirs etc. Its seal performance is good and efficient; it also has high delivery head, large flow, and is quiet and durable.

Features:

- Power 1W

- Fixed Form Sitting
- Power Source Charge
- Voltage DC 5V
- Power 0.6-1.8W
- Qmax 120L / H (44GPH)
- Hmax 15.7 - 60 inch / 0.4 - 1.5 meter
- Outlet Diameter 8mm
- Dimension (L x W x H) 3.8 * 3.4 *2.8cm
- USB Cable Length 145cm

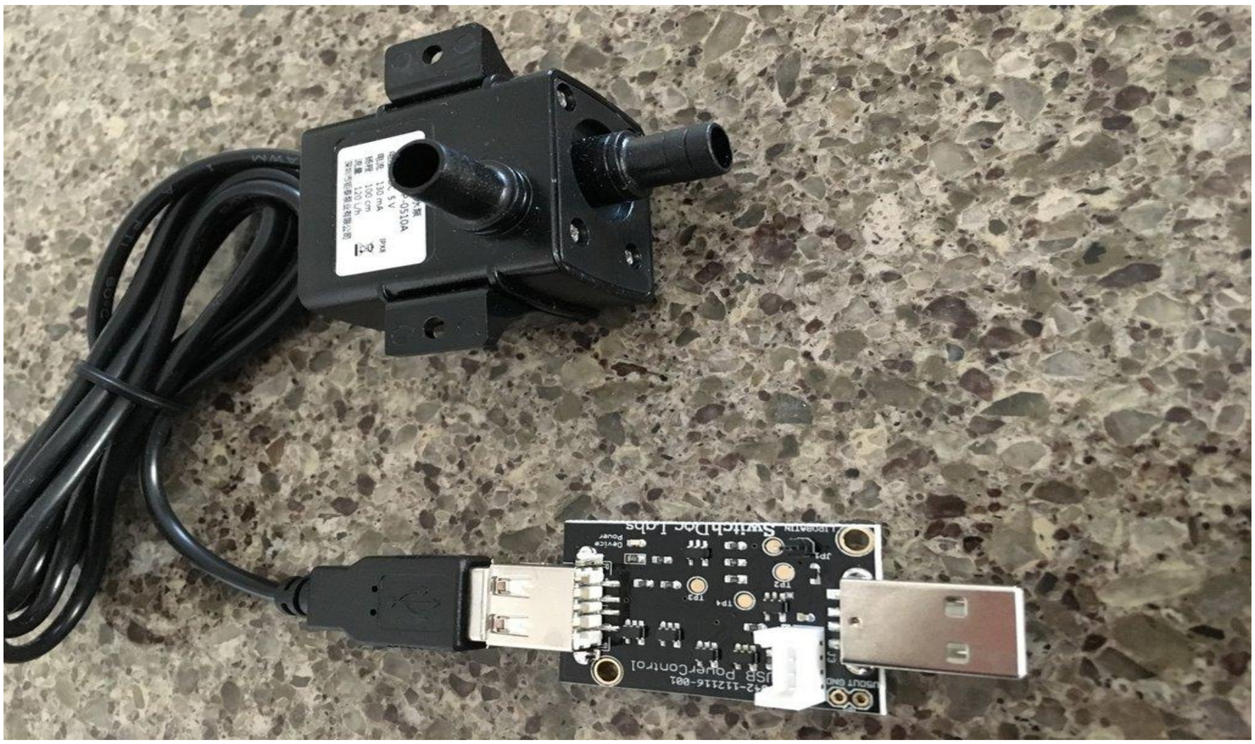

Fig 3.2 USB Submersible pump

3.2.5 RELAY MODULE

A relay can be defined as a switch that is electrically operated switch. The main purpose is to control circuits using a single or low-power signal. Originally relays were used in long distance telegraph circuits as amplifiers, where they had to repeat a signal they decoded from one circuit, and conveyed it into a different one. Early computers also used them to do logical operations. This module is intended for various for microcontrollers which include the Arduino Uno, AVR, PIC etc. A 2 channel relay module integrates 2 relays. The relay system is formed with Input being Vcc, GND connected to the earth and 2digital inputs and also output. This relay module is measured like a series switches.

Fig 3.3 Arduino Relay Module

Features:

➢ Relays	2
➢ Control Signal	TTL Level
➢ Load	7A/240VAC 10A/125VAC 10A/28VDC
➢ Contact Action Time	10ms/5ms
➢ Interface Board	5V 2-Channel Relay, 15-20mA Driver Current.
➢ Equipment ·	AC250V 10A; DC30V 10A
➢ Indication	LED's for Relay output status.
➢ Supported Microcontrollers	Uno, 8051, AVR, PIC, DSP, ARM, ARM etc.

3.2.6 ULTRASONIC SENSOR

This device that is used measure the distance between the sensor and an object using sound waves. The principle used to measure distance involves gauging a sound wave at a known frequency and listens and measures how long it takes for that sound wave to bounce back. Of the two opening that the sensor has on its front, one is for transmitting ultrasonic waves like a tiny speaker whilst the other one receives the waves just like a microphone. This device uses the approximated speed of sound in the air that is 341 meters per second as well as the elapsed time between sending and receiving the sound pulse to calculate the actual distance to an object. The following equation is used for operation:

Distance = Time * Speed of Sound/ 2

Where Time is the period elapsed when the wave is conveyed and when it is received.

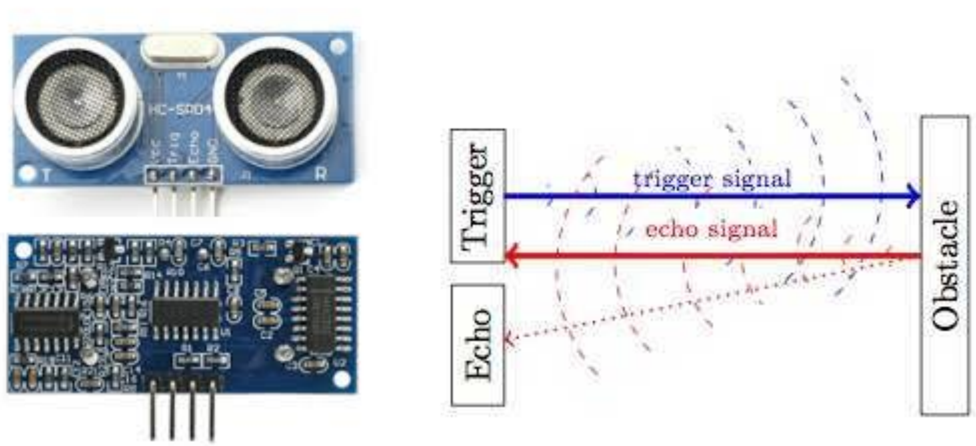

Fig 3.4 Ultrasonic sensor and the principle of operation

Features:

- DC Power Supply (5V)
- Quiescent Current (2mA)
- Operating current (15mA)
- effective Angle (15°)
- Reaching Distance (2cm – 400 cm)
- Resolution (0.3 cm)
- Measuring Angle (30º)
- Trigger Input Pulse width (10uS)
- Dimension (45mm x 20mm x 15mm)

3.2.7 TEMPERATURE AND HUMIDITY SENSOR (DHT11)

This device is used for measure temperature ranging from 0 to 50 degrees Celsius with +-2 degrees of accuracy. It is on the other hand used to measure humidity ranging from 20 to 80% with 5% accuracy. It made up of a capacitive humidity sensor and a thermistor that are used for measuring the adjacent air, and produces a digital signal on the data pin.

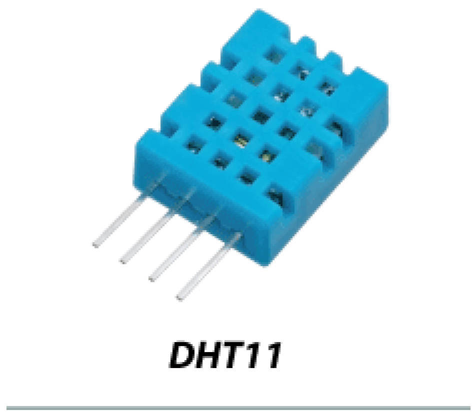

Fig 3.5 DHT11 Temperature and humidity sensor

3.2.8 LCD SCREEN

This device is used to display any circuit output in form of a readable message. There are sixteen pins on the screen and the ground pin is the first one from left to right, the preceding pin is the Vcc which is connected to the five volts pin on the microcontroller. The Vo is respectively used to integrate a potentiometer for controlling the contrast of the display.

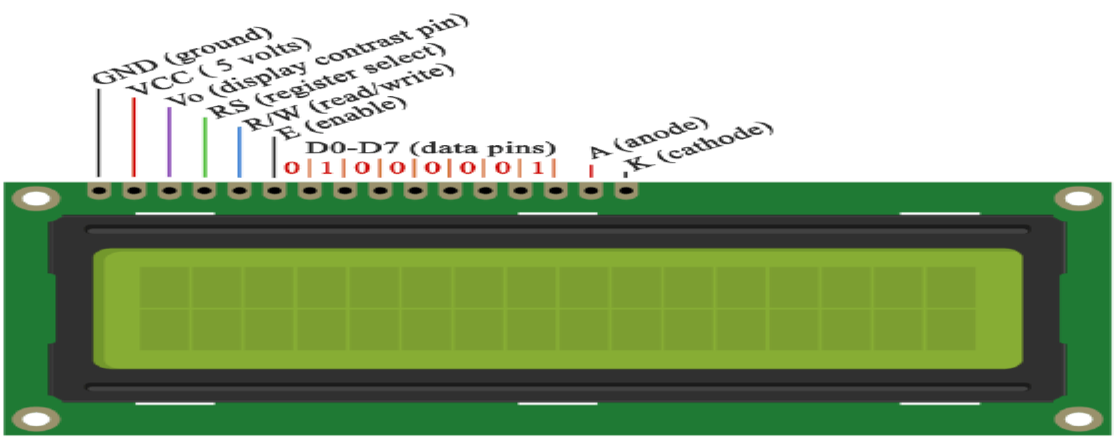

Fig 3.6 LCD screen display

3.2.9 BREADBOARD

Breadboard is a component used to make up temporary circuits for testing or to try out an idea. It doesn't require soldering thus making it is easy to make connection changes and replace components. More so it doesn't damage parts so they will be available for later use. The bread board is made up of many strips of copper metal which run underneath the board for conductivity purposes.

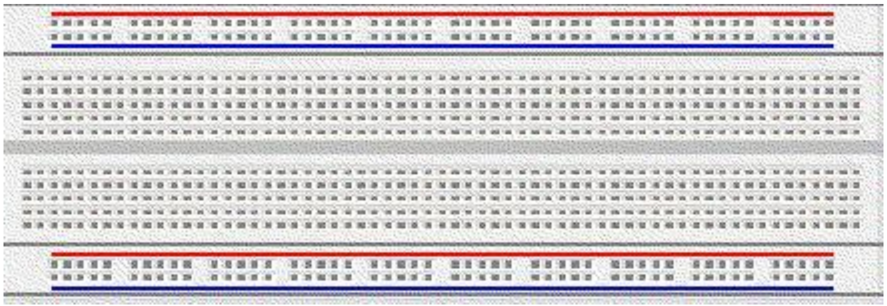

Fig 3.7 Breadboard

3.2.10 JUMPER WIRES

Jumper wires are small wires used to connect components to the Arduino board and the breadboard. They are made up of conductive material insulated with plastic materials of several colors. There different types of jumper wires which are male to female, female to female and male to male.

Fig 3.8 Jumper wires

3.2.11 RESISTORS

Resistors are used to bind the flow of current throughout an electrical circuit. There are several types of resistors which include Carbon, Film and Wire wound. They use color codes to mark the rating for small resistors. To identify large size resistors BS1852 Standard uses letters.

Fig 3.9 Resistor

3.2.12 COOLING FAN

This is a device that brings a cooling effect to the surrounding air. It makes use of any current or power supply to turn on the moving wings.

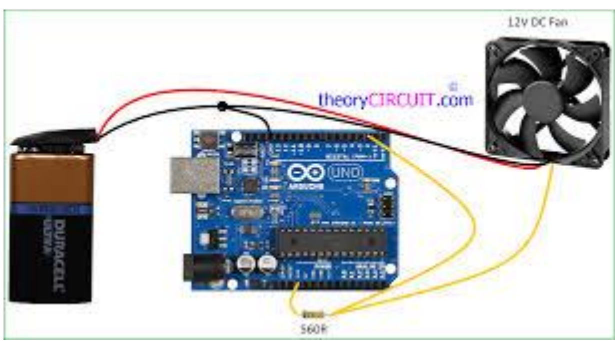

Fig 3.10 cooling fan

3.2.13 BUZZER MODULE

The role of a Buzzer is assimilated to the structure of electronic transducers, Direct Current voltage power supply. It is extensively utilized by computers, printers, photocopiers, alarms, telephones, timers, etc. it is basically an Electronic product for sound devices. It is connected on Arduino circuit to give the sound effect.

Fig 3.11 Buzzer Module

3.3 INFORMATION GATHERING METHODOLOGIES

The type of methods used to gather information for a research study can be interactive, non-obtrusive and comparing gathering (Denis, et al. 2006). In this study observations are used, observations are a comparing and gathering method. The mentioned methodology is used as follows:

3.3.1 OBSERVATIONS

Sobh (2008) states that observations consist of some gathered information of how any system operates on a day to day basis. Observation can be defined as a way of collecting data by watching behavior, events, or noting physical characteristics in their ordinary scenery. The observations can be overt where the objects being observed have the knowledge that they are being observed while they can also be covert where the objects being observed are not aware and the observer is concealed. Observations help to study the relationship between poultry and its farmers; they are mostly done on decision makers and the physical environment. This method can be direct or indirect, for this study direct observation was used because of the flexibility to watch interactions, processes or behaviors as they occurred. This method was used by the researcher with the quest to gather information on the research topic.

Several rooster poultry farms was observed, the rooster water canisters were filled with water. Responsible persons were to fill in the canisters again at regular and random intervals. There was no method used to notify that the canisters needed a refill. To test whether the water had the most suitable temperature for drinking fingers were used and in some cases thermometers were used. Temperature was only measure when there is an unusual or slow water intake. In cases where there were intruders in the rooster run on the sound of the rooster would be used to interpret but only by experienced farmers. The advantage of this data collection method is that the researcher can collect data for an event or activity as it occurs and there is no need to know the willingness or ability to of the other person to provide information.

3.4 CONCLUSION

An overview of the research methodology stated in this chapter. This chapter also illustrates how the components are interfaced to each other and how the software is loaded into the microcontroller. A new system should therefore be developed with reference to the information gathered on the expected requirements of the study.

CHAPTER 4

SYSTEM DESIGN

4.1 INTRODUCTION

According to Valvano and Yerraballi (2014) the design phase involves building hardware or software conceptual model that is a representation of a set of relationships between factors that that point to a situation in question. Designing can be defined as a basic method of arranging all the logic of the system through generating a structure. The creation of the proposed system will be elaborated in this chapter by looking at the system flow chart, architecture design, interface design as well as the results obtained. The system will be designed such that all the objectives mentioned in the first phases are met as stated.

4.2 PROPOSED SYSTEM SUMMARY

The proposed system aims to lesser the burden for rooster breeders as well as enhancing healthy growth for roosters. Instead of using traditional method of manually filling in the water canisters at random intervals this system automatically refills the water canisters whenever there is need to do so. More so the proposed system ensures a consistent intake of water by monitoring and maintaining favorable environmental temperatures. The system measures the amount of water in the canister using an ultrasonic sensor. The sensor communicates with the microcontroller such that when there is need for a refill, the microcontroller automatically turns on the pump which will supply water to the canister. When the required amount of water fills the canister the pump automatically turns of.

The system on the other hand maintains favorable temperature for the rooster run, to do this a temperature sensor communicates with the Arduino board such that a fan is automatically switched on each time the temperatures goes beyond the stated values. Nauta et al (2009) believes that tap water is affected by hot temperatures more than it is by cold temperatures thus this system focus on cooling the rooster run temperatures. To add more in modern day rooster breeding new lighter with heaters have been invented thus accounting for the warming of the drinking water. A buzzer module is also used for this project to alert through a buzzing sound that the water level has reached an unfavorable state; the system is now refilling the canister. The purpose of the buzzer is to serve as an alternative alert in the case that there has been interference in the flowing of water to the canister thus the responsible personnel can choose to go and check the conditions at the buzzer sound.

4.2.1 FLOW CHART OF THE PROPOSED SYSTEM

A flowchart is a diagram that represents progress of system or computer algorithm. Oriel (2002) asserts that flow charts shows the detailed steps in a process and the entities involved in each step. They are extensively utilized by various fields for documenting a study or a project hence providing room for planning and improving processes. It also gives a clear view of complex processes through diagrams that are easy to understand. The diagram below shows the flow diagram of the proposed system:

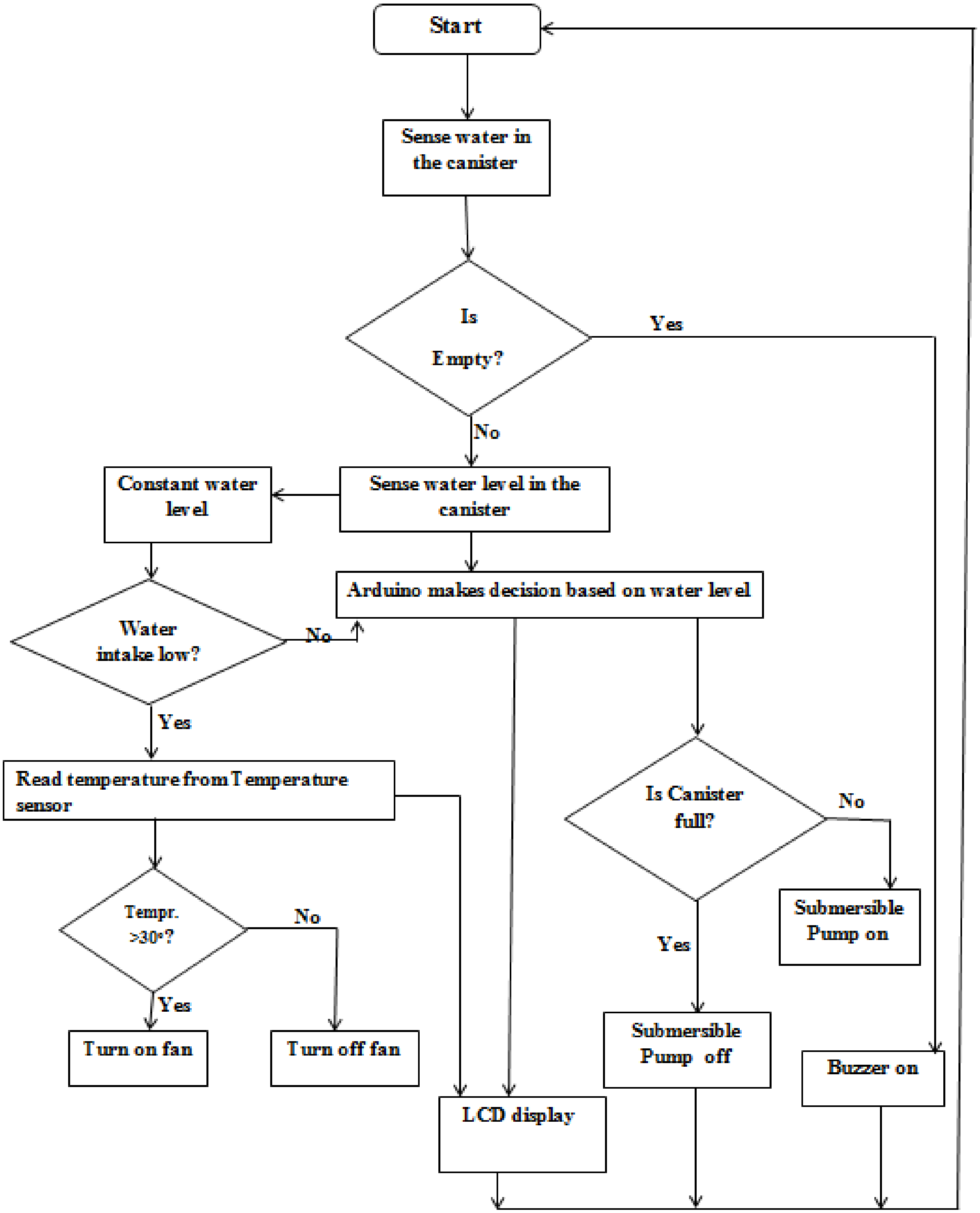

Fig 4.1 Flow chart of the proposed system

4.3 ARCHITECTURAL DESIGN

The architectural design is defined by Fairbanks (2010) as a design that emphasis on the describing the assembly, performance, and more views of the system. The writer asserted that this design includes the integration of compatible software and hardware in an operational manner in order to improve the throughput of the system. The scope of the architectural design of this system focuses on the communication between the user, Arduino IDE, Arduino board and the sensor modules to give the desired output. More so Arduino board uses the Harvard architecture where the program code and program data have separate memory. The diagram below shows the architectural design of the system:

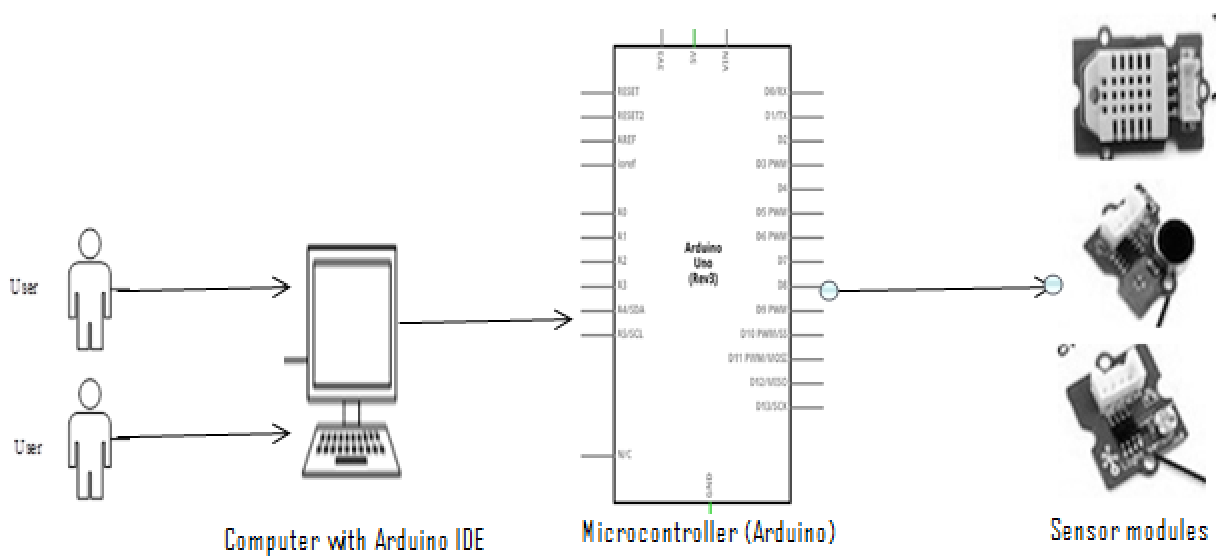

Fig 4.2 Architectural Diagram

4.4 PHYSICAL DESIGN

Otero (2012) suggests that the physical design relates the actual input, processes and output. He also states that the physical design focus on how hardware components of the system communicate with each other with the aim of achieving the stated goals. This design will also ensure that the components will be effectively connected in a circuit to accept input and produce output of the system.

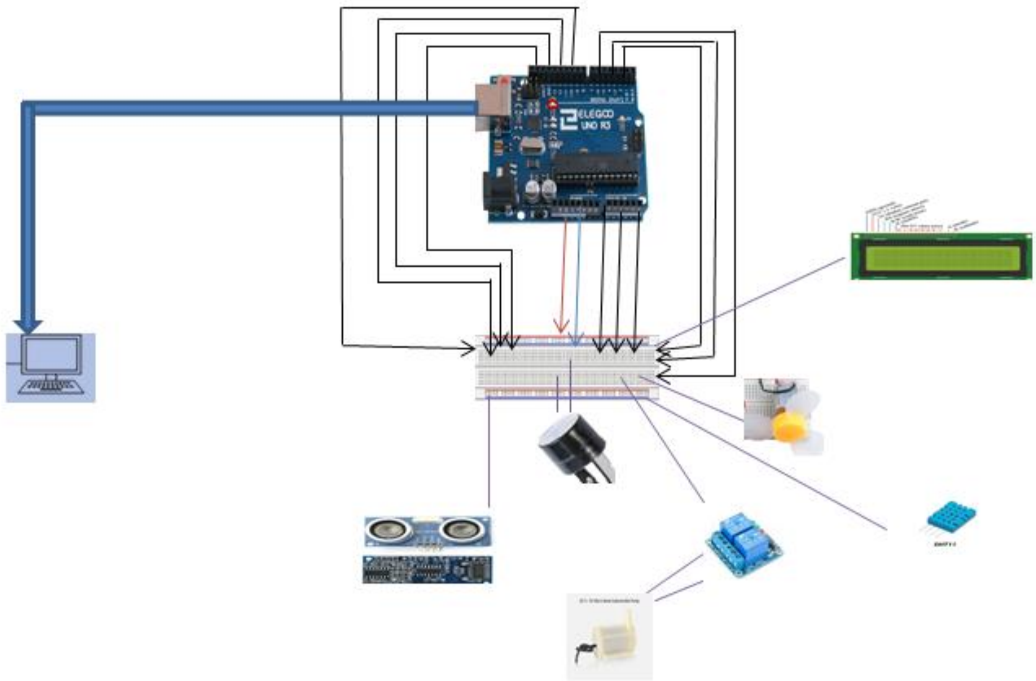

Fig 4.3 Physical design of the system

4.5 INTERFACE DESIGN

According to Fairbanks (2010) interface design includes the design of components in the new system in way that enables users to interact with the system. In this stage the inputs and outputs of the new system are outlined as illustrated in the diagrams below.

4.5.1 INTERFACING ARDUINO AND THE SUBMERSIBLE PUMP

In order for the pump to communicate with the Arduino board it is connected through a relay module. The purpose of the relay module as mentioned earlier is to control the circuit by a low power signal or when several circuits are controlled by one signal. It role in this project is to control the submersible pump using commands from the Arduino board. A relay can be activated or deactivated by the microcontroller thus determining the state of the pump. The pump can only work when the relay is activated otherwise there can never be a communication between the Arduino and the pump. The circuit diagram of this connection is shown in the diagram below:

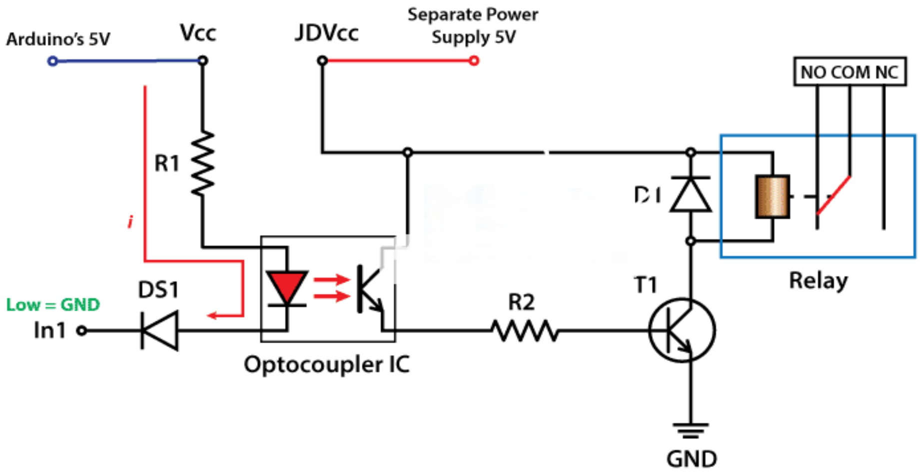

Fig 4.4 Submersible pump to relay circuit diagram

The main aim of the project is to refill water in the canister and it is achieved by interfacing Arduino board to the relay and the pump. It is important to note that there is need for an external power supply as the power from the Arduino might not be sufficient to run the pump. The interface design of the three components was successfully done and is demonstrated in the diagram below:

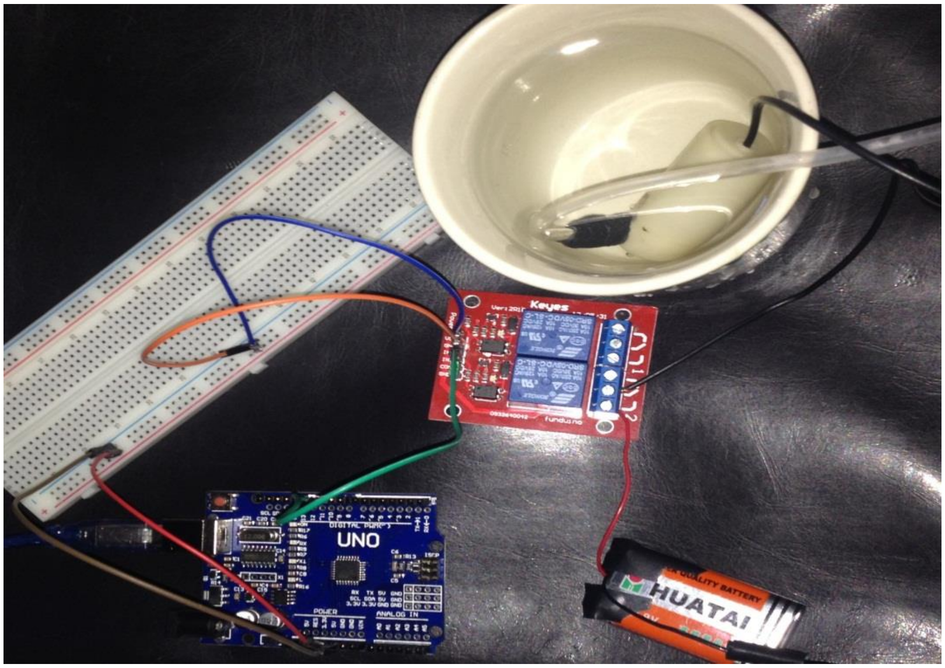

Fig 4.5 Arduino connected to the relay and submersible pump.

4.5.2 INTERFACING ARDUINO AND THE ULTRASONIC SENSOR

An interface between the ultrasonic sensor and Arduino is essential for this project. The ultrasonic sensor will be used to measure distance between the transceiver and water. The distance is determined by time of the pulse to and fro as well as the speed of sound. This measurement can only be initiated by instruction from the microcontroller. After obtaining the distance the rooster water is refilled accordingly. The diagram below shows the connection semantics of the two components:

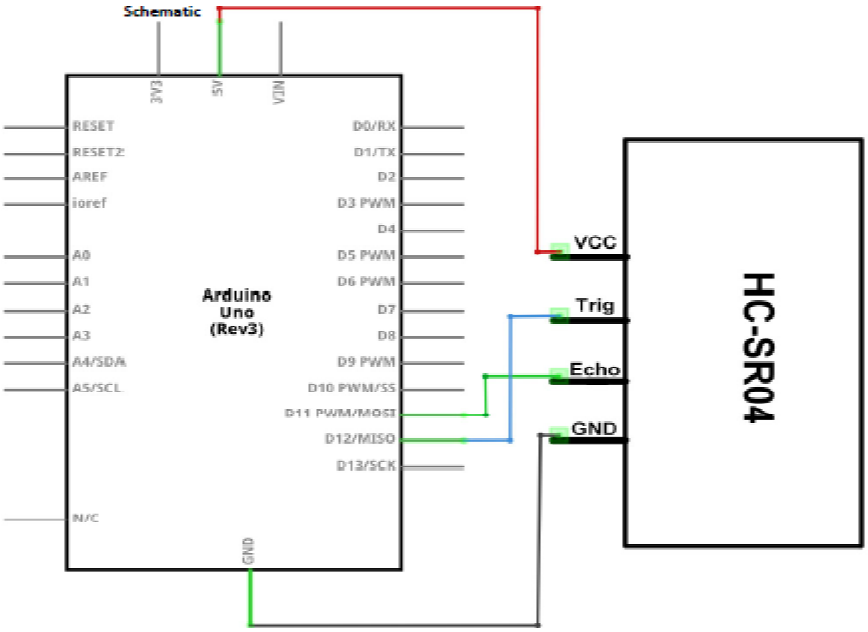

Fig 4.6 Semantic connection diagram of the Arduino and ultrasonic sensor

The ultrasonic connection to the Arduino board was successfully done for this project. The diagram below shows the connections:

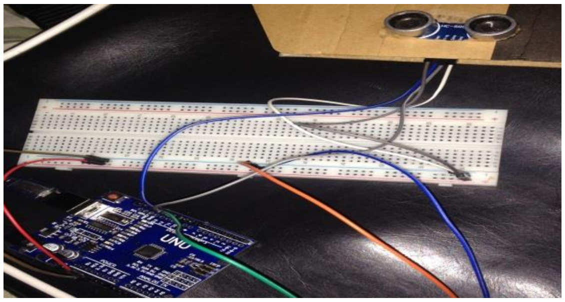

Fig 4.7 Ultrasonic sensor to Arduino interface diagram

To achieve one of the objectives of this project the ultrasonic sensor is connected to the Arduino such that it communicates with the pump as well via the relay module. Once the distance measured reaches its minimum water is automatically refilled by the pump. Otherwise when the water is full the relay module is deactivated thus switching off the pump. The diagram below shows the successful connections of the ultrasonic sensor to the pump.

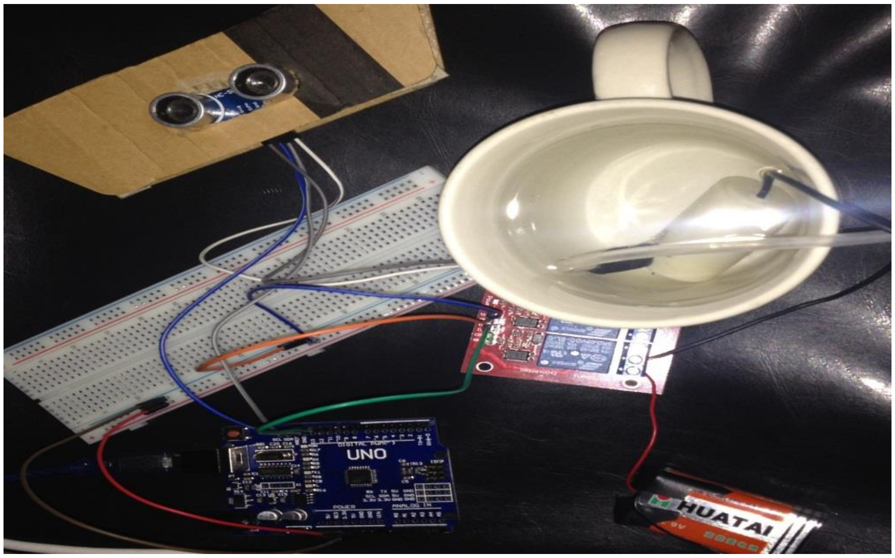

Fig 4.8 Arduino interfacing the pump and the ultrasonic sensor

4.5.3 INTERFACING ARDUINO, TEMPERATURE SENSOR AND THE COOLING FAN

The water intake of roosters is affected by their surrounding temperatures, in order to fully monitor the manner in which the water is refilled to benefit the roosters, environmental parameters were measured. The system seeks to control high temperatures of the rooster run using a cooling fan. Similarly low temperatures need to be controlled and the system counters for it using a buzzer. Temperature drops are accompanied by buzzer rings to alert the users of the system so that they may turn on the heaters. In order to establish this connection the components were successfully connected individually and they were later integrated to achieve their stated goal.

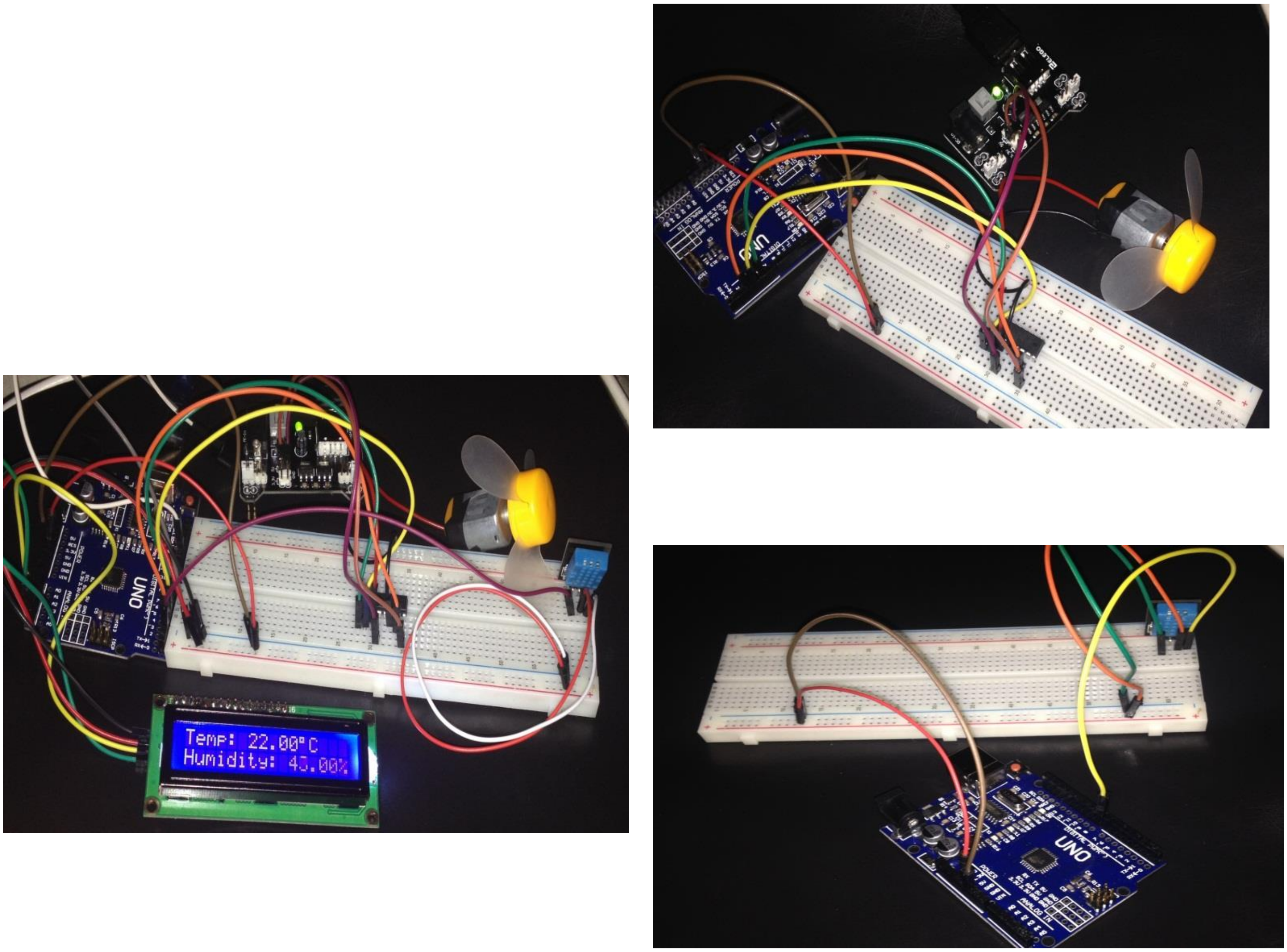

Fig 4.9 Showing individual connection (left) and the integrated interface (right).

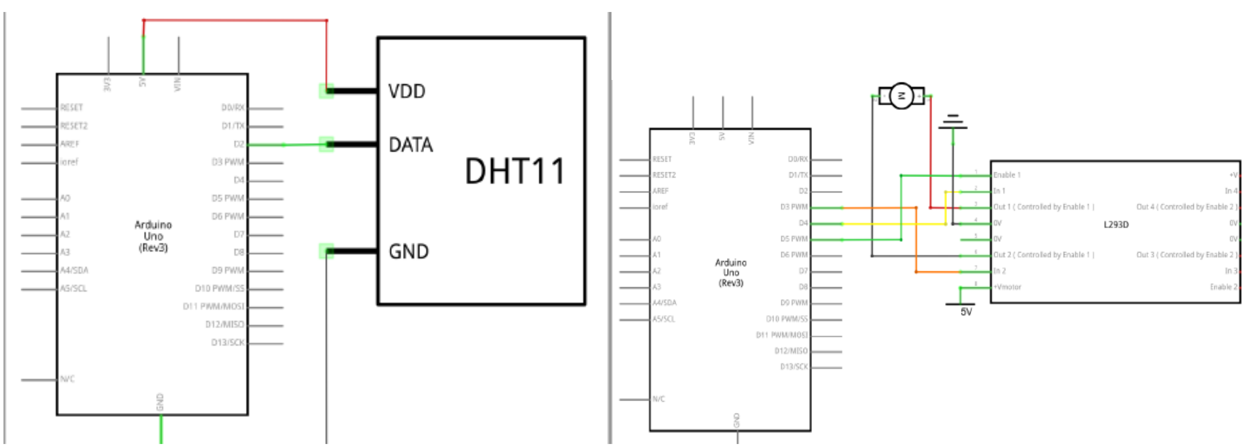

Fig 4.10 Connection semantics of the temperature sensor and the cooling fan

4.5.4 INTERFACING ARDUINO AND THE BUZZER MODULE

In order to produce sound the Arduino board was interfaced with the buzzer module. The buzzer in this system alerts the users of the system of an undesirable condition present in the rooster run. Each time the water has reached its minimum level and each time the temperature teaches the minimum level the buzzer produces a sound as an alert. The buzzer was successfully interfaced with the Arduino as shown in the diagrams below:

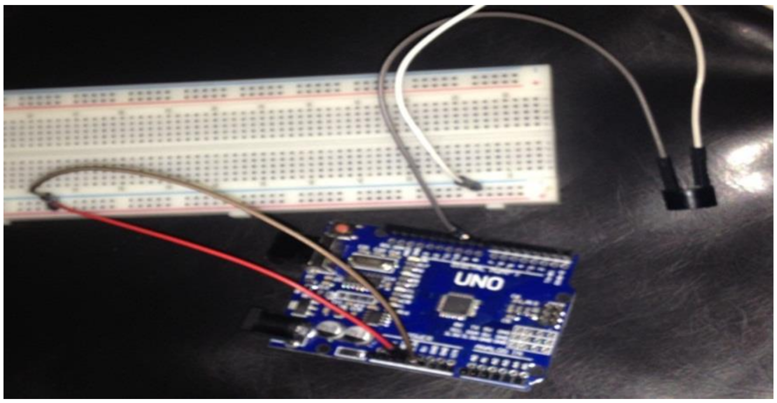

Fig 4. 11 Arduino interfacing the buzzer module.

The connection semantics of the buzzer are shown in the following diagram:

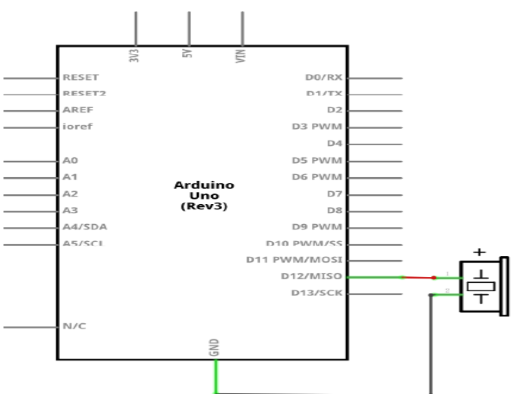

Fig 4.12 Buzzer connection semantics

4.5.5 INTERFACING ARDUINO AND THE LCD SCREEN

Every measured parameter of the project was displayed on the LCD screen. This was achieved by interfacing the LCD screen with the Arduino board. Temperature readings as well as water levels visually displayed for the users to see the current conditions at any given time thus allowing easy assessment. The interface of Arduino board and the LCD screen are shown in the below diagram:

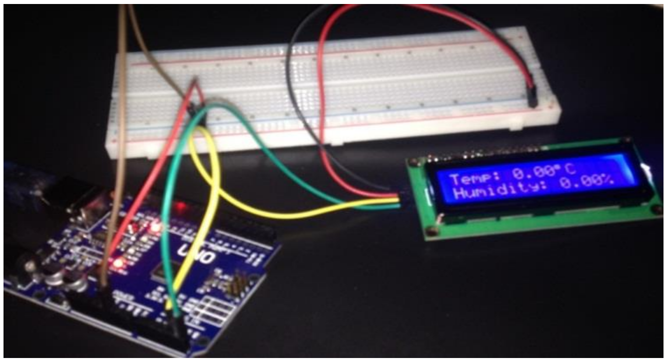

Fig 4.13 Arduino to LCD interface

The circuit diagram of this connection is shown below:

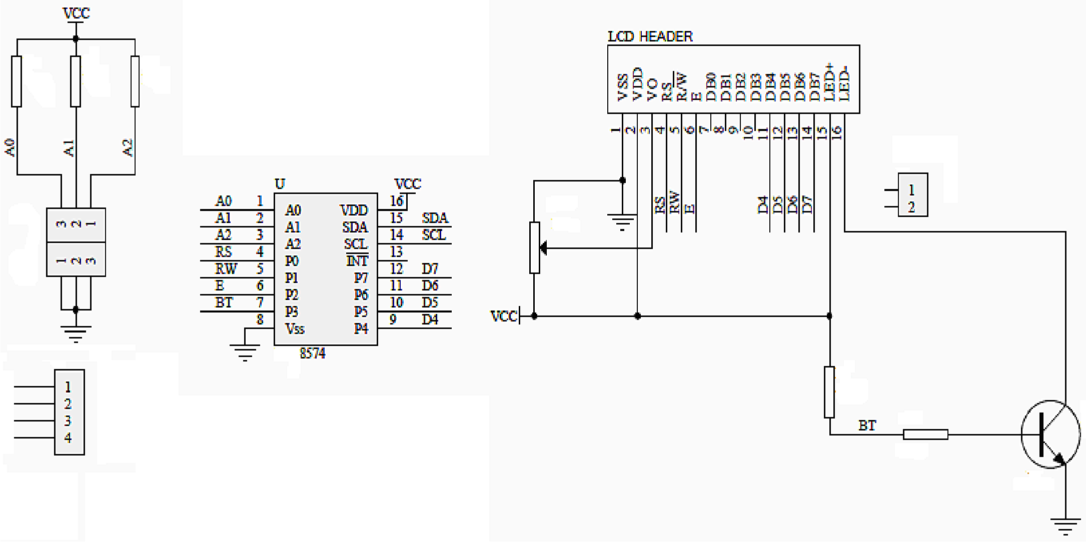

Fig 4.14 Circuit diagram of the LCD display.

4.5.6 INTERFACING ARDUINO AND ALL THE COMPONENTS

The Arduino board is designed with 14 pins, both digital and analog the interfacing of all the components required for this project was hence achievable. The communication of connected components was facilitated by the microcontroller commands. The commands were programmed by the writer using Arduino IDE and C++ programming language. The diagram below shows how the Arduino was interfaced to all the components.

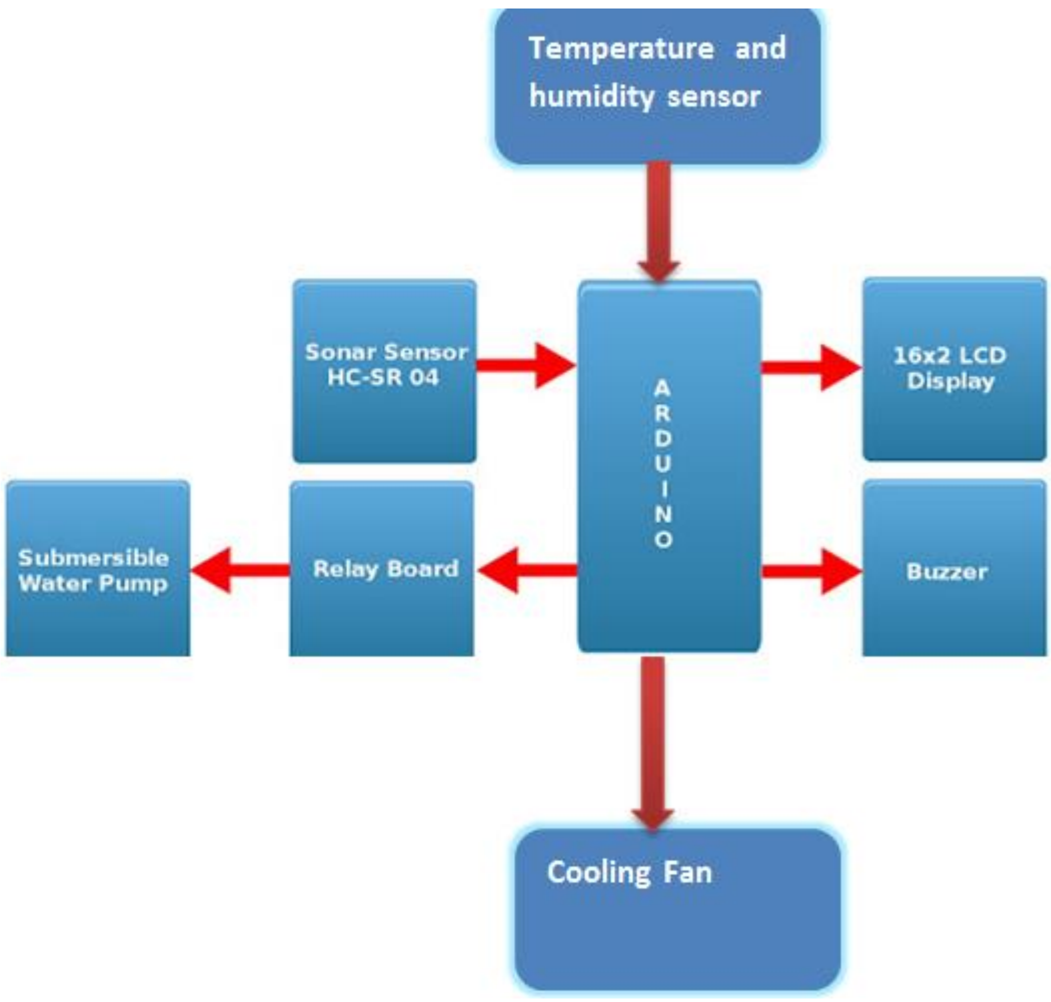

Fig 4.15 Block diagram of all the components interfaced to Arduino

The connections of the whole circuit were successfully designed and they are shown in the diagram below:

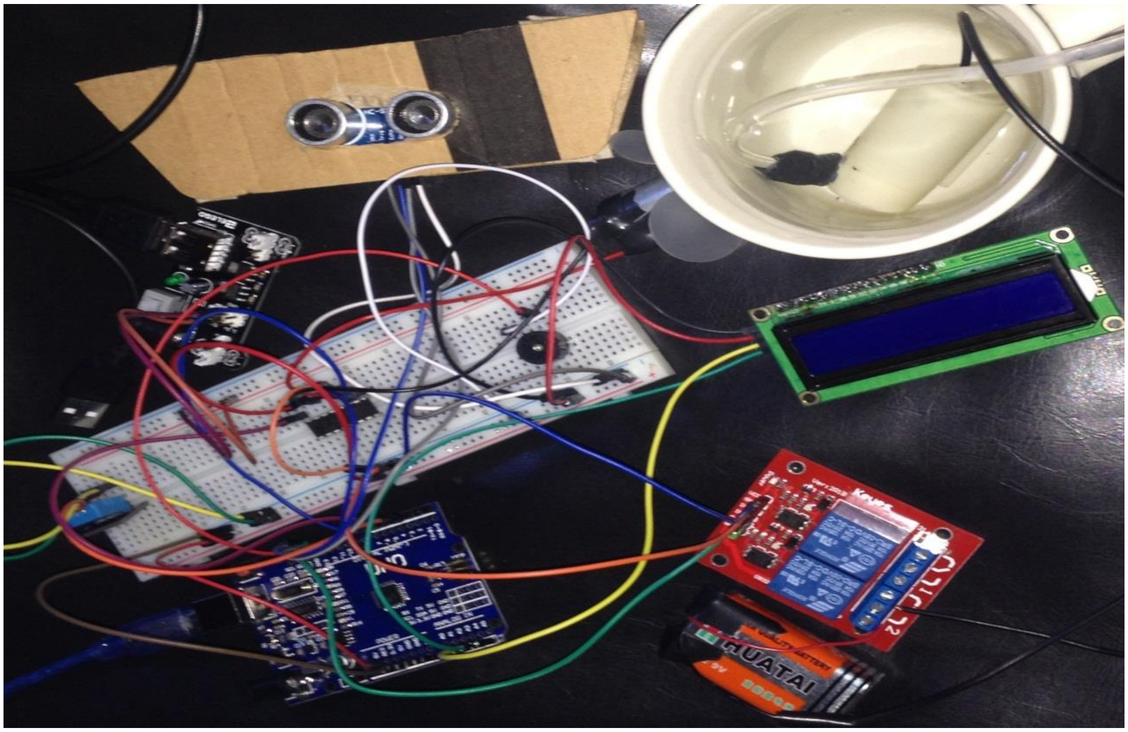

Fig 4.16 Complete circuit connections

4.6 RESULTS AND ANALYSIS

A number of checks were made on the system to observe the results given by each parameter. Results were recorded as the Arduino microcontroller process instructions from each input sensor to the output sensors.

4.6.1 ULTRASONIC SENSOR MEASUREMENT AND VARYING PARAMETERS.

The ultrasonic sensor measures distance from the transceiver to the liquid using a short ultrasonic pulse where the travel time of that pulse multiplied by the speed of sound gives the required distance as the result. There is a small possibility that at any given time the pulse might not be received by the transceiver since it is transmitting. This problem can be solved by placing the ultrasonic sensor a few centimeters from the maximum water level. To add more the beam length determines the diameter of the container where the distance will be measured. The tables below shows the variations of the actual distance and the distance measured in different parameters.

Sensor distance from the maximum water level (cm)	Actual distance (cm)	Measured distance(cm)
1	21	15
3	21	18
5	21	20.7

Table 4.1 Measured distance comparison

Diameter of the container (cm)	Actual distance (cm)	Measured distance(cm)
2	21	18.4
4	21	19.1
6	21	20.4
8	21	20.9

Table 4.2 Varying diameter against measured distance

4.6.2 WATER REFILLING PROCESS

The results demonstrate the successful water refill whenever there is need. The ultrasonic sensor is placed on the most desirable position of the canister that the roosters feed from. Water is pumped from the water supply reservoir tank through the relay module. An alert system was added to the system in order to notify the users of the system that there is a water refill taking place, the sound is produced by a buzzer. Water is only pumped when it is necessary and the working of the system is shown in the table below:

Distance	Pump state	Buzzer state	Display water level
< = minimum level	ON	ON	YES

< minimum level	OFF	OFF	YES
>= maximum level	OFF	OFF	NO

Table 4.3 Water refill table

4.6.3 TEMPERATURE CONTROL PROCESS

Temperature affects the growth and the water intake of roosters depending with their age. In order to enhance water intake the system measures and controls the environmental temperature of the run. Temperature measured by the temperature sensor triggers the cooling fan and the buzzer module. When the temperature is extremely hot the cooling fan automatically turns on, it is important to note that the speed of the fan also depends on the magnitude of the temperature. A buzzer can only be turned on when the temperatures are low so that the users can switch on heaters for the roosters. The table below demonstrates how temperature is controlled in the rooster run:

Temperature	Cooling fan	Fan speed	Buzzer
Extremely high	ON	255	OFF
High	ON	180	OFF
Normal	OFF	0	OFF
Low	OFF	0	ON

Table 4.4 Temperature control table

4.7 CONCLUSION

The design of the proposed system was successful. Designing the architectural, physical and interface designs was given more prominence. Results of the project and their aspects were presented in this chapter. The obtained results have therefore highlighted areas that need improvement which will be recommended in the next chapter.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

An intelligent, smart and portable rooster water level monitoring system was successfully designed, tested and results were obtained. The proposed system solved the problems that farmers or individuals whilst breeding roosters. The intake of water is of paramount importance in the growth of roosters hence an intelligent system was designed and implemented. As part of solving monitoring the manner in which these roosters drink water, a temperature monitoring element was also integrated into the system. This chapter deliberates a number of findings and recommendations in areas of study as well as the conclusion of the study.

5.2 FINDINGS

- Some findings were observed during the design of the system and they are explained as follows:
- The measurements of distance by ultrasonic sensor were dependent on the height as well as the diameter of the container.
- Any distraction that comes in the way of the ultrasonic sensor may give inaccurate measurements.
- Temperature is directly proportional to humidity, however this study proved that temperature can be constant while humidity rises or vice versa.
- The results that were obtained were in agreement with theory hence the study is feasible.
- The developed system developed is adaptable as it reduces labour and lessens the burdens previously experienced when breeding roosters.

5.3 LIMITATIONS OF THE SYSTEM

- The system cannot be used with small containers
- The problems associated with rooster feeds are not solved by this system.
- It does not provide an automated response in case of low temperatures.
- The buzzer cannot be turned off by the user only the system can turn off the buzzer which is a problem to the users when they are in a no noise situation.
- Any movement that affects the ultrasonic sensor can result in inaccurate results being produced.
- A cut of water supply to the pump can damage the motor.

5.4 RECOMMENDATIONS

The users of the system are encouraged to find time to manually check the rooster run whenever the buzzer rings. There is need for the researchers of Arduino based to study the scope at earlier levels. Enough wires and Arduino components should be readily available to undertake Arduino based projects. When connecting components dc motors and other components that requires high voltage to the Arduino Uno board, an external power supply should always be used otherwise the board will be damaged. More so there is need to take extra caution when working with water and electrical circuits otherwise there can a short circuit that will burn out components.

5.5 AREAS OF APPLICATION

The process of rearing roosters can come in small and large scales. The system can be implemented in both cases, some of the areas may include:
Layer Poultry Farming where the purpose of the birds is to produce eggs. This area is crucial since the intake of water and the growth of the birds determines the rate of producing eggs. Hens start laying eggs at 12-20 weeks hence temperatures are maintained by the system during that time. To add more this system is applied in broiler poultry farming where birds are raised for meat production. Roosters are able produce meat when they healthy and fully grown hence the system is implemented for their swift healthy growth. Since the maximum number of weeks that these birds need for maturity is known the conditions expected for the fowl run are also know thus the system will guide them to keep favorable conditions and also the users' response to the

buzzer will be improved as they know what they want for their birds. Finally the system can be applied in domestic poultry rearing; roosters can be kept for personal use that is personal consumption of the birds. The system can be implemented also for this use to reduce the labour of refilling water at regular intervals. The system generally makes the rooster breeding process worthwhile.

5.6 FUTURE APPLICATIONS

Studies suggest that the intelligent rooster system can include the use of Bluetooth and/ or ZigBee technology to control the rooster run inside their homes. Also drones will be implemented to visually monitor the environment for intruders. To add more the system will be implemented in Ziggity watering systems have been looked into to offer broilers the adequate amount of water without wastages at every stage of growth. Autonomous water supply will be implemented in the nipple water supply method for enhancement of the system. Finally the system can be implemented using Internet of Things to enhance user-system interfaces

5.7 CONCLUSIONS

The proposed intelligent rooster water monitoring system has managed to meet all the objectives and above all it has improved the rooster rearing process by eliminating some of the burdens associated with rearing roosters. The system was successfully designed and implemented and the results obtained will be used as a guide for future developments of the system. Maintenance will be done on the as a continuous practise to ensure that the functionality of the system is prolonged. Finally this chapter marks a successful completion of the project.

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APPENDIX A: USER MANUAL

To begin using the Intelligent Rooster Water Monitoring System the following steps are to be followed by the user. The steps are elaborated below, when you are using a board that has the code already uploaded we begin with step two.

Step One: Upload the code

Firstly user must upload the code into the Arduino UNO board. To open the sketch of the code the user must have Arduino IDE installed in the machine; follow the link https://www.arduino.cc/en/Main/Donate to download the setup. Once the IDE is installed open the folder containing the sketch for this project, double left click the file to open it. The sketch file saved with .ino extension. Once the code has been uploaded it is kept in the microcontroller board unless changes are made by an expertise of a programmer. Click on the upload button as shown below:

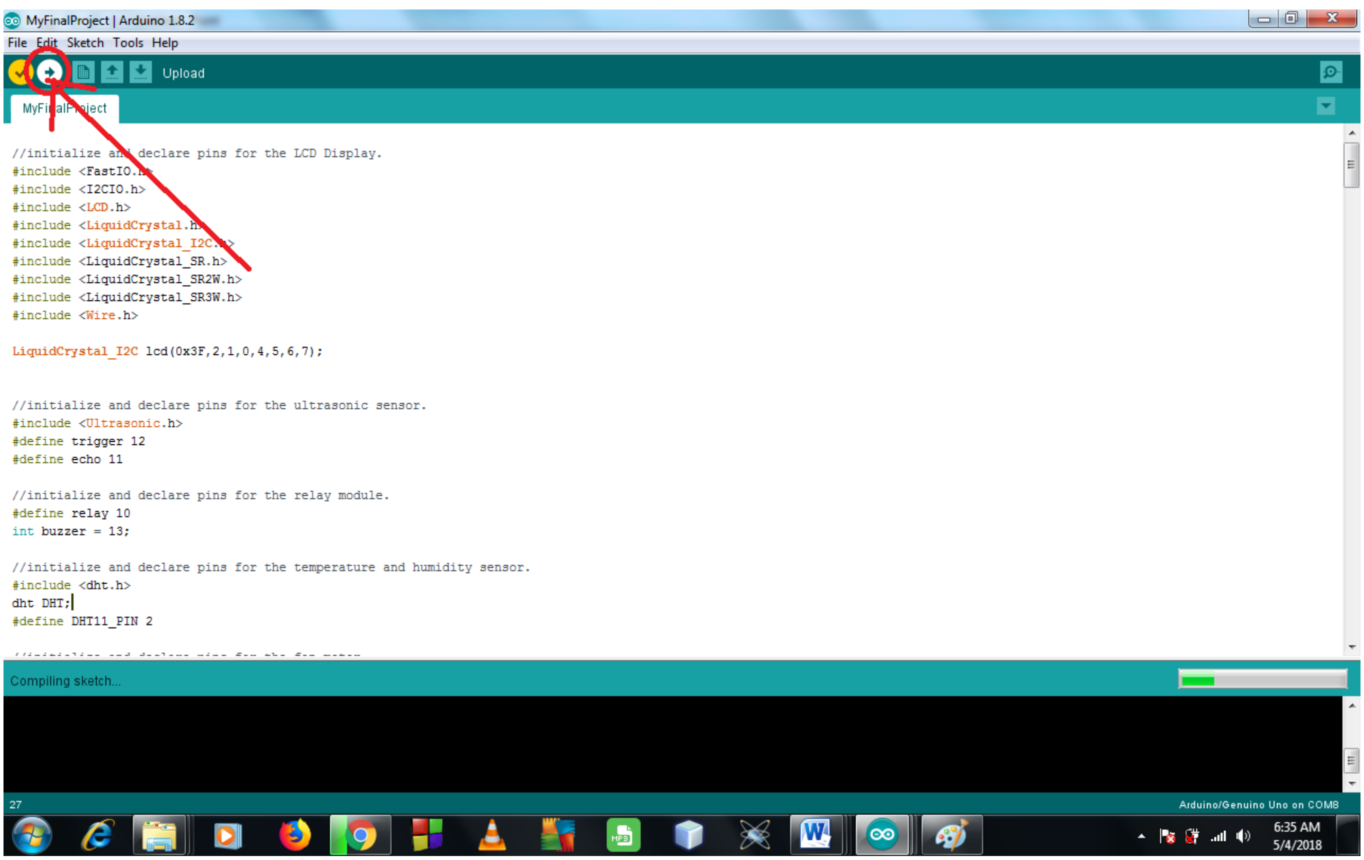

Fig A1 Step 1: Code uploading diagram.

Step two:

Place a pump in a tank that is continuously supplied water by the water supply and make sure the pipe outlet from the pump is going into the rooster water canister. The ultrasonic sensor must be placed horizontally above the rooster water canister for it to make measurements.

Step three: Power up the Arduino UNO Board

The Arduino Uno board is designed in such a way that it can get its power either from a USB cable or an external power source. The diagrams below shows how to go about the two method

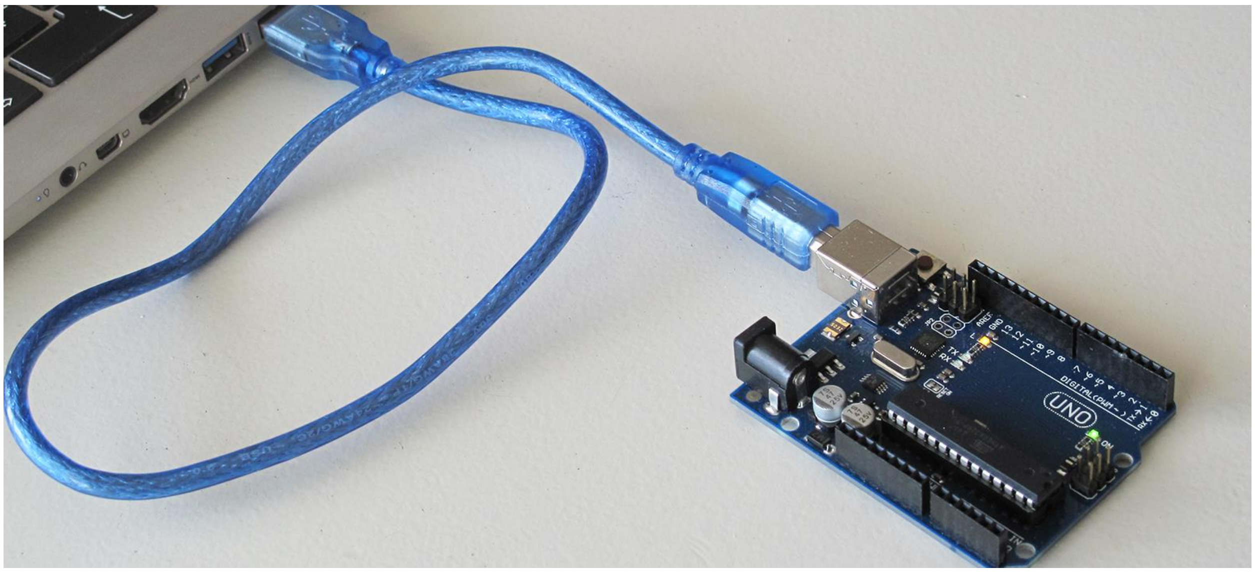

Fig A2 Power up Arduino using USB cable.

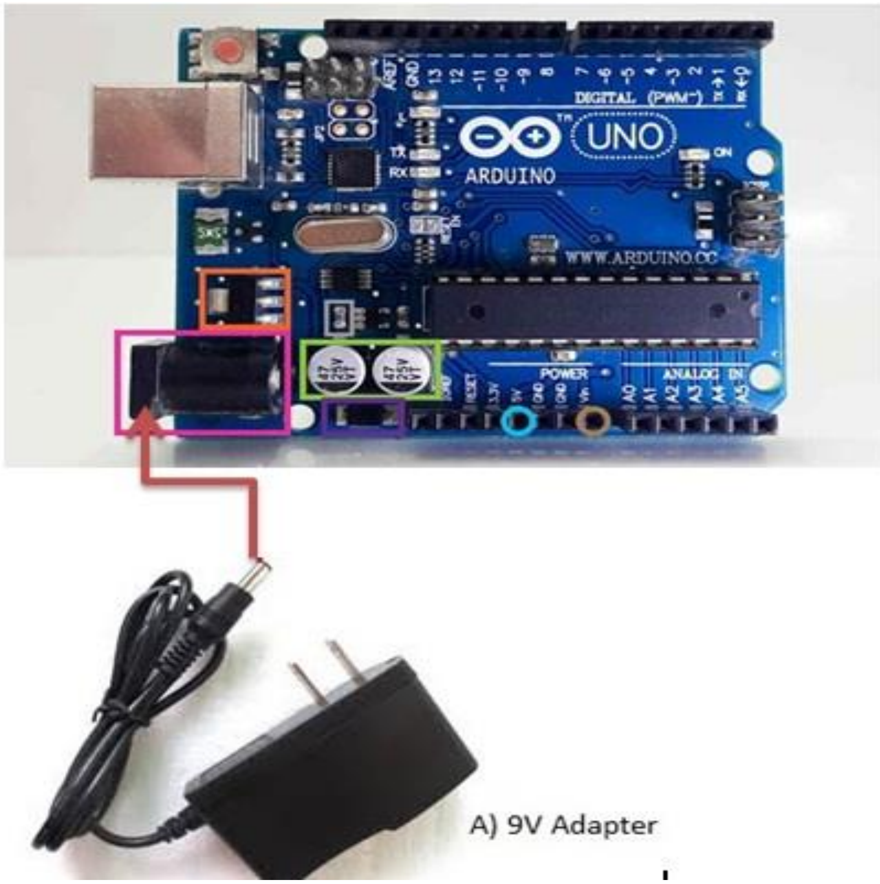

Fig A3 Powering up Arduino Uno using external power supply.

Step Four: Power up the External power supply module for the pump and the fan

Arduino power supply module is also powered up using USB cable or External power supply. Power up the module by using one of the two methods in a way that is similar to their use with the Arduino Uno board.

Step five: Take note of the displayed messages on the LCD and the sounds produced by the system

Once the Arduino board has been powered up, the system is ready for work. In order to fully utilise the system there is need to randomly check the messages displayed by the LCD screen and to pay close attention to the buzzer as it rings. The buzzer sound symbolises an alert that requires the user’s attention. To know the correct action to take on the buzzer sound the message displayed on the LCD screen will guide the user through. A sample of the messages displayed is shown below:

Fig A4 LCD displaying the parameters of the rooster run.

APPENDIX B: CODE SNIPPET

```
//initialize and declare pins for the LCD Display.

#include <FastIO.h>

#include <I2CIO.h>

#include <LCD.h>

#include <LiquidCrystal.h>

#include <LiquidCrystal_I2C.h>

#include <LiquidCrystal_SR.h>

#include <LiquidCrystal_SR2W.h>

#include <LiquidCrystal_SR3W.h>

#include <Wire.h>


LiquidCrystal_I2C lcd(0x3F,2,1,0,4,5,6,7);




//initialize and declare pins for the ultrasonic sensor.

#include <Ultrasonic.h>

#define trigger 12

#define echo 11


//initialize and declare pins for the relay module.

#define relay 10
```

```
int buzzer = 13;


//initialize and declare pins for the temperature and humidity sensor.

#include <dht.h>

dht DHT;

#define DHT11_PIN 2


//initialize and declare pins for the fan motor.

int Motor_Pin1 = 4;

int Motor_Pin2 = 3;

int Enable = 5;



void setup() {

pinMode(Motor_Pin1, OUTPUT);

pinMode(Motor_Pin2, OUTPUT);

pinMode(Enable, OUTPUT);


pinMode(buzzer, OUTPUT);

pinMode (relay, OUTPUT);

pinMode(trigger,OUTPUT);

pinMode(echo,INPUT);

lcd.begin(16,2);
```

```
lcd.setBacklightPin(3,POSITIVE);
lcd.setBacklight(HIGH);

lcd.setCursor(0,0);
lcd.print("Smart RoosteRun");
delay(3000);

lcd.clear();
lcd.setCursor(0,1);
lcd.print("Healthy feeding");
delay(3000);
}

void loop() {

  digitalWrite(trigger,LOW);
 delayMicroseconds(2);

 digitalWrite(trigger,HIGH);
 delayMicroseconds(10);

 digitalWrite(trigger,LOW);
 delayMicroseconds(2);
```

```
 // Measuring and reading distance using ultrasonic sensor
  float distance=0, ptime=0, tempi=0;



  ptime=pulseIn(echo,HIGH);
  ptime=ptime;

  distance = ptime * 340/20000;
float  percentage = 5.556 * distance;

//Measuring and reading temperature using temperature and humidity sensor
int chk = DHT.read11(DHT11_PIN);
   double temp = DHT.temperature;
  double humid = DHT.humidity;

  for (int x =0; x < 2; x++){
  if (percentage > 83 && percentage < 94 && tempi == 0){

  digitalWrite(buzzer, HIGH);
 delay(2000);
   digitalWrite(buzzer, LOW);
   delay(1000);
```

```
  digitalWrite(relay, HIGH);
 delay(1000);


  lcd.clear();
    lcd.setCursor(0,0);
    lcd.print("SpaceLeft:");
     lcd.print(percentage);
    lcd.print("%");
    lcd.setCursor(0,1);
    lcd.print("Pump Turned On");
   lcd.noDisplay();
 delay(1000);
 lcd.display();
 delay(2000);
 }
else if (percentage < 83 && percentage > 28 && tempi == 0){


  digitalWrite(buzzer, LOW);
  delay(1000);
  digitalWrite(relay, HIGH);
 delay(1000);
```

```
 lcd.clear();
   lcd.setCursor(0,0);
   lcd.print("SpaceLeft:");
    lcd.print(percentage);
   lcd.print("%");
   lcd.setCursor(0,1);
   lcd.print("Pump Turned On");
  lcd.noDisplay();
delay(1000);
lcd.display();
delay(2000);
 }

else if (percentage < 27 && tempi == 0){
digitalWrite(buzzer,LOW );
digitalWrite(relay,LOW );
 lcd.clear();
   lcd.setCursor(0,0);
   lcd.print("tank full");
   lcd.setCursor(0,1);
   lcd.print("Pump Turned off");
  lcd.noDisplay();
delay(1000);
```

```
lcd.display();

delay(2000);

}

temp = 1;

  if (percentage > 83 && percentage < 94 && tempi == 1 ){


digitalWrite(buzzer, HIGH);

delay(2000);

 digitalWrite(buzzer, LOW);

 delay(1000);


 digitalWrite(relay, HIGH);

delay(1000);


 lcd.clear();

   lcd.setCursor(0,0);

   lcd.print("SpaceLeft:");

    lcd.print(percentage);

   lcd.print("%");

   lcd.setCursor(0,1);

   lcd.print("Pump Turned On");

  lcd.noDisplay();

delay(1000);
```

```
  lcd.display();

  delay(2000);

  }

else if (percentage < 83 && percentage > 28 && tempi == 1){


   digitalWrite(buzzer, LOW);

   delay(1000);

   digitalWrite(relay, HIGH);

  delay(1000);


   lcd.clear();

     lcd.setCursor(0,0);

     lcd.print("SpaceLeft:");

      lcd.print(percentage);

     lcd.print("%");

     lcd.setCursor(0,1);

     lcd.print("Pump Turned On");

    lcd.noDisplay();

  delay(1000);

  lcd.display();

  delay(2000);

   }

  else if (percentage < 27 && tempi== 1){
```

```
 digitalWrite(buzzer,LOW );

 digitalWrite(relay,LOW );

  lcd.clear();

    lcd.setCursor(0,0);

    lcd.print("tank full");

    lcd.setCursor(0,1);

    lcd.print("Pump Turned off");

   lcd.noDisplay();

 delay(1000);

 lcd.display();

 delay(2000);

 }

 }



if (temp > 35){

 analogWrite(Enable,255);

digitalWrite(Motor_Pin1,HIGH); //one way

 digitalWrite(Motor_Pin2,LOW);

 digitalWrite(buzzer, LOW);

 lcd.clear();

 lcd.setCursor(0,0);

 lcd.print("Temp: ");
```

```
  lcd.print(DHT.temperature);
  lcd.print((char)223);
  lcd.print("C");
  lcd.setCursor(0,1);
  lcd.print("Humidity: ");
  lcd.print(DHT.humidity);
  lcd.print("%");
  delay(1000);
   lcd.noDisplay();
  delay(2000);
  lcd.display();
   delay(2000);
  }
else if (temp > 30 && temp <35){
  analogWrite(Enable,180);
   digitalWrite(Motor_Pin1,HIGH); //one way
  digitalWrite(Motor_Pin2,LOW);
  digitalWrite(buzzer, LOW);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Temp: ");
  lcd.print(DHT.temperature);
  lcd.print((char)223);
```

```
lcd.print("C");
lcd.setCursor(0,1);
lcd.print("Humidity: ");
lcd.print(DHT.humidity);
lcd.print("%");
delay(1000);
 lcd.noDisplay();
delay(2000);
lcd.display();
 delay(2000);
}
else if (temp == 30){
analogWrite(Enable,50);
 digitalWrite(Motor_Pin1,HIGH); //one way
digitalWrite(Motor_Pin2,LOW);
digitalWrite(buzzer, LOW);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Temp: ");
lcd.print(DHT.temperature);
lcd.print((char)223);
lcd.print("C");
lcd.setCursor(0,1);
```

```
 lcd.print("Humidity: ");
 lcd.print(DHT.humidity);
 lcd.print("%");
 delay(1000);
  lcd.noDisplay();
 delay(2000);
 lcd.display();
  delay(2000);

 }
else if (temp < 30 && temp > 15){
 analogWrite(Enable,0);
 digitalWrite(Motor_Pin1,HIGH); //one way
 digitalWrite(Motor_Pin2,LOW);
 digitalWrite(buzzer, LOW);
 lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("Temp: ");
 lcd.print(DHT.temperature);
 lcd.print((char)223);
 lcd.print("C");
 lcd.setCursor(0,1);
 lcd.print("Humidity: ");
```

```
lcd.print(DHT.humidity);

lcd.print("%");

delay(1000);

 lcd.noDisplay();

delay(1000);

lcd.display();

delay(2000);

}


else {

analogWrite(Enable,0);

 digitalWrite(Motor_Pin1,HIGH); //one way

digitalWrite(Motor_Pin2,LOW);

digitalWrite(buzzer, HIGH);

delay(1000);

 digitalWrite(buzzer, HIGH);

 delay(1000);

lcd.clear();

lcd.setCursor(0,0);

lcd.print("Temp: ");

lcd.print(DHT.temperature);

lcd.print((char)223);

lcd.print("C");
```

```
  lcd.setCursor(0,1);
  lcd.print("Humidity: ");
  lcd.print(DHT.humidity);
  lcd.print("%");
  delay(1000);
   lcd.noDisplay();
  delay(2000);
  lcd.display();
   delay(2000);
  }
}
```